THE PROPOSAL'S FORGOTTEN EFFECT ON PROJECT RISK AND PERFORMANCE

by

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A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of
Business Administration

Charlotte

2020

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ABSTRACT

Lawrence Haynes. THE PROPOSAL'S FORGOTTEN EFFECT ON PROJECT RISK AND PERFORMANCE (Under the direction of DR. Franz Kellermanns)

The Request for Proposal (RFP) process is used extensively for the procurement of products and services internationally by government and industry. The United States Government (USG) is the largest customer in the world, and yet, this important procurement process has been forgotten in the project management literature. The extant literature has concentrated on the identification of project risks and the negative effect risk has on the performance of a single project. This study expands the risk beyond a single project to include the risk that one project may have on the risk and performance of another project, particularly between the development of the proposal in response to a RFP and the execution of the corresponding project for which the proposal becomes the baseline. Once the proposal development has been completed, the proposal team may be assigned to the next available project while the customer decides if the proposal is to be executed. There is no guarantee that the proposal development team will also be part of the project execution team once the customer has accepted the proposal and the project execution begins. Transactive Memory Systems (TMS) theory has shown that a disruption of a project team may decrease the team's productivity suggesting that a project's risk may be reduced, therefore increasing performance, as the number of members of the proposal development team who also work on the project execution team

increases. The findings show that as the number of team members that worked on both the proposal development and the project execution increases, the negative relationship between the project's requirements risk and process performance is reduced. These findings have practical implications for managers by suggesting that project performance can be increased by ensuring that more members of the proposal development team are also members of the project execution team.

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List of Abbreviations

CMV	Common Method Variance
COTS	Common-Off-The-Shelf
DARPA	Defense Advanced Research Projects Agency
DFARS	Defense Federal Acquisition Regulations
DOD	Department of Defense
DV	Dependent Variable
FAR	Federal Acquisition Regulation
FY	Fiscal Year
GAO	Government Accounting Office
IS	Information Systems
IT	Information Technology
IV	Independent Variable
RFP	Request for Proposal
PMBOK	Project Management Book of Knowledge
PMI	Project Management Institute
R&D	Research and Development
SLR	Systematic Literature Review
SME	Subject Matter Expert
T&C	Terms and Conditions
TMS	Transactive Memory Systems
US	United States

USG	United States Government
VIF	Variance Inflation Factor

"Identifying and dealing with risks early in the development lessens long-term costs and helps prevent software disasters."

- (Boehm, 1991, p. 32)

"The main purpose of project risk management is to identify, evaluate, and control the risks for project success."

- (Gharakhani, Jalalifar, & Behdadfar, 2018, p. 60)

CHAPTER 1 - RESEARCH OVERVIEW

1.1 Introduction of Context and Theory

Projects are used extensively by organizations such as manufacturing, IT, government, healthcare, oil, and construction to drive strategy, to drive change, and to create value (Project Management, 2017). Projects improve the competitive position of an organization, contributes to growth of the company though increased earnings, cost reductions and other aspects of the company's profitability, and differentiates itself from the competitors in the industry (Abdullah & Verner, 2012). Globally, $20TN is spent yearly on projects; the US spends $2.3TN or ¼ of the GDP. Companies have grown heavily dependent on the successful delivery of projects for operational and strategic importance (Project Management, 2018).

Yet, projects are rarely developed within schedule or budget or meet the expectations of the users (Nidumolu, 1995; L. Wallace & Keil, 2004). An annual survey reports that project performance completion rates for 2015 consists of 29% chance of succeeding, 19% chance of being cancelled, or 52% chance that the project would be completed but would exceed the planned budget, schedule, and would not deliver the intended functionality (Standish, 2018). The intended outcomes of projects can affect millions of potential customers as is illustrated by such major projects as the baggage system which delayed the opening of the Denver airport for 2 years costing taxpayers $2B (Chua, 2009), 30 failed or challenged IT projects by organizations such as McDonalds, AT&T, Nike, Ford, and the IRS labelled the "Software Hall of Shame" (Charette, 2005), and the debacle of the Healthcare.gov website (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016). Globally, 10% of every dollar invested in a project is "wasted" due to poor project performance (Project Management, 2018).

As many organizations operate in dynamic markets with new and continually changing user and customer requirements and increased competition, project management frequently implements risk management practices to address these challenges (Bakker, Boonstra, & Wortmann, 2010; Raz, Shenhar, & Dvir, 2002). According to the project management literature, failure to identify, analyze, and mitigate risk is often a major cause of poor project performance; poor performance being defined as schedule and budget overruns, unmet customer and user requirements, and the delivery of systems that do not provide the expected value to the organization (Abdullah & Verner, 2012; Barki, Rivard, & Talbot, 1993; Boehm, 1991; McFarlan, 1981; L. Wallace & Keil, 2004). In this dissertation, project risk applies to the Project Execution event. Project risk is the unexpected event or condition that, if it occurs, can pose a threat to the project's objects and therefore, the successful completion of a project (Boehm, 1991; Nidumolu, 1995; Project Management, 2017; L. Wallace & Keil, 2004; Y. Zhang, Liu, Tan, Jiang, & Zhu, 2018). Project risk management refers to the methods and tools used to identify, analyze, and mitigate the risk to minimize the threat to the project's objectives and performance (Gharakhani, Jalalifar, & Behdadfar, 2018; Project Management, 2017; Schmidt, Lyytinen, Keil, & Cule, 2001; L. Wallace & Keil, 2004). Traditional project performance refers to the project operational parameters (budget, schedule, scope) that the project must adhere to during execution (Nidumolu, 1995; Stanley & Uden, 2013). Project management research has identified a large variety of risks that affect projects including poor or undefined requirements, lack of user input, poor project planning, and control, lack of organizational support, and team members that lack the appropriate skills or motivation (Kappelman, McKeeman, & Zhang, 2006; Keil, Cule, Lyytinen, & Schmidt, 1998; Liu & Wang, 2014; Wallace, 1999). Addressing the sources of project risks is a complex endeavor (Nidumolu, 1996). Empirically, project risk literature has shown that a throng of different risks negatively affects project performance and that managing project risk is positively correlated with successful project performance (Barki, Rivard, & Talbot, 2001; De Bakker, Boonstra, & Wortmann, 2011; Ropponen & Lyytinen, 1997; L. Wallace & Keil, 2004).

In a dynamic organization, research has shown that multiple projects are being executed simultaneously in an organization emphasizing flexibility, speed, and learning and to achieve those goals relies heavily on teamwork (Moreland & Argote, 2003). Such an environment is one of instability and constant change for the project team. A project team consists of a multi-disciplined group of individuals with specialized skills executing the project to achieve the desired outcome; members of the project team includes the project manager and may include technical, financial, legal, and manufacturing specialists as required. Project teams are formed for specific projects and then are dissolved when the projects have been completed causing teams to be constantly forming and disbanding over time (Moreland & Argote, 2003; Payne, 1995). Project team members that have not previously worked together and will not work together again causing project teams to suffer from miscommunication and misunderstandings due to diversity of the team members, different backgrounds, areas of expertise, and assigned responsibilities (Hirst, 2009). The team members will not be motivated to rectify their differences since the team is temporary, working together for only a short amount of time (Johnson & Johnson, 2005). Such an environment limits the development of transactive memory between team members.

Developed over time by individuals within a project team, transactive memory systems (TMS) is the learning, storing, and remembering the expertise of each member of the project team; basically, TMS is knowing "who does what" within a project which is crucial to the success of the project since a project team is comprised of specialists in multiple disciplines (Argote & Ingram, 2000; Lewis, 2003; Y. Wang, Huang, Davison, & Yang, 2018). TMS studies have articulated that losing a member of the team can have detrimental effects on project performance due to knowledge depreciation especially since the project team is comprised of multiple functional specialists. Losing members of a project can slow the execution of the project, cause vital information or knowledge loss, and disruption to the project's progress, all affecting the project performance (Akgün & Lynn, 2002; Moreland & Argote, 2003). The function of transactive memory is most effective when team members are required to rely on each other to develop and deliver a project, a common goal (Y. Wang et al., 2018). Transactive memory research has shown that people who are interdependent upon each other for information can recognize, locate, and access the expertise of other project team members to supplement their own knowledge, thereby strengthening their own knowledge, broadening the collective knowledge of the project team, and generating creative integrated solutions to problems (Y. Wang et al., 2018). The longer the project team is together provides opportunities for members to learn about the capabilities of the other members, increasing the transactive memory of the team, and therefore, increasing project performance. Transactive teams will be more efficient as long as the task remains the same, such as between a proposal, Proposal Development event, and the project, Project Execution event (Hirst, 2009).

A project is a temporary, with a defined start and stop time, unique endeavor undertaken to create a product or service (Kerzner, 1987; Project Management, 2017). A project can be a multi-disciplined endeavor that includes a project manager and may include, as needed, technical, financial, legal, and manufacturing team members specialists who are relied on for the successful completion of the project (Prahalad & Ramaswamy, 2004). A proposal, Proposal Development event, is used to propose a method for providing a solution such as: (1) an analytical study or (2) providing a service or developing a product to meet a customers need (Freed & Roberts, 1989). The primary purpose of the proposal is to define the budget, scope, planning or schedule, and management for the corresponding project (Elonen & Artto, 2003). It specifies the methods to be performed during project execution, the objectives of the project, project budget and schedule, project expectations, benefits, and the qualifications of the team (Freed & Roberts, 1989). A proposal is a trade-off between cost, schedule, and scope; lots of compromises are made that are primarily known to the proposal team (Pennypacker & Dye, 2002b). Once submitted, the customer evaluates the proposal, which may take an extended period of time, and based on this evaluation will accept or reject the proposal; if accepted, the project execution begins, Project Execution event, using the project performance parameters as defined in the proposal (Sedano, Rengasamy, & Péraire, 2016). The proposal development is similar to a project in that it is a temporary, unique, multi-disciplined endeavor undertaken to create a unique product, the proposal, which defines the performance goals of the project. The project management literature has marginally focused on the proposal.

Figure 1 summarizes the sequence of events between the proposal and the project. The first event, RFP Issued, is the recognition by an organization that change is necessary; a Request for Proposal (RFP) is issued by the buyer organization. The RFP is one or more procurement documents used to solicit proposals, bids, or quotations from potential seller organizations. The RFP defines the service or product desired by the buyer organization. The second event, Proposal Development, is performed by the seller in response to the issued RFP. The seller organization assembles a multi-disciplined proposal team that develops the proposal which is, upon completion, delivered to the buyer organization. The proposal includes the technical approach as well as the performance parameters (cost, scope, and schedule) of the desired service or product as specified in the RFP. While waiting for the buyer evaluation, the members of the proposal development team are assigned to other projects. The buyer evaluates the proposal, RFP Evaluation, and makes a selection as to the seller that will provide the service or product as defined in the RFP. The amount of time required by the buyer organization for the RFP evaluation and seller selection is variable, from several weeks to several months or even years. The project is executed in the final event, Project

Execution; the selected seller assembles a project team and the project is executed. The project execution team is assembled that may consist of members of the proposal development team depending on the individual's availability at the time that the project commences. The project should meet the performance goals as specified in the RFP; yet, as discussed previously, project management has not been very successful at meeting these performance goals due to poor risk management.

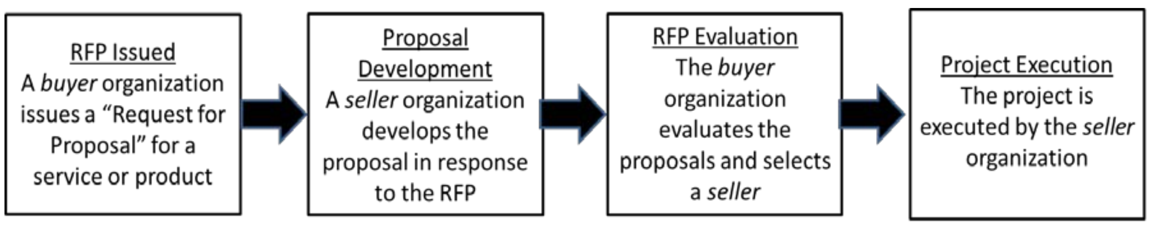

Figure 1 Proposal – Project Sequence of Events

1.2 Research Objective

The project management literature has widely acknowledged that project risk management has a the positive effect on project performance; research has focused primarily on individual projects across various applications, industries, and nationalities (De Bakker et al., 2011). Studies, some empirical, have determined the risk factors for a variety of projects including construction (Flyvbjerg, 2006), outsourcing (Liu & Wang, 2014), and software development (L. Wallace, Keil, & Rai, 2004a). Therefore, one objective of this study is to continue the empirical study of project risk and the correlation with project performance.

Project management literature has focused only on the five phases of a single project lifecycle and has not investigated the project risks due to the interdependencies between projects; each new project has both technical and organizational linkages and interdependencies with past or current projects (Pennypacker & Dye, 2002b). Therefore, the second objective of this research is to empirically study the impact of the development of a proposal on the corresponding project, expanding beyond the traditional single project study.

1.3 Research Questions

This dissertation research investigates if project risks are affected if the project is executed by a project team during the Project Execution event that is different than the team that generated the proposal during the Proposal Development event. Therefore, the study addresses the following research question:

Does having members of the proposal team also assigned to the project team moderate the project risk and, hence, the performance of the corresponding project?

1.4 Contributions

This dissertation makes several contributions to the project risk and performance literature, theory, and practice.

First, the present study answers the call for more empirical evidence for the relationship between project risks and performance (Liu, 2016); little empirical evidence exists that shows that project risk contributes to project performance (Bakker et al., 2010; Liu & Wang, 2014; Verner, Brereton, Kitchenham, Turner, & Niazi, 2014; Y. Zhang et al., 2018). This study empirically shows that the requirements risk of a project has a negative impact on the process performance of that project.

Second, the present study expands project management risk theory; it brings the concept of interdependencies of risk and performance between projects into the risk-performance equation, particularly between the proposal and the project. As stated previously, most project risk and performance literature has studied the risk and performance of a single project (Olsson, 2008); yet, portfolio research has called for the investigation of risk between projects (Pennypacker & Dye, 2002a). Portfolio research has determined that it is insufficient to consider only individual project risks; risk dependencies beyond the single project should be investigated (Olsson, 2008).

Third, this study provides additional tools for project managers to mitigate risk. One of the biggest challenges is to convert project management research into tools that are practical and more importantly are effective (Bakker et al., 2010; Bannerman, 2008; Taylor, Artman, & Woelfer, 2012); there are few practical tools available for project managers to help identify and mitigate risk factors in order to minimize the project risk (Liu, Wang, & Xiao, 2009; L. Wallace, Keil, & Rai, 2004b). Understanding risks is vital for project managers because it allows them to effectively identify and mitigate project risks before they seriously jeopardize the project causing harm to project performance (Liu, 2016).

Finally, little research has been performed on the proposal. This study formally defines the concept of a proposal for future research. In addition, the affect a proposal may have on the risk of the corresponding project is also studied; specifically, the impact that the proposal development team has on project performance when that team that is also involved in the execution of the project.

1.5 Organization of Dissertation

This dissertation is organized in the following manner. Chapter 2 provides a literature review that explores the background into the existing stream of project risk and performance research that is used to provide a theoretical framing for the model, introduces the theoretical model of the study, and conceptualizes the hypotheses of this study. Chapter 3 outlines the quantitative data collection methods, the extant constructs and measures that will be adapted for this study, survey development, and the analytical methodology for this study. Chapter 4 provides the results of the analysis of the survey data. Finally, chapter 5 discusses the findings, contributions, limitations, of this study and possible future research.

CHAPTER 2 LITERATURE REVIEW AND HYPOTHESES

This chapter provides a review of the existing literature that supports this research agenda. This review is detailed in four main sections. The first section discusses the forgotten Request for Proposal (RFP) procurement process upon which this research is developed. The second section reviews the performance success criteria of a project, the dependent variable for this research. The third section reviews the independent variables, the risk factors of a project that negatively effects the performance success criteria of a project. The final section discusses the model and develops the hypotheses for this research.

2.1 The Proposal

The RFP procurement process has been given minimal attention in the literature (Mandell, 1986). Very few articles have been published investigating the RFP process (Paech, Heinrich, Zorn-Pauli, Jung, & Tadjiky, 2012). The project management literature has primarily focused on single-project risks, failures, successes, and the methodology for determining the risk factors that affect the performance, failure, and success of a single project (De Bakker, Boonstra, & Wortmann, 2010). The literature search resulted in a limited amount of studies on proposals and a lack of research on the effect proposals have on the corresponding project. Most of the articles reviewed discuss the proposal in regard to the RFP procurement process between an originating organization, the buyer, and the supplier or vendor organization providing the needed product or service, the seller. The proposal literature search included the following keywords: RFP, Request for

Proposal, Proposal, Project Proposal, Vendor Proposals, Contractor Proposals, Tender Responses, and Tender Proposals. A literature search of portfolio theory, multi-project firms, and project-based firms lacked results regarding proposals. There were two primary streams of research in these areas: (1) strategy of project selection for a portfolio and (2) the allocation of scarce resources among competing projects (Artto & Wikström, 2005; Artto, Wikström, Hellström, & Kujala, 2008; Elonen & Artto, 2003; Patanakul & Milosevic, 2009; Payne, 1995; Pennypacker & Dye, 2002a; Tikkanen, Kujala, & Artto, 2007). Both streams lacked a discussion of proposals even though there was a call for investigating linkages between projects (Pennypacker & Dye, 2002a; Teller, 2013; Tikkanen et al., 2007). A literature search of project outsourcing returned a substantial number of papers dealing with project risks and performances of outsourcing, primarily for the perspective of the buyer firm requesting the outsourcing (Lacity & Willcocks, 1998; Levina & Ross, 2003; McFarlan & Nolan, 1995); the outsourcing literature search regarding the proposal was lacking. Research has been performed regarding COTS in general, particularly from the seller perspective and the development of COTS products; little has been done regarding COTS acquisition from the perspective of the buyer (Lauesen & Vium, 2005), and again, there was a lack of results regarding proposals. Table 1 contains the articles relating to the RFP procurement process resulting from the literature search. The primary methodology of the reviewed articles is based upon a practitioner, an author with much experience in the procurement process that articulates the procurement strategies and processes based on their experience. No empirical methods were used; little theory was discussed, and no models were presented.

The proposal literature consists of two primary streams of information, the buyer and the seller perspectives. The buyer perspective discusses a strategy for developing a proposal in response to a Request for Proposal (RFP) that has been issued such as by a government agency or a firm. The A Guide to the Project Management Book of Knowledge (PMBOK) provides limited guidance on answering a RFP, basically, a single page in a 750-page book on current project management processes (Project Management, 2017). The buyer literature consisted primarily of "How to" books and papers. Most of these books have been written by a practitioner who has had many years of practice developing proposals, the practitioner methodology. The buyer perspective provides a strategy for developing the RFP documents in response to a need required by the buyer organization such as a need for a product or services. Again, the literature consisted primarily of "How to" books and papers.

Using the practitioner methodology, many of these books and articles from the literature search were written by practitioners who have had many years of experience developing the RFP documents. For example, the consultant Searcy (2009) published a book on the RFP process from the seller perspective which provides guidance on whether to get involved in the RFP procurement process (strategy), and if so, how to organize a project to respond to the RFP. The PMBOK provides substantial guidelines for the RFP process and proposal evaluation from the buyer perspective (Project Management, 2017). Paech et al. (2012) performed a literature search on the RFP process that included only five citations; all have been included in this review. The seller perspective is used for this dissertation. The seller assembles a proposal development team to develop the proposal in response to a buyer's RFP; some members of this proposal team may be become members of the project execution team. Most of the buyer and seller perspectives literature had to do with government procurement as will be discussed in the next section.

Why are proposals important? Most of the proposal literature dealt with procurement from United States Government (USG) (Lauderdale, 2009; Parvey & Alston, 2010; Saenz, 2018; Sant, 2012; Searcy, 2009). Other procurement sources that were marginally discussed in the literature were the United States (US) state, county, and municipal government procurements, procurement by industry and public utilities (Lauesen & Vium, 2005). There is good reason for targeting the USG procurement; it is the largest procurer of products and services in the world (Lauderdale, 2009; Parvey & Alston, 2010; Saenz, 2018; Sant, 2012; Searcy, 2009). State, county, and municipal governments also purchase goods and services nearly equal to the procurement budget of the USG but is distributed over many different entities. For Fiscal Year 2017 (FY2017), the USG committed $507 billion in contracts for products, services, and R&D; that is approximately 13% of the total FY2017 USG budget of $3.98 trillion (*Congressional Research Service: Report*, 2018). Every 20 seconds, the government awards a contract with an average of $495K (Stanberry, 2012). The Department of Defense (DOD) has long relied on sellers to provide the US military with a wide range of products and services, including weapons, ships, aircraft, vehicles, food, training, construction, and operational support. Without seller support, the US military would not be able to supply, train, and field an effective fighting force. In FY2017, DOD obligated more money on contracts, $320B, than all other government agencies combined. Services accounted for 41% of total DOD contract obligations, products 51%, and R&D 8% (*Congressional*

Research Service: Report, 2018). Nearly every publication in the literature search included similar monetary descriptions for the years they were published (Lauderdale, 2009; Parvey & Alston, 2010; Saenz, 2018; Sant, 2012; Searcy, 2009); the statistics above are the current values.

In additional to the USG spending, most fortune 1000 companies contract for products, services, and R&D. Governance rules dictated by many companies' boards have made the RFP process a major component of their procurement strategy (Searcy, 2009). Many organizations have become reluctant to develop products or services due to the risks in delivering a product or service that meets the user's requirements and is within their schedule and budget causing corporations to outsource such products or services (Arnstein, 2002). The Sarbanes-Oxley Act of 2002 requires proof that companies have made the best business decisions in choosing suppliers. The act requires industry to provide evidence, accountability, and the selection criteria for choosing a seller (Searcy, 2009). Since the USG is the largest customer in the world, similar procurement processes as defined by the USG are used by state and local governments, industry, and internationally. Public organizations in the EU have to follow strict guidelines for acquisitions similar to the USG procurement process (Lauesen & Vium, 2005). The next section describes the RFP procurement process.

What is the RFP procurement process? The RFP procurement process is an established process executed in order to find the seller that best meets the buyer's requirements (Andrea, 2003); it is an established business process of doing business throughout the world, a standard rigorous process to purchase products and services by promoting competition. The process allows both the buyer and seller to establish a dialogue and to work from the same agreed-upon set of rules, requirements, schedules, and costs; the RFP and the corresponding proposal documents become the foundation for a working relationship (Cobb & Divine, 2016).

The RFP procurement process consists of four phases. First, the buyer recognizes a need and then determines the requirements, schedule, terms and conditions (T&C), seller evaluation criteria, and management conditions for the required needs. A RFP is then developed and published for solicitation. Second, the sellers assess the requirements, schedule, T&C, and management conditions as specified in the RFP and then decides if they will respond with a proposal. If so, a proposal is developed which primarily includes the proposed solution to the buyer’s requirements, schedule, and the proposed costs. Third, the buyer evaluates the responses and selects a seller based upon how well the submitted proposal meets their requirements and as well as their schedule and costs. Finally, the buyer and the seller implement the solution according to the seller’s proposal (Andrea, 2003; Porter-Roth, 2002; Searcy, 2009).

All procurement for the USG must be competitively bid using the rules and regulations as documented in the Federal Acquisition Regulation (FAR), nearly 4000 pages. The FAR as well as the Defense version (DFARS) is the primary regulation, set of rules, for use by all USG agencies and the DOD in their acquisition of products and services (*Federal Acquisition Regulation*, 2019; *Overview of the Federal Procurement Process and Resources*, 2015). Competition promotes the efficient use of taxpayer resources by helping to drive down prices and to motivate better contractor performance. A seller that does not perform to the requirements as defined in the RFP and the delivered proposal may be barred from further government activity (Bodziak, Koster, & Plexico, 2012; *Overview of the Federal Procurement Process and Resources*, 2015). The main principles of the FAR includes meeting the buyer's needs in terms of requirements, schedule, and cost and ensuring integrity, fairness, openness and transparency during the procurement process (Bodziak et al., 2012; *Overview of the Federal Procurement Process and Resources*, 2015).

In 2015, 2/3 of USG spending was by competitive contracts and 2/3 of the contracts were fixed-priced. Eighty-six percent of all RFPs issued by the USG received multiple bids showing the importance of the procurement process. For fiscal years 2011 through 2015, analysis of government-wide contracting data by the GAO found that federal agencies used fixed-price contracts for an average of 63% of all contracts issued which shows the importance of the proposal process being accurate (*Contracting Data Analysis - Assessment of Government-wide Trends*, 2017). Similar values were discussed in the literature for the years they were published and were updated here with the current figures. Procurement at the state and local levels is also very competitive (Bodziak et al., 2012). The next two sections describe the buyer and seller perspectives.

What are the buyer and seller perspectives? When a buyer recognizes a deficiency of products or services, the buyer will begin the procurement process. Primary purpose of the RFP is to transmit the buyer's understanding of the their needs to possible sellers (Porter-Roth, 2002), to communicate the requirements of the buyer, to elicit responses from sellers, and to provide the basis for the standardized evaluation of the submitted proposals since the responses must meet defined requirements as specified in the RFP (Mandell, 1986). The RFP is a written document used to establish the joint understanding of the requirements between the buyer and seller which becomes the project baseline (Porter-Roth, 2002). The purpose of the RFP is to solicit responses from sellers that will provide cost-effective solutions to the buyer's requirements (Mandell, 1986). The buyer determines the requirements needed, develops the RFP, and then issues the RFP which includes strict procurement rules for content, schedule, and seller responses as defined by the rules established in the FAR. The RFP identifies what an agency wants to buy, provides instructions to would-be sellers, identifies the criteria that will be used to evaluate offers, describes the requirements, the deadlines for the submission of proposals, T&C that will apply, expected proposal structure, information to be provided in the proposal, and expected solution implementation schedule. Two of the three project performance goals, quality and schedule, are included in the seller's proposal. The budget is not included in the RFP to spur competition among the suppliers (*Federal Acquisition Regulation*, 2019; Gransberg & Barton, 2007; *Overview of the Federal Procurement Process and Resources*, 2015).

According to Mandell (1986), the goals of the RFP is to provide the seller with an accurate and complete description of their requirements, mission, functionality, and the processes that are currently in place; to generate competition among the sellers so as to encourage cost-effective and creative solutions; to provide a standardized evaluation method so that all the proposals submitted by the sellers may be judged similarly. Every RFP is a unique document (Mandell, 1986). The RFP should be well designed to engage the interest of the seller, to elicit creative approaches to the problem, and to allow generated proposals to be easily evaluated and compared. A poorly written RFP is a major determinant in the successful procurement from a seller (Abiri & Kirpekar, 1997; Cobb & Divine, 2016; Kennedy & Cannon, 2004; Mandell, 1986; Porter-Roth, 2002).

When a seller receives a RFP, a decision must be made as to whether to proceed with the proposal. Does the RFP fit into the overall strategy of the company, does the seller have the appropriate expertise, and does the seller have the resources, time, budget, and personnel, to develop a proposal all contribute to the decision to compete (Cobb & Divine, 2016; Searcy, 2009); these are all risk factors for a project. Proposals are expensive; they involve a tremendous amount of time and resources and require the commitment of the employees and top management (Cobb & Divine, 2016; Porter-Roth, 2002; Searcy, 2009). If the RFP is prepared with minimum preparation, the success rate will be 7% or lower (Andrea, 2003).

A well-crafted proposal, a difficult task, helps win contracts by separating the seller from the competition by demonstrating competence, professionalism, excellent reliability, support, and a superior solution that meets the business requirements of the buyer. A good proposal is persuasive, accurate, and complete; most proposals do not provide these qualities (Sant, 2012). The proposal development process requires attention to detail and a complete understanding of the requirements as stated in the RFP (White & Bales, 2018). Proposals are the seller's interpretation of the buyer's requirements (Cobb & Divine, 2016; Porter-Roth, 2002; Searcy, 2009). The proposal shows how each requirement is fulfilled (Cobb & Divine, 2016; White & Bales, 2018). Winning proposals need to comply with the stated requirements in the RFP but must go beyond the stated requirements and help the customer achieve their business goals (Cobb & Divine, 2016; White & Bales, 2018). Relatively little has been published on the processes used for developing the requirements for the proposal (Paech et al., 2012).

Once the RFP has been submitted to the buyer, the evaluation process begins as described in the next section.

What is the RFP evaluation process? Based on the proposals, the buyer selects a seller (Cobb & Divine, 2016; Paech et al., 2012; Searcy, 2009). Following the deadline for companies to submit their proposals, the buyer evaluates the submitted proposals using the source selection method and criteria described in the RFP. Such evaluation criteria may include cost, schedule, meeting the technical requirements, and past performance on completing contracts. The awarding of a contract marks the beginning of the next stage in the acquisition process, project execution. Overseeing the project, which is the responsibility of buyer agency, helps to assure that the government gets what it paid for in terms of quality, cost, and schedule (*Federal Acquisition Regulation*, 2019; Gransberg & Barton, 2007; *Overview of the Federal Procurement Process and Resources*, 2015).

The RFP and submitted proposal build the foundation for clear and precise communication between the buyer and the seller (Porter-Roth, 2002). The RFP and the proposal become the foundation that allows both the buyer and seller to establish a dialogue and to work from the same set of rules, requirements, costs, and schedules; it becomes the project baseline. This relationship allows both to operate against the same agree-upon requirements, schedules, costs, and understandings (Cobb & Divine, 2016). The proposal as agreed is then incorporated into the contract and it obligates that the supplier to contractually comply with what is in the proposal. The agreed upon project plan, schedule, costs, and requirements in the proposal becomes the primary method for executing the project. The RFP lays the groundwork for the project; it spells out how the project is to be implemented, what the first steps are, and how performance will be measured (Cobb & Divine, 2016; Porter-Roth, 2002).

Sedano et al. (2016) developed a process for evaluating industry proposals to be used for college class projects. This was the first study to investigate the project selection process in academia using the RFP process. The results of the evaluation showed that most of the seller's proposals were lacking many of the required features as specified in the RFP (Sedano et al., 2016). The issued RFP and the submitted proposal require a complete understanding of the requirements as is discussed in the next section.

How do requirements contribute to a proposal? The RFP is a written document used to establish the joint understanding of the requirements (Cobb & Divine, 2016). Proposals are the seller's interpretation of the requirements in the RFP (Porter-Roth, 2002). The proposal and the RFP become the foundation for a working relationship and is also included in the project baseline (Cobb & Divine, 2016; Porter-Roth, 2002). The customer provides a RFP with requirements of varying detail for the desired product. In the proposal development, the seller, in detail, determines the requirements that can be met, how the requirements are going to be met, and provides the solution (Cobb & Divine, 2016; Paech et al., 2012). The seller has to make difficult decisions as to which requirements that can be satisfied as defined in the RFP and how much effort (cost) it is to deliver the required needs and still remain competitive. Little has been published on the requirements engineering required by sellers in producing the proposal (Paech et al., 2012).

Neither the buyer and seller interests are served if the RFP is poorly written, unnecessarily vague, inconsistently prepared, of low quality and contains requirements that are ambiguous, missing, incomplete, poorly written, and not achievable; basically, all the requirement risks associated with a project (Burek, 2009; Cobb & Divine, 2016; Lauesen & Vium, 2005; Mandell, 1986; Paech et al., 2012; Porter-Roth, 2002). A well-designed RFP with requirements precisely defined will reduce the risks associated with the procurement and actual delivery of the service or product but this rarely occurs. If buyer spends time and energy in creating a well-articulated RFP that truly defines the needed requirements and defines the process that the seller must utilize in their response, risks with the desired outcome will be reduced (Mandell, 1986). Poorly designed RFPs will not only increase buyer time and costs when selecting the seller, but will also increase the risk that the wrong seller will be selected to fulfil the buyers requirements (Burek, 2009; White & Bales, 2018). Therefore, the requirements must be clear, but usually the requirements in the RFPs are of varying detail. A seller might not be able to respond to the requirements due to the poor quality of the requirements. This happens all of the time in the procurement process (Burek, 2009; Cobb & Divine, 2016; Porter-Roth, 2002). Lauesen and Vium (2005) performed a case study with the sellers regarding the requirements for an IT system to be purchased by a municipality. Basically, the sellers had a hard time responding to the RFP due to the poor quality of the requirements in the RFP. Issues encountered included lack of completeness or missing requirements, ambiguity in the requirements, requirements not understood, and requirements insufficiently described. This made it hard for the seller to provide a solution, if they didn't understand the customer's real requirements (Lauesen & Vium, 2005). Once the

RFP is published for solicitation, typically, there is very little if any communication allowed between the buyer and the seller which may be needed to clarify the requirements in the RFP. Therefore, the seller will need to guess the meaning of the buyer’s requirements (Paech et al., 2012). Using Agile methodology in the RFP process, Andrea (2003) makes the case that the process is more cost-effective and that better seller selections are made by the buyer because Agile provides guidance on how to specify and evaluate the requirements (Andrea, 2003). Abdullah and Verner (2012) did a case study regarding seller risks. A seller managed to provide a solution that met the requirements of the RFP but did not meet the performance requirements as specified in the RFP (Abdullah & Verner, 2012). Another issue with the procurement process is the lack of standardization.

Is there a standard for proposals? Porter-Roth (2002) states that a typical RFP consists of the following sections: (1) project overview, (2) administrative information such as summary of the problem, and management of the project, (3) technical requirements, (4) management requirements which state the conditions for managing and implementing the project, and (5) supplier qualifications. Mandell (1986) states that a typical RFP consists of the following sections: (1) proposal information, (2) guidelines, (3) description of the business, (4) software requirements, (5) hardware requirements, (6) implementation plans, and (7) appendices. As just illustrated, RFP documents lack consistency or common structures. Lauderdale (2009) states that a proposal should have three volumes as follows: (1) management, (2) cost, and (3) technical. Freed (1989) states that the generic structure of a proposal should be as follows: (1) situation, (2) objectives, (3) methods, (4) qualifications, (5) costs, and (6) benefits. As just illustrated, proposals lack consistency or common structures. The RFP procurement process needs a structure and an organizational methodology for developing the RFP and the proposal documents (Porter-Roth, 2002).

To craft well-written proposals, "*the writers must understand: what proposals are (their nature); what they do (their rhetorical function); and how they do what they do (their generic structure). It would be desirable if business and technical writing textbooks were clear about the nature, function, and structure of proposals. Such clarity would help writers and teachers alike and would also indicate that some degree of disciplinary agreement exists about this common and extremely important genre of professional writing*" (Freed & Roberts, 1989, p. 318). Freed and Roberts (1989) examined 40 current business, technical, and professional textbooks; each had their own proposal structure. "*The inconsistencies in the textbooks are so marked and remarkable that we are faced with much more than a healthy difference of opinion. Our state is not of the art but of disarray-much to the detriment of students, teachers, and proposal writers alike*" (Freed & Roberts, 1989, p. 332). The study suggests that there is little disciplinary agreement about the purpose of a proposal; how the different types of proposals should be classified; and the structural a proposal should have (Freed & Roberts, 1989). The final section deals with proposal development as a project.

The development of a RFP and the proposal is a project (Arnstein, 2002; Cobb & Divine, 2016; Lauderdale, 2009; Porter-Roth, 2002; Sant, 2012). Creating a proposal takes a "village" or a "metropolis" depending on the size of the proposal (Cobb & Divine, 2016). Development of either requires unique skills and knowledge sets including technical, sales, costing, scheduling, contracting as well as the staff that actual puts the proposal together. Each proposal is unique because each customer is unique and the needs for each are unique (Cobb & Divine, 2016; Mandell, 1986). The PMI definition of a project is a temporary endeavor with a defined start and stop time undertaken to create a unique product, service, or result (Project Management, 2017). The proposal is a unique endeavor that has a beginning when the RFP is issued and an end when the proposal is submitted to the buyer. The outcome of the project is the proposal. The procurement process requires a project team for both the buyer in developing the RFP and the seller in developing a response to the RFP. Applying a structured project approach to the process can lead to better decisions for deciding upon a seller by the buyer (Arnstein, 2002; Mandell, 1986; Searcy, 2009). Writing a proposal also requires a rigid project structured process to ensure that the proposal meets all of the requirements of the RFP (Searcy, 2009). The proposal development team may consist of individuals who professionally write proposals as a profession (Cobb & Divine, 2016); therefore, they may not be part of the project execution team.

Table 1 Proposal Literature Review

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Abiri & Kirpekar, 1997)	P	How to write a RFP for a Picture Archiving System	None	B	None discussed	Phases of the RFP process: 1 Initial data gathering phase by the buyer 2 RFP written: - Information about the business purpose - Information about the system to be installed - Required seller information - Evaluation guidelines 3 RFP distributed to sellers 4 Sellers respond with a proposal 5 Evaluation of the proposals by the buyer
(Andrea, 2003)	P	Would Agile practices improve the RFP process	None	B	Writing an effective RFP	Agile practices can make the RFP development more cost efficient because guidance is provided about how to specify and evaluate the requirements
(Arnstein, 2002)	P	What is the process for developing a good RFP	None	B	The RFP development process will have the same risks as a project.	RFP development is a traditional project
(Burek, 2009)	P	Concepts for successful RFP projects Tools and techniques for a successful RFP project	None	B	Poorly defined or missing requirements RFP project manager is not experienced Not all stakeholders are included in the development of the RFP	RFP requirements need to be clear else vendor will not provide the correct solution RFP development has same risks as a project Poorly constructed RFPs lead to increased costs and schedules for vendor selection but may all lead to the selection of the wrong vendor

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Cobb & Divine, 2016)	P	How to win government contracts with good proposals	none	S	A poorly written proposal will decrease the chances of winning a government contract	Meet the customer's requirements. Write the proposal from the viewpoint of the government How are you solving their problems Use their terminology and language in the proposal
(Freed & Roberts, 1989)	SLR	Develop a generic structure for proposals	None	S	There is no clarity as to the function and structure of proposals No differentiation between proposals and other types of documents	The purpose of a proposal is to propose a method for providing an outcome There are two types of proposals: 1) Analytic proposals propose a study for solving a problem that includes research, R&D, and consulting proposals. 2) Service and product proposals purpose a method for meeting a user need Defines the generic structure of a proposal: 1) Situation; 2) Objectives; 3) Methods; 4) Qualifications; 5) Costs; 6) Benefits
(Gransberg & Barton, 2007)	Q	How accurately is the evaluation criteria in the RFP followed	None	B,S	Is the evaluation criteria defined in the RFP being accurately followed	Price is clearly dominate evaluation factor Federal buyers are using the qualifications evaluation as a risk mitigation tool Schedules was rarely considered

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Greenly, 1985)	P	To provide guidance to those who compete for government contracts	None	S	A poorly written proposal will decrease the chances of winning a government contract	Government contracts are often won, not by the most qualified, but by the firm that presents most persuasive written proposal Presented 10 strategies for developing a good proposal
(Heemstra & Kusters, 2004)	Q	To define the Information structures for RFPs and proposals for the Dutch utility	None	S	DMT does not have guidelines for the ICT proposal structure and required information to be included in the proposal that can be used to evaluate the proposals DMT spends a significant amount of time and cost evaluating the incomparable proposals due to lack of guidelines	1 Developed a structure for proposals that consists of the following structure: -Cost - Risks - Benefits -System overview.
(Kennedy & Cannon, 2004)	P	How to win government contracts with good proposals	None	S	A well-written proposal will usually wins over a poorly written proposal Government is looking for assurance they will receive quality services and goods at a reasonable price and delivered as specified in the proposal Competition is increasing for limited funds causing the success rates to decline	Need to preliminary research to ensure the proposal is meeting the requirements of the RFP Proposal needs to be accurate, complete, and written in the language that the reviewers will understand

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Lauderdale, 2009)	P	How to win government contracts	None	S	Getting into government procurement is difficult and risky for a firm	Does government contracts fit into the strategic plan for the company Top management must support the effort Contracts take a long time to be awarded A firm must have the financial staying power to be in government contracting Government contracting procedures are different than commercial contracting Creating a proposal is a project
(Lauesen, 2004)	Case Study	How to deal with integration requirements during the tender process	None	B	1) Mandatory requirements hinder effective responses 2) Scope is not clear	Define requirements that explain the outcome in a semi-structured format Specify requirements that allows the product to be extended The requirements must cover the interfaces, functionality, and the uses of the product

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Lauesen & Vium, 2004)	Q	What were the issues with the requirements from the seller perspective	None	S	Writing an effective RFP is a project. Need to ensure that the requirements are correct	Sellers could not correctly develop a proposal in response to the RFP due to poor requirements in the RFP
(Mandell, 1986)	P	How to write a good RFP	Systems science	B	In order to receive accurate and competitive responses, a RFP must be written with well-defined requirements that can be methodologically evaluated by the buyer	Provides a format for the RFP Goals of a RFP: 1) provide accurate and objective description of the requirements 2) provide a mechanism to create competition and cost-effective creative solutions 3 Provide a standardized method for vendor response so they are judged on a common basis
(Paech et al., 2012)	Case Study	Describing issues with requirements engineering from the RFP when developing a proposal	Information model	S	Limited time to respond to a RFP Requirements may not be accurate or complete. Little contact with the customer for clarification of the requirements	The following are the primary solutions for the writing the RFP challenges: 1) Develop of a risk checklist 2) Good documentation of the existing system and the RFP process
(Parvey & Alston, 2010)	P	How to win government contracts	None	S	Getting into government procurement is difficult. Much time is required to learn about the processes of government contracting and to learn the needs of the government customer you are pursuing	Provides a step-by-step procedure for competing for government contracts

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Project Management, 2017)	P	What is the latest strategy, and processes that should be used by project managers	None	B,S	Not discussed	Presents the processes for developing a RFP that should be used by project managers
(Porter, 2007)	P	Why academics do not write time good proposals	None	S	A failed proposal is due to the writing style, not the content Competition is increasing for limited research funds causing the success rates to decline Grant reviewers have many proposals to read and will look for any reason to discard a proposal	1 Successful proposals have to be written as an elegant sales pitch in the style similar to the language of the RFP and not as a journal article 2 Need to meet the goals of the funder as specified in the RFP
(Porter-Roth, 2002)	P	How to write an effective RFP	None	B	Writing an effective RFP is a project.	RFP is the basis for a contract and the working requirements
(Sant, 2012)	P	How to write a good proposal	none	S	Most sellers do not understand the purpose of a proposal not the techniques that should be used to create a proposal. Very few proposal are good, they do not persuade the customer to select you.	1 A proposal is a sales tool. 2 A proposal should be about the customer, not the seller.

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Santos, 2004)	P	How to apply project management processes to proposal development.	None	S	Competition is increasing for limited funds causing the success rates to decline. Need to efficiently develop a viable proposal to increase the chances of winning a contract. Sellers want a good solution as well as proof that the seller can manage the development and delivery of the promised solution as specified in the proposal. The development of the proposal has all of the risks of a project such as including all stakeholders and meeting the requirements specified in the RFP.	Managing the proposal development as a project will help to minimized development costs and produce a quality proposal that meets the requirements of the buyer.

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Searcy, 2009)	P	How to respond to a RFP	None	S	Responding to RFPs takes a huge commitment on the seller	Provides 5 characteristics of a company winning a contract with a proposal: 1) Strategy: they know the market and their competitors, their strengths and weaknesses, and about the company issuing the RFP 2) Time and Effort commitment: evaluate their RFP, asses the chances of winning; dedicate employees to the proposal 3) Imagination and curiosity: provide new solutions outside the normal business procedures 4) Patience: takes time to answer the RFP 5) Realistic stance: do you fit the profile for taking new customers
(Sedano et al., 2016)	Q	What is the current state of projects based on the delivered proposals What is ideal state of a project for the class How do proposals compare against the minimum and ideal project states	SEMAT (Software Engineering Method and Theory) Essence Framework	B	No guidance is provided for selecting projects from industry that will be used for teaching in a college level class Most of the received proposals for industry were missing important information	Provides a selection criteria that was included in the RFP for the selection of actual industry projects to be used by students as part of their coursework Criteria consisted of the following: stakeholders, opportunity, requirements, software system

Publication	Method P – Practitioner Q - Qualitative	Research Question	Theory	Perspective B- Buyer, S- Seller	Challenges	Major Findings
(Stanberry, 2012)	P	How to participate in the government procurement process	None	S	A business can overrun a projects budget if the government procumbent process is not understood and followed	Government procurement is big business with many opportunities Need to understand the procurement process
(White & Bales, 2018)	P	How to write a good proposal	None	S	Crafting a well-written and compelling proposal is a complex and difficult task	Must understand the requirements

2.2 Project Performance

Central to the risk-performance model is the concept that the mitigation of risk by project management has a positive impact on project performance (Abdullah & Verner, 2012; Dedolph, 2003; Liu & Wang, 2014; Nidumolu, 1995; Parsons, 2006; Taylor, 2007; L. Wallace & Keil, 2004; Y. Zhang et al., 2018). The goal of risk management is to help ensure that the objectives of the project are successfully accomplished (Taylor, 2007). How is project performance defined?

"There are few topics in the field of project management that are so frequently discussed and yet so rarely agreed upon as the notion of project success" (Pinto & Prescott, 1988, p. 67). A clear definition of project success remains elusive (De Bakker et al., 2010; Dvir, Raz, & Shenhar, 2003). According to the Federal Acquisition Regulations (FAR), it is the responsibility of the issuing agency to ensure that the government gets what it paid for in terms of cost, schedule, and quality (FAR, 2019). Historically, the literature has viewed project success through specific success measures of time, cost and quality, the so-called iron triangle (Atkinson, 1999). Research on project success seems to adhere to these traditional project success criteria (Aloini, Dulmin, & Mininno, 2007; Atkinson, 1999; Savolainen, Ahonen, & Richardson, 2012; Shenhar, Dvir, Levy, & Maltz, 2001; Standish, 2018). The goal of the project manager is to bring a project to completion within budget, on schedule, and to meet the planned product performance goals; these are considered the traditional project management performance-criteria for a project (Dvir et al., 2003; Hughes, Rana, & Simintiras, 2017; Pinto & Prescott, 1988; Project Management, 2018; Taylor et al., 2012). Poor control of

any of these three traditional constraints by project management poses threats to the success of a project (Chen, Law, & Yang, 2009; L. Wallace & Keil, 2004). De Bakker et al. (2010) did a meta-analysis of IT studies from 1997 to 2009 to determine if the handling of risk by project management effected project performance. In the 26 publications on the relationship between risk management and project performance that were investigated, the traditional definition for project success was still very common; about two thirds of the publications in the meta-analysis referred to project success in terms of the traditional compliance with meeting cost, schedule, and quality (De Bakker et al., 2010). Savolainen et al. (2012) did a Systematic Literature Review (SLR) of risk-performance articles from the perspective of the seller. The majority of the articles in the study also used the traditional criteria for project performance (Savolainen et al., 2012). All projects have constraints on cost, schedule, and quality (Chen et al., 2009). The project manager and the project team constantly make tradeoff decisions among these three constraints (Chen et al., 2009; Nidumolu, 1996). When developing a proposal, these tradeoffs must also be competitive with the other possible sellers (Gransberg & Barton, 2007; Santos, 2004; Searcy, 2009).

But, criteria other than the traditional cost, time, and quality are defined as project success in the literature. A project may be considered successful that met the traditional constraints but may not have met user, customer, other stakeholders requirements (Baker, Murphy, & Fisher, 1997; Hughes et al., 2017); various definitions for project success other than the traditional have been used (De Bakker et al., 2010; DeLone & McLean, 1992, 2003; Savolainen et al., 2012; Y. Zhang et al., 2018). Delone and McLean (2003) proposed a model based upon previous literature for conceptualizing and operationalizing

IT success factors. The model's key criteria include information quality, system usage, and user satisfaction; cost and schedule were not included (DeLone & McLean, 1992, 2003). Y. Zhang et al. (2018) used for performance the overall satisfaction of outsourcing, attaining the outsourcing goals and contract agreements, and willingness to continue using outsourcing. These three aspects differ from the traditional performance measurements and emphasizes the subjectivity of the outsourcing project success (Y. Zhang et al., 2018). Research into project success has not converged to a standard definition (Dvir et al., 2003). A comprehensive definition of project success must therefore reflect different interests and views of the project manager, project team, users, customer, and other stakeholders, which leads to a multi-dimensional, multi-criteria definition (Dvir et al., 2003; Hughes et al., 2017; Pinto & Mantel, 1990).

A project delivered within the estimated schedule and costs, and meeting the agreed upon requirements is likely to be judged a success, but may be seen as a failure by its users and customers as the amount of expected use and benefit are not achieved; therefore, several criteria should be used to define success, not just a single measure (Hughes et al., 2017; Pinto & Prescott, 1988). Measuring success when the system is delivered and before the system is fully adopted by the users, will have a different result than if the evaluation is performed after being used for a period of time allowing for a more complete evaluation of the benefits of the delivered system (Hughes, Dwivedi, Simintiras, & Rana, 2015). Therefore, evaluating project performance when the system is delivered could be premature as the benefits and satisfaction of the system may be realized only after the system has been in use for a time. In addition, different stakeholders may have vastly differing views on what is considered successful (Delone & McLean, 2003; Hughes et al., 2017; Pinto & Prescott, 1988).

L. Wallace and Keil (2004) used two constructs adapted from (Rai & Al-Hindi, 2000) and (Nidumolu, 1996) to measure project performance: product performance and process performance (L. Wallace & Keil, 2004). Product performance measures the outcome of the project product that was developed such as the quality and response time of the delivered product; project performance measures the outcome of the project development process, was the project delivered by the project team within the estimated schedule, cost, and fulfilling the desired requirements (Nidumolu, 1996; Rai & Al-Hindi, 2000); the proposal includes these estimates. It is important to study both performance criteria because even though the project meet the product performance criteria, the project itself may have significantly exceeded the estimated time and cost budgets or not have fulfilled all of the requirements as specified in the proposal, but, a well-managed projects which come in below time and cost budgets may deliver quality poor products (Nidumolu, 1995; Pinto & Prescott, 1988). Project performance is multidimensional depending on the user perspective. Customers and developers are interested in cost and schedule (process) while users are interested in functionality, performance, reliability (product) (Boehm, 1991). The two constructs are discussed next.

Process or development performance is the success that the project manager and team had in developing the project outcome, to operate within traditional criteria of cost and schedule (Rai & Al-Hindi, 2000; L. Wallace & Keil, 2004). This approach is the traditional method of determining process performance; it captures two of the critical metrics typically associated with the so-called triple constraint, iron triangle, that a project manager must meet (Keil, Rai, & Liu, 2013). In his studies, Nidumolu's performance measures focuses on the success of the development process and refers largely to the ability of the project manager to keep a project within budget and schedule (Nidumolu, 1995, 1996). It was expected that projects with higher risk would be more likely to experience unsatisfactory project outcomes, cost and budget overruns (L. Wallace & Keil, 2004). For example, if the requirements are not clearly defined, then it is expected the project team may have to rework a portion of the project outcome due to misunderstood requirements thus possibly increasing the project costs and schedule (Boehm, 1991; Nidumolu, 1995).

Product performance refers how good the final product was when actually delivered to the customer. Product performance is the evaluation of the final developed product and includes criteria such as reliability, maintainability of the product, if product meets the intended functional requirements, and basically, if the product works without failures or errors (Nidumolu, 1995; Rai & Al-Hindi, 2000; L. Wallace & Keil, 2004). For example, if the project team met the cost and schedule constraints but the expected functionality of the product was not met or the product continually had failures during operation, then the process performance would be successful while the product performance would not (Liu & Wang, 2014; Nidumolu, 1996).

For this study, only the process performance will be evaluated against project risk. While other performance measures could have been investigated, the project management literature considers process performance to be a critical metric in determining if a project has been successful or not; projects that exhibit that fail to meet the estimated budget or schedule are less likely to be considered successful than the product performance related criteria (Keil et al., 2013). Table 2 provides a summary of the performance criteria from the project management risk-literature. The survey for this study contains the items for both performance constructs.

Table 2 Performance Literature Review

Publication	Time	Cost	Quality	Other Criteria Used
(Abdullah & Verner, 2012)	Yes	Yes	Yes	Risks on performance were discussed as part of each case study
(Barki et al., 1993)	Not discussed	Yes	Not discussed	Organizational and customer loss perspective, customer relations, financial health, reputation, profitability, market share
(Boehm, 1991)	Yes	Yes	Yes	Successful projects in general
(Cule, Schmidt, Lyytinen, & Keil, 2001)	Not discussed	Not discussed	Not discussed	Risks that effected project performance but specifics were not discussed
(Dongus, Ebert, Schermann, & Krcmar, 2015)	Yes	Yes	Yes	Process and product performance constructs
(Keil et al., 1998)	Not discussed	Not discussed	Not discussed	Risks that effected project performance but specifics were not discussed
(Liu & Wang, 2014)	Not discussed	Not discussed	Yes	Based on product performance construct (L. Wallace et al., 2004a)
(Liu, 2016)	Not discussed	Not discussed	Yes	Based on product performance construct (L. Wallace et al., 2004a)
(McFarlan, 1981)	Yes	Yes	Yes	Failure to obtain the anticipated benefits
(Schmidt et al., 2001)	Not discussed	Not discussed	Not discussed	Risks that effected project performance but specifics were not discussed.

Publication	Time	Cost	Quality	Other Criteria Used
(L. Wallace et al., 2004a)	Yes	Yes	Yes	Process and product performance constructs.
(Y. Zhang et al., 2018)	Not discussed	Yes	Yes	The overall satisfaction of outsourcing: attaining the outsourcing goals and contract agreements, and willingness to continue using outsourcing These three aspects differ from the traditional performance measurements and emphasizes the subjectivity of the outsourcing project success.

2.3 Project Risk

Given the multi-dimensionality and magnitude of factors required to manage a project, project management is not a trivial task; projects are complex. The effective application of project management techniques such as those outlined in the PMBOK is essential for projects to successfully achieve their goals (Project Management, 2017). Projects are risky ventures (Boehm, 1991; Gemino, Reich, & Sauer, 2007; Menezes, Gusmão, & Moura, 2019; Schmidt et al., 2001; Taylor, 2007; L. Wallace & Keil, 2004; Y. Zhang et al., 2018). Managing the risks by identifying and reducing the risks is a critical factor in the successful completion of a project (Barki et al., 2001; Boehm, 1991; Charette, 1996; Fairley, 1994; Heemstra & Kusters, 1996; Liu, 2016; Schmidt et al., 2001; Taylor, 2007; L. Wallace & Keil, 2004; Y. Zhang et al., 2018) and is widely recognized as an effective approach to improving the project performance (De Bakker et al., 2010; Liu & Wang, 2014; Schmidt et al., 2001). Project management research has empirically determined that many different types of risks negatively influence project performance (Han & Huang, 2007; Liu, 2016; Liu & Wang, 2014; L. Wallace & Keil, 2004; Y. Zhang et al., 2018) and that risks should be identified before they can be addressed (Boehm, 1991; Schmidt et al., 2001). A significant amount of research has focused on identifying risk factors during project execution in order to aid project managers in mitigating risk (Baccarini, Salm, & Love, 2004; Barki et al., 1993, 2001; Boehm, 1991; Cooke-Davies, 2002; Keil et al., 1998; Moynihan, 1996; Schmidt et al., 2001; Taylor, 2007). Such studies have included surveys primarily of project managers from a mixture of cultures, including Australia (Baccarini et al., 2004), Canada (Barki et al., 1993), Europe (Cooke-Davies, 2002), Ireland (Moynihan, 1996), Finland (Schmidt et al., 2001), Hong Kong (Cule et al., 2001), China (Liu & Wang, 2014; Y. Zhang et al., 2018) as well as the US (Boehm, 1991; Schmidt et al., 2001; L. Wallace & Keil, 2004) shows substantial commonality of risk factors across cultures (Taylor, 2007). Understanding risk is vital for managers because it allows them to manage project risks effectively, improve project performance, and, therefore, improve project performance and minimize the investment of wasted scarce resources (Liu, 2016). Successful project managers are also good risk managers (Boehm, 1991).

The project management literature views risk management as first identifying and assessing the risk, and then the mitigation of the risk (Boehm, 1991). The first stage consists of the identification of potential risks that may occur during the project development and the probability that each risk will occur along with potential monetary damage to the project from that risk if it were to occur. If good tools to help project managers identify risks are not available, risk management is of little value (Cule et al., 2001; Keil et al., 1998; Schmidt et al., 2001). Since 1975 when researchers began investigating project risks, there has been extensive research published on project risks, project failure, and project success (McLeod & MacDonell, 2011). Articles regarding risks negatively affecting performance have been written for software development (Schmidt et al., 2001; L. Wallace & Keil, 2004), ERP installations (Aloini et al., 2007; Chen et al., 2009; De Bakker et al., 2011), outsourcing (Liu, 2016; Liu & Wang, 2014; Nakatsu & Iacovou, 2009), new product development (NPD) (Gharakhani et al., 2018; Keizer, Vos, & Halman, 2005; Pattikawa, Verwaal, & Commandeur, 2006), construction projects (Barber, 2005; Flyvbjerg, 2006; Lyons & Skitmore, 2004), and IT governance

(Pa, Bokolo, Nor, & Murad, 2015). There is even a SLR of SLRs (Da Silva et al., 2011). Research methodologies in published studies include a practitioner's observation of successful and failed projects (Boehm, 1991; McFarlan, 1981), surveys of project managers (Barki et al., 1993), Delphi surveys (Cule et al., 2001; Schmidt et al., 2001), qualitative case studies (Abdullah & Verner, 2012; Dvir et al., 2003), empirical studies based on the surveys (Han & Huang, 2007), and the development of theoretical models (Liu, 2016; Liu & Wang, 2014; Nidumolu, 1995, 1996; L. Wallace & Keil, 2004). The proliferation of published papers illustrating the causes of poor project performance demonstrates that there is no consensus on the causes of poor project performance (Hughes et al., 2017; Perminova, Gustafsson, & Wikström, 2008) and that the classification of the causes of project risk, failure, success are multi-dimensional (Dongus et al., 2015; Gharakhani et al., 2018; Pinto & Mantel, 1990; Taylor, 2007). Project risks are not independent of each other; they are closely intertwined, correlated (L. Wallace et al., 2004a). Due to the proliferation of risk articles, a search of project risk SLRs and meta-analysis was performed using the keywords project risk, risk factors, project risk factors, project failures. These articles provided the initial articles to be reviewed for this study. For example, risk factors in Menezes et al. (2019) included the 10 most cited articles were used as the initial articles for this literature review. Similarly S. Gupta, Gunasekaran, Antony, Bag, and Roubaud (2019) performed a SLR on project failure; the top cited articles from that study were also included in this study. An additional search for risk factors for outsourced projects was performed in anticipation of finding articles on proposals since many outsources projects require proposals from the sellers but, again, there was a lack of articles.

Risk management research has been trying to formalize these risk-performance correlations in which a project manager can use to identify and mitigate possible risk factors before they become threats to the project (Boehm, 1991; Cule et al., 2001; Schmidt et al., 2001). According to (Boehm, 1991), one of the most cited authors and considered the father of risk management, risk management is critical because it helps project managers avoid both rework of completed portions of the project and project cancellations by not meeting user expectations, and in addition, helps to increase the successful performance of projects (Menezes et al., 2019; Schmidt et al., 2001). To avoid these issues, risks associated with a project be first identified, assessed, and then mitigated (Barki et al., 1993; Boehm, 1991; Schmidt et al., 2001; L. Wallace et al., 2004a). Identifying the risks threatening projects and mitigating these risks is a challenge for the project manager (Longstaff, Chittister, Pethia, & Haimes, 2000).

Project risk literature has focused primarily on five domains as follows: (1) the development of framework for identifying and managing risks (Persson, Mathiassen, Boeg, Madsen, & Steinson, 2009), (2) identification of risk factors (Barki et al., 1993; Schmidt et al., 2001; L. Wallace et al., 2004a), (3) development of methods and techniques for assessing risk (Aloini, Dulmin, & Mininno, 2012; Hu, Zhang, Ngai, Cai, & Liu, 2013), (4) development of mitigation strategies to reduce and avoid project risks (Liu & Wang, 2014), and (5) empirical evaluation of the negative effect risk has on project performance (Nidumolu, 1996; L. Wallace et al., 2004a). The first four domains have been intensively investigated, the fifth domain remains poorly understood and requires additional empirical research on the relationship between different risks and project performance (Gemino et al., 2007; S. Gupta et al., 2019; Liu, 2016; Y. Zhang et al., 2018). This study helps to provide additional empirical evidence.

A great degree of similarity exists in the research methodology used to study project risk (Barki et al., 1993). This section discusses the three primary types of results from the project management literature: (1) risk checklists, (2) risk frameworks, and (3) empirical models. These three types are interrelated and often used together in the research methodology (Bannerman, 2008). A description of the three types follows.

2.3.1 Risk Checklists

One popular method for identifying risk factors in the literature has been the use of checklists which are basically lists that identify risks that threaten the success of projects that have been compiled by surveys of experienced project managers (Addison & Vallabh, 2002; Bannerman, 2008; Barki et al., 1993; Boehm, 1991; Moynihan, 1997; Schmidt et al., 2001). Boehm (1991) provides a typical checklist based on his informal observations within the company he was employed as chief scientist, TRW Defense systems, and then as director of the government agency, Defense Advanced Research Project Agency Information and Technology Office (DARPA) (Schmidt et al., 2001). Checklist helps a project manager identified risks and that few are overlooked (Schmidt et al., 2001). The value of these lists is that the listed risks are generic and may be used by project managers on a variety of projects (Bannerman, 2008). Therefore, an elementary strategy for identifying risks is to use these checklists to ensure that each risk factor in the list is accounted for in the project (Bannerman, 2008; Schmidt et al., 2001).

Checklists should be develop and then used to identify and manage each risk that may occur on a project (Boehm, 1991).

There are issues with the use of checklists including: (1) which checklist to use, (2) risks vary over the project life cycle, (3) stakeholders often look at risks outside of their domain, at other people's domain and ignore their own risks, (4) managers concentrate on the wrong risks, perceptions seem to be based on the potential loss that may occur rather than the probability of occurrence, a low probability risk may be catastrophic for the project, (5) lack of coherent structure (Bannerman, 2008; Cule et al., 2001). Complex projects have many risks and managing such a multitude of risks as unique factors is impractical causing managers to miss some risk factors; some checklists have over 50 factors (Bannerman, 2008; Cule et al., 2001; Schmidt et al., 2001). The checklists in this category do not have a ranking of relative importance enabling project managers to be watchful for the high-ranked critical risks (Schmidt et al., 2001). Most of the published checklists vary significantly in the amount of detail and scope to be useful to the project manager because they have been created with limited samples and with questionable methodology and analysis. Another limitation has been that the collected data has been taken from a single culture, possibly biasing the results (Schmidt et al., 2001). Long detailed checklists, sometimes consisting of a 100 risks, need to be reduced to a more manageable level such as by categorizing the risks according to their source or means of mitigation (Boehm, 1991; Cule et al., 2001; Schmidt et al., 2001).

2.3.2 Risk Frameworks

Consolidating and classifying risk factors into frameworks have been developed to explain different dimensions of risks (Keil et al., 1998; Liu & Wang, 2014; McFarlan, 1981; McLeod & MacDonell, 2011). Risks often cluster into categories so that similar mitigation techniques can be applied to the category rather than treating each individual risk (Addison & Vallabh, 2002; Barki et al., 1993). Using this approach, risk management becomes more manageable since every risk in a project does not need to be identified, just the category (Abdullah & Verner, 2012; Addison & Vallabh, 2002; Cule et al., 2001; Liu & Wang, 2014). For example, Keil et al. (1998) developed a 2 × 2 grid framework to categorize project risk. Barki et al. (1993) developed a comprehensive list of risk factors from the literature and organized them into five general risk categories by factor analyzing data retrieved using a survey (Schmidt et al., 2001). Frameworks consisting of risk categories can provide a strategy for determining risks that might threaten a project rather than to work through a long checklist of risks (Bannerman, 2008).

2.3.3 Theoretical Models

The final and least common of the results is the development of a theoretical model such as (L. Wallace et al., 2004a). Typically, such a study begins with a review of the literature resulting in a checklist or framework of risk factors. Using these factors, a model is typically developed with risks as the independent variable and project performance as the dependent variable; moderators might also be included in the model. Empirical methodology is used to support the model and the hypotheses. Example of such theoretical models include (Jiang, Klein, & Ellis, 2002; Liu, 2016; Liu & Wang, 2014; Nidumolu, 1995, 1996; L. Wallace et al., 2004a; Y. Zhang et al., 2018). Additional empirical evidence on the relationships between different types of risk and performance is needed particularity in different project sourcing context (Bannerman, 2008; Liu, 2016;

Rai & Al-Hindi, 2000; L. Wallace et al., 2004a). Rigorous, evidence-based, empirical studies are still not very common in determining the relationship between risk and performance (S. Gupta et al., 2019). The types of research methodologies used in identifying risks is discussed next.

Hughes et al. (2017) classified articles by the methodological approach that includes: (1) practitioner reviews, (2) case studies, (3) empirical studies, and (4) theoretical studies. A discussion of the four types follows.

2.4 Practitioner Experience

The majority of articles in this category are typically compiled from the experiences of practitioners, primarily project managers, detailing their experiences with projects resulting in a summary of their generalized observations from past projects (Bannerman, 2008; L. Wallace et al., 2004a). These articles typically contain lists of risks that are frequently encountered that lead to poor project performance. These articles are largely observations and provide little empirical support for the importance of a particular risk and the effect on project performance (L. Wallace et al., 2004a).

Boehm (1991) observed project managers and came up with a list of risks that was mapped into the L. Wallace et al. (2004a) categories for this study. His checklist of the top-10 software risk items includes: (1) personnel shortfalls (team risk), (2) unrealistic schedules and budgets (planning & control risk), (3) developing the wrong functions and properties (requirements risk), (4) developing the wrong user interface (requirements risk), (5) gold platting (requirements risk), (6) continuing stream of requirement changes (requirements risk), (7) shortfalls in externally furnished components, (8) shortfalls in externally performed tasks, (9) real-time performance shortfalls (complexity risk), and (10) straining computer-science capabilities (complexity risk) (Boehm, 1991). Four of the top 10 are requirements related.

McFarlan (1981) observed three important dimensions that influence the risk inherent in a project as follows:

- Project size: The larger the project is in cost, staff, duration, and the number of departments affected by the project, the greater the risk. Million dollar projects carry more risk than $100,000 projects and may affect the company more if the risk is realized causing the project to fail.
- Experience with the technology (team risk): Project risk increases as familiarity of the project team with the technology decreases due to unexpected issues that may occur.
- Project structure (requirements risk): Highly structured projects carry much less risk due to the requirements being systematically developed and agreed upon; such requirements are determined at the beginning of the project and not subject to change during the project. Low structure projects are those whose requirements are more subject to the manager's judgment and may cause the requirements to change during the project development.

Based on these three observations, McFarlan (1981) developed a 4 x 4 matric consisting of high and low structure and high and low technology. Table 3 includes characteristics of articles that uses the practitioner experience methodology.

Table 3 Practitioner Literature Review

Publication	Research Characteristics	Number of Risk Factors	Results	Application
(Avots, 1969)	Observations	10	Checklist	Projects in general
(Boehm, 1991)	Observations	10	Checklist	Software development
(McFarlan, 1981)	Observations	3	Checklist	Software development

2.5 Case Studies

Abdullah and Verner (2012) developed a risk framework for critical outsourcing risks mostly based on a comprehensive list of risks developed by L. Wallace et al. (2004a) and Schmidt et al. (2001). Schmidt's study relies on input from practicing project managers; Wallace's study is based on risks from previous studies as well as and input from project managers. Nine case studies of infamous project failures were used to validate this framework including the London stock exchange, Intrico's travel reservation system, RACV Insurance workflow system, and Sainsbury's supply chain system. The resulting framework consisted of the following risk dimensions: (1) organizational environment, (2) team, (3) user, (4) complexity, (5) contract (new), (6) financial (new), (7) legal (new), (8) scope and requirements, (9) planning and control, and (10) execution (new). Six of the ten fall into the six dimensions of risk as defined by (L. Wallace et al., 2004a). Most of the risk factors identified are common and may appear in any type of project. Requirement risks were the critical cause of project failure in six of the nine case studies (Abdullah & Verner, 2012). Table 4 includes the characteristics of articles using the case study methodology.

Table 4 Case Study Literature Review

Publication	Research Characteristics	Risk Dimensions	Risk Factors	Results	Requirements
(Abdullah & Verner, 2012)	9 case studies of failed outsourced projects	11 primarily based on (Wallace, 2004) and (Schmidt, 2001).	51	Developed a risk framework for outsourced projects	Requirements was the # 3 cause of failure was evident in 6 of the 9 case studies.
(Sumner, 2000)	7 case studies of ERP installation projects	11	29	Developed a risk framework for ERP projects	Requirements was one of the dimensions
(Ahonen & Savolainen, 2010)	Post-mortem analysis of 5 software projects to determine the causes for the cancellations	not discussed	4	Staff is not available for the project Tight schedule	Team did not understand the requirements of the buyer.

2.6 Empirical Studies

This classification involves some empirical analysis such as the analysis of the results of a survey or a Delphi survey study leading to a ranked checklist but does not result in a model or hypotheses. According to Barki et al. (1993), the concept of software development risk in IT projects still lacks a generally accepted means of assessment. He attempts to address these issues by developing a conceptual definition and proposing an initial measure for the project risk construct. Barki et al. (1993) developed a comprehensive list of risk factors from the literature and then organized them into five categories by analyzing the results of a survey to project managers; project performance consisted of only project failure. The five dimensions are: (1) technological newness that includes new requirements that must be developed due to new software and hardware, new suppliers, and number of user's outside the organization, (2) project size that includes the size of the scope and requirements, (3) lack of expertise of experience by the team and users, (4) technical complexity that includes the number of links to other systems, (5) organizational environment that includes the number of changes to the organization users, conflicts between users, and the lack of resources (Barki et al., 1993). The five dimensions were shown to be correlated with each other as was empirically verified by (L. Wallace et al., 2004a). An important limitation of this study is the fact the dependent variable is only project failure, not the many facets of project performance.

The first step in the risk management process is to identify the risk so that the appropriate mitigation can be taken to control and reduce the risk. One problem with this approach is that there are no validated checklists available to help the project manager identify and mitigate project risks (Schmidt et al., 2001). Schmidt develop a more disciplined approach to software project risk management by asking the following two questions: (1) what are the typical risks that project managers encounter and (2) which risks require more attention than others? The data collected by (Keil et al., 1998) was also used by (Cule et al., 2001) and (Schmidt et al., 2001) in their studies illustrating that risks can be defined by multiple frameworks and checklists. Using three (3) panels of project managers from Finland, US, and Hong Kong, using a Delphi survey, a rigorous data collection method, a list of risks in order of importance was generated through iterative, controlled feedback. Using three international panels was done to broaden the view of the types of risks, rather than relying on the view of a single culture as has been performed in previous research (Schmidt et al., 2001). Using the (Barki et al., 1993) study and the results of the conference paper which became (Schmidt et al., 2001), (Schmidt et al., 2001) developed a very comprehensive list of risk that had over 100 articles and books that either dealt directly or indirectly with IT project risk (Y. Zhang et al., 2018). Schmidt et al. (2001) had 14 different risk dimensions with a total of 53 factors. The 14 dimensions are as follows: (1) corporate environment (organizational), (2) sponsorship / ownership, (3) relationship management (user), (4) project management (planning & control), (5) scope (requirements), (6) requirements (requirements), (7) funding (planning & control), (8) scheduling (planning & control), (9) development process, (10) personnel (team), (11) staffing (team), (12) technology (complexity), (13) external dependencies, and (14) planning (planning and control). These 14 dimensions map, in parentheses, into the six risk dimensions developed by (L. Wallace et al., 2004a). The requirements risk dimension was defined by these three factors: (1) requirements continuing changing due to the changing needs of the users causing the system to be delayed, (2) requirements not adequately defined before starting the project leading to not having the required skills required for the project and to underestimating the team effort for the required during the project development, and (3) poorly defined requirements due to not understanding the new or unfamiliar products or technology. Other dimensions and factors that included requirements risk illustrating that this risk is involved with multiple factors and dimensions follows: (1) unstable environment, radically changing user needs, (2) lack of cooperation from users, (3) not identifying or ignoring stakeholders, ignoring some key stakeholders in the project that affects multiple phases of the project including requirements definition and implementation, (4) scope creep caused by not completely defining the scope and the requirements before starting, (5) underfunding of development, estimating the budget and schedule the project before the scope and requirements are completely defined, (6) lack of “people skills” in project leadership, the project manager tries to develop schedules and budgets without including the project team, and (7) the project not based on a business case. Eleven of the 14 risk dimensions were on all three international panels showing that these are universal risks (Schmidt et al., 2001). The top-10 risks factors were as follows: (1) lack of top management support (organizational) (2) failure to gain user commitment (user), (3) misunderstanding the requirements (requirements), (4) lack of user involvement (user), (5) lack of team skills (team), (6) lack of frozen requirements (requirements), (7) changing scope and objectives (Indirectly related to requirements by Schmidt), (8) introduction of new technology (complexity), (9) failure to manage end user expectations, and (10) insufficient and inappropriate staffing (planning and control). Eight of the top-10 risks were map into the six constructs, in parenthesis, developed by (L. Wallace et al., 2004a). Requirements were in two of the top six factors and indirectly one of the top 10 totaling three of the top-10 risk factors. This comprehensive list of risk factors was used by (L. Wallace et al., 2004a), (Abdullah & Verner, 2012), (Liu & Wang, 2014), and (Liu, 2016).

Keil et al. (1998) made a 2x2 quadrant with high and moderate importance which represented the severity of the risk to the project on one axis and high and low control represented the control the project manager had over the risk on the other axis. The four quadrants were labeled as follows: (1) customer mandate, high importance-low control (2) scope and requirements, high importance-high control, (3) environment, moderate importance-low control, and (4) execution, moderate importance-high control. Requirements were represented in three of the four quadrants. Misunderstanding the requirements was a critical risk because, as one panelist stated, "*requirements drive the entire project*" (Keil et al., 1998, p. 79). Without requirements that are complete and accurate, there is a distinct possibility of building a system that does not meet the expectations and needs of the users underscoring the importance of understanding the requirements. Another critical risk was the failure to gain user commitment to the requirements in the early stages of the project because it helps to ensure that users are actively involved with requirements definition. "*The users of the system to be delivered are the ultimate customer of the deliverable* . . . *If the users are not committed to a joint effort in which they are heavily involved in the effort; there is a high risk of assuming their detailed functional and business requirements. Without their commitment, they withdraw critical feeling of ownership and the project has a high chance of missing the mark*" (Keil et al., 1998, p. 79).

The Cule et al. (2001) framework had four categories: (1) self risks, (2) task risks, (3) client risks, and (4) environment risks. Self and task risks were considered "inside" the project environment and controllable by the project manager while client and environment risks were considered "outside" the project managers control. Requirements were represented in three of the four quadrants (Cule et al., 2001). Table 5 includes the characteristics of articles that use the empirical study methodology.

Table 5 Empirical Research Literature Review

Publication	Research Characteristics	Risk Dimension	Risk Factors	Results	Application	Country	Requirements
(Barki et al., 1993)	Lit review Survey Factor analysis	5	23	Framework	Software development	Canada	Requirements were 1 one of the dimensions.
(Schmidt et al., 2001)	Delphi Study	14	53	Ranked Risks Framework	Software development	US, Finland, Hong Kong	One dimension was requirements. Requirement factors were 2 of the top 6 factors.
(Cule et al., 2001)	Delphi Study	4	53	Framework	Software development	US, Finland, Hong Kong	Requirements risks were in 3 of the 4 quadrants.
(Keil et al., 1998)	Delphi Study	4	53	Ranked Risks Framework	Software development	US, Finland, Hong Kong	Requirements risk were in 3 of the 4 quadrants.
(Baccarini et al., 2004)	Lit review Survey	Not discussed	27	Ranked Risks	IT	Australia	Requirements risk was in the top 5 factors

2.7 Theoretical Studies

These studies developed a theoretical model with hypotheses. L. Wallace et al. (2004a), following the methodological steps typically performed by other studies, developed the software project risk construct. After an extensive literature review was performed, using primarily (Barki et al., 1993) and (Schmidt et al., 2001), an extensive list of factors identified as contributing to riskiness of IT development projects was developed. From this list, a survey was developed and sent to the project managers. With the results of the survey, six risk constructs were developed that became the independent variables. Two established constructs developed by (Nidumolu, 1995) were used for project performance, product and process performance. The model showed that there was a correlation between the six project risk constructs and that the risk constructs had a negative correlation with project performance (L. Wallace et al., 2004a). Six dimensions of IT project risks were identified: (1) team, (2) organizational environment, (3) requirements, (4) planning and control, (5) user, and (6) complexity with a total of 27 factors. Following is are the final survey items for the six categories of risk developed by (L. Wallace et al., 2004a, p. 299).

- Complexity risk consists of four factors: Project involves use of technology that has not been used in prior projects, technical complexity, or immature technology.
- Organizational and Environment risk consists of four factors: Change in organizational management during the project, corporate politics with negative effect on project, unstable organizational environment, and organization-undergoing restructuring during the project.
- Planning & Control risk consists of seven factors: lack of an effective project methodology, project progress not monitored closely enough, inadequate estimation of required resources, poor project planning, project milestones not clearly defined, inexperienced project manager, and ineffective communication.
- Requirements risk consists of four factors: continually changing system requirements, system requirements not adequately identified unclear system requirements, and incorrect system requirements.
- Team risk consists of three factors: Inadequately trained development team members, inexperienced team members, and team members lack specialized skills required by the project.
- User risk consists of five factors: users resistant to change conflict between users, users with negative attitudes toward the project, users not committed to the project, and lack of cooperation from users.

This model will become the basis for the model in this study as will be discussed in the next section.

Liu and Wang (2014) developed a list of risks based upon Schmidt (2001) and (L. Wallace et al., 2004a). The Schmidt (2001) study used input from practicing project managers while the L. Wallace et al. (2004a) based its study on risks developed from past research as well as input from project managers (Liu & Wang, 2014). The model developed by (L. Wallace et al., 2004a) was also validate by this study. Liu (2016) again validated the model developed by L. Wallace et al. (2004a) in which user risk and planning and control risk were negatively correlated with product performance and were moderated by (1) the type of outsourcing, internal or external, and (2) by the strategic importance of the project. Validating L. Wallace et al. (2004a), Han and Huang (2007) found that requirements is the principal risk affecting project performance. If the project manager is unable to effectively manage the requirements during the initial stages of the project when the requirements are defined as well as changes during the project execution due to customer requests, projects are likely to perform poorly. Four of the five top software risks were requirements related. Project performance research should explore the relationship between risks and some important project attributes including project size, duration, and cost (Han & Huang, 2007). Using similar methodology as Han and Huang (2007), risk and product performance were affected by duration of the project (Huang & Han, 2008).

2.8 SLR and Meta-analysis Studies

Examples of SLRs includes surveys of risk factors that affect software performance (McLeod & MacDonell, 2011) and (Menezes et al., 2019) and a meta-analysis determining if risk contributes to IT project success by (Bakker et al., 2010). A SLR of project risks by (Menezes et al., 2019) had 148 different risk factors that were categorized. They found that risks relating to requirements were the most cited indicating a need for more studies on this factor as it is a fundamental risk for improving project performance. The top-10 risks are as follows: (1) staff does not have required skills (resources dimension), (2) requirement ambiguity (requirement dimension), (3) bad commitment of the user/customer (program interfaces dimension), (4) requirement changes (requirement dimension), (5) introduction of new technology (requirement dimension), (6) unstable organizational environment (program interfaces dimension), (7) shortfalls in externally furnished components and bad interfaces (design dimension), (8) technical complexity (requirement dimension), (9) no planning or inadequate planning (management dimension), and (10) incomplete requirements (requirement dimension). Five of the top-10 factors were requirements related. Table 6 includes the characteristics of articles that were SLRs or used the meta-analysis methodology.

Table 6 SLR and Meta-analysis Literature Review

Publication	Method	Research Question	Date range	Articles	Risk Dimensions	Risk Factors	Outcomes
(Arnuphaptrairong, 2011)	SLR	What are the common risk factors from the top-ten lists	All available articles	12	Not discussed	6	Requirements was the #2 risk factor
(De Bakker et al., 2010)	Meta	Does risk management contribute to project success	1997 - 2009	32	Not discussed	Not discussed	Top cited risk factor was requirements
(Dongus et al., 2015)	Meta	The determinants that have an effects on systems IT project performance	1985 - 2014	230	6	22	Requirements had the second highest negative impact on performance and had the third highest number of articles
(S. Gupta et al., 2019)	SLR	What are the most common project failure factors	Prior to December 2016	111	Not discussed	13	Top 7 failure factors included requirements based factors
(Hughes et al., 2017)	SLR	Key factors that lead to project failure	All available articles	62	10	Not discussed	Top 10 risk factors included 2 requirement based factors
(McLeod & MacDonell, 2011)	SLR	Identify and classify factors that have an impact on project outcomes	1996 - 2006	177	4	18	One of the factors was requirements determination Requirements was also involved in 6 other risk factors
(Menezes et al., 2019)	SLR	What are the evidence of risk factors in SW projects?	Prior to December 2016	41	13	148	Top 10 risk factors included 5 requirement based factors

Publication	Method	Research Question	Date range	Articles	Risk Dimensions	Risk Factors	Outcomes
(Song, Cai, Li, & Wu, 2009)	Meta	What are the most common project risk factors	1988 - 2008	23	6	56	Requirements was one of the six dimensions. Three of the top 6 were requirements

2.4 Model and Hypotheses Development

Many prior studies focus on identifying project risks (Alter & Ginzberg, 1978; Barki et al., 1993; Boehm, 1991; McFarlan, 1981; Moynihan, 1997; Schmidt et al., 2001) and a few studies empirically examine the relationship between risk and performance (Han & Huang, 2007; Jiang & Klein, 2000; Jiang, Klein, & Discenza, 2001; Keil et al., 2013; Liu, 2016; Liu & Wang, 2014; Nidumolu, 1995, 1996; L. Wallace et al., 2004a; Y. Zhang et al., 2018). These studies show that the identification and management of risks are critical for successfully meeting the objectives of the project (Menezes et al., 2019). There is a negative correlation between risk and project performance and managing these risks reduces the risk and increases project performance (Liu, 2016; Liu & Wang, 2014; L. Wallace et al., 2004a; Y. Zhang et al., 2018).

L. Wallace et al. (2004a) empirically tested the relationship between the six risk constructs and the two performance constructs. (L. Wallace et al., 2004a) developed six reflective constructs of project risk: (1) requirements with four factors, (2) planning & control with seven factors, (3) complexity with four factors, (4) team with three factors, (5) organizational environment with four factors, and (6) user with five factors for a total of 27 factors and used two established reflective constructs developed by (Nidumolu, 1995) for project performance: (1) process with two factors, and (2) performance with five factors. The results showed that there was positive correlation between the different risk constructs. Similarly, there was a negative correlation between the risk constructs and the two performance constructs. Similar models have been validated by other research (Han & Huang, 2007; Liu, 2016; Liu & Wang, 2014; Y. Zhang et al., 2018). (Liu & Wang, 2014) used similar risk constructs to also empirically test the relationship with system performance: process and product. (Liu, 2016) tested two similar risk constructs, user-related and project management risks, against product performance with the similar results. Y. Zhang et al. (2018) showed that the six similar constructs used by (L. Wallace et al., 2004a) negatively correlated with outsourcing satisfaction. Nidumolu (1996) empirically tested the relationship of requirements uncertainty risk with process performance with similar results. Nidumolu (1995) empirically tested the relationship of requirements uncertainty risk with process and product performance with similar results. Based upon these results, the research model for this dissertation is illustrated in Figure 2.

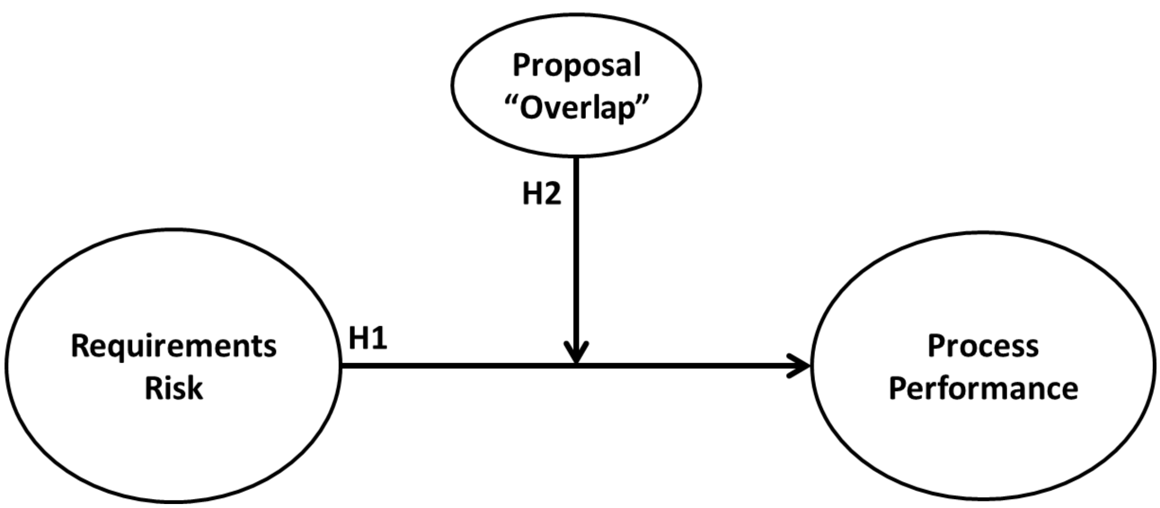

Figure 2 Research Model

Requirements risk was selected due to the importance of the risk as demonstrated previously in the literature search. In a SLR of risk factors, requirements based factors included five of the top-10 factors (Menezes et al., 2019). In a SLR of project failure factors, requirements based factors included seven of the top-10 factors (S. Gupta et al., 2019). In a meta-analysis of project success factors, requirements was the top cited factor (De Bakker et al., 2010). Requirements was shown to have a negative relationship with project performance (Nidumolu, 1995, 1996). Keil et al. (2013) using two risk constructs (user, requirements) showed that project control, formal and informal, moderate process performance. The results of all the above studies show that requirements risks were negatively correlated with project performance. Following in the paths of these previous studies, the following hypothesis is proposed:

> Hypothesis 1 (H1) - Requirements risk will have a negative impact on process performance.

This model was also selected due to the capability of testing the five other risk constructs against both product and process performance. The survey for this study included all of the 27 risk items for the six independent variable risk constructs and the seven items for the two dependent variable performance constructs. Post-hoc analysis included the requirements risk construct correlation with the product performance construct as well as the moderator.

2.4.1 Moderator

Basically, transactive memory system (TMS) refers to the knowledge of “who knows what” and “who does what” on a project (Argote & Ren, 2012; Lewis, 2003; Lewis & Herndon, 2011; Y. Wang et al., 2018; Wegner, 1987). What is TMS, what causes TMS to develop on a project, and what is the effect that TMS has on project performance are discussed in this section. Table 7 contains the articles relating to TMS resulting from the literature search.

Table 7 TMS Literature Review

Publication	Research Question	IV	Mediators / Moderators	DV	Major Findings
(Akgün & Lynn, 2002)	1) What happens if teams undergoes frequent turnover 2) How does team turnover impact project outcomes	Team stability	none	Speed-to-market Project Success Team learning	Team stability is positively correlated with project team learning, new product development, and speed-to-market Team accelerate new project success
(Akgün, Byrne, Keskin, Lynn, & Imamoglu, 2005)	What factors effect TMS	Team stability, trust, proximity, familiarity, communication	Task complexity: routines, knowledge	Project performance, learning, speed-to-market	Team stability, trust, familiarity were positively related to development of TMS Task complexity was only partially supported as a moderator for TMS and project outcomes Complexity was significant for speed to market and success in low and high complexity tasks.
(Argote & Ingram, 2000)	Develop a framework for analyzing knowledge transfer in organizations Interactions among people, tasks, and tools are unlikely to fit the new organization and are the difficult to transfer	Framework is the interaction between people, tasks, and tools	multiple discussed	Competitive advantage in firms	The framework consisted of interactions between people, tasks, and tools This framework is hard to move from one firm to another and thus provides competitive advantage

Publication	Research Question	IV	Mediators / Moderators	DV	Major Findings
(Argote, McEvily, & Reagans, 2003)	What are the current themes emerging from recent research	none	none	none	Researchers are increasing the understanding of managing knowledge in organizations Proposed a framework that highlights knowledge management outcomes, and contextual properties as key dimensions
(Argote & Ren, 2012)	Is TMS a source of a firm's competitive advantage	Three (3) TMS dimensions: specialization, credibility, coordination	none	Performance of a dynamic organization	TMS is a source of competitive advantage An organization's TMS develops with experience, is unique to that organization, and is hard to duplicate Organizations with well-developed TMS are able to build and integrate knowledge more effectively than those without TMS TMS helps with the development of dynamic capabilities in organizations .
(Argote & Fahrenkopf, 2016)	Provide a summary of research on TMS including major findings, current trends, challenges, and opportunities for future research	none	none	none	TMS plays an important role in the competitive advantage of a firm More research is needed on TMS and the effect on performance

Publication	Research Question	IV	Mediators / Moderators	DV	Major Findings
(Argote & Guo, 2016)	Compare and contrasts the effects of two knowledge repositories, routines and TMS, on knowledge creation, coordination, retention, and transfer	Routines and TMS	none	Knowledge creation, coordination, retention, and transfer	TMS improves team performance if the membership is stable TMS is unique to a team who have gained understanding of each other's knowledge, skills, and abilities The team must integrate the new members and rebuild TMS when a member leaves
(Brandon & Hollingshead, 2004)	A dynamic model of TMS development over time within a team based on the tasks to be performed	none	none	none	Developed a model for the dynamic development of TMS within a project The model consists of prerequisites and TEP development; each connects to the other and each is continually developed
(Lewis, 2003)	To develop measures / scales for TMS - not having a scale impedes the progress of TMS	none	none		The developed scale consists of the following reflective constructs: specialization, credibility, and coordination
(Lewis, Belliveau, Herndon, & Keller, 2007)	Examine the effects of membership change on performance for knowledge-intensive tasks To identify the factors that explain changes in membership effects on group cognition and performance	TMS structure stability TMS process efficiency	Intact groups Partially-intact groups Reconstituted Groups	Operational performance	Partially intact teams were much less efficient than intact teams and performed much worse than did intact teams and regenerated teams

Publication	Research Question	IV	Mediators / Moderators	DV	Major Findings
(Bachrach et al., 2019)	Which contexts affects TMS development and team performance	Three (3) TMS dimensions: specialization, credibility, coordination	Culture, distance, performance orientation, in-group collectivism	Team Performance defined as: task performance, affective performance, and creative performance	TMS is positively associated with task, affective, and creative performance and is more significantly related to performance than other forms of collective cognition Environmental change, leadership, and human capital resources have a positive effect on TMS National culture can impact the relationship between TMS and performance
(Y. Wang et al., 2018)	What are the correlations between TMS and knowledge transfer How does knowledge transfer affect team performance Is knowledge transfer a mediator on TMS relationships	Three (3) TMS dimensions: specialization, credibility, coordination	Knowledge transfer (team interaction)	Team Performance	Specialization and credibility were more significant than coordination Knowledge transfer correlated with team performance and fully mediated the effect of specialization and credibility on team performance
(DeChurch & Mesmer-Magnus, 2010)	How important is cognition to team performance Aspects of cognition are important to team process and performance Which types of teams benefit from team cognition	Cognitive (emergence, form, content) Motivational & Affective Behavioral (transition, action)	Cognitive (emergence, form, content) Task (team type, team interdependence) Study characteristics (experimental vs non-experimental, laboratory vs field, performance criterion)	Team effectiveness	Team cognition positively correlated with team performance, motivational states, and behavior Team type did not moderate the relationship between TMS and team performance Team performance is determined team members able to predict and anticipate each other's actions and to fully utilize the team expertise are essential underpinnings of team performance

Publication	Research Question	IV	Mediators / Moderators	DV	Major Findings
(Z. Zhang, Hempel, Han, & Tjosvold, 2007)	What factors of group interdependence increase TMS development Does TMS development influence team performance	Task Interdependence Cooperative goal interdependence Support for innovation	TMS	Team performance	Task, common goal, and support for innovation positively correlate to TMS TMS positively correlates to team performance
(Kotlarsky & Oshri, 2005)	What are the social effects of managing a distributed IT development projects	None	None	None	Human related issues such as TMS, social and knowledge sharing were keys to successful collaboration and performance in globally distributed projects

Many organizations rely on the knowledge, experience, and expertise of their personnel to differentiate products and services from their competitors; projects are used by organizations to exploit this knowledge, expertise, and experience to create products and provide services (Kellermanns, Floyd, Pearson, & Spencer, 2008; Lewis, 2003). Projects tend to be staffed based upon the availability of personnel at the start of project execution rather than the deliberate allocation of resources due to the dynamic and unpredictable flow of project–based work causing projects to be staffed with members who have previously worked together, such as proposals, and new members with no prior working experience with the other project members. Projects involve members with different expertise, specializations, backgrounds, and methods of operation (Lewis, 2003; Lewis et al., 2007; Maister, 1982). This trend towards projects by organizations may explain the renewed interest in team research, particularly in the knowledge processes of projects, such as TMS (Lewis, 2003). A project is multi-functional including project managers, engineers, contracts, and sales and requires personnel that specialize in these functions (Akgün et al., 2005). Due to this specialization, TMS was selected as the moderator for this study. What is TMS?

TMS was conceived by (Wegner, 1987) when he observed that members of long-tenured projects tended to rely on each other to obtain, integrate, and communicate information from different areas of knowledge. Wegner termed this system of cognitive interdependence TMS (Brandon & Hollingshead, 2004). The basic principle of TMS is that people who need to rely on each other such as on a project can recognize, locate, and access the expertise of another person on a project to integrate with their own expertise, thereby avoiding duplicating knowledge (one expert per project), broadening the collective knowledge of the project, and using this broadened collective knowledge to developed integrated solutions to problems (Lewis, 2003; Wegner, 1987). TMS is the collective system of an individual for encoding, storing, and retrieving information about the specialization, expertise, and the credibility of members of a project (Argote & Guo, 2016; Argote & Ren, 2012; Hollingshead, 2001; Lewis & Herndon, 2011; Wegner, 1987). TMS is composed of each member's knowledge of "who knows what", "who does what", and their methods for learning, remembering, and communicating this information (Argote & Ren, 2012; Lewis, 2003; Wegner, 1987; Wegner, Giuliano, & Hertel, 1985). Transactive memory exists in the memory of an individual; TMS exists between individuals of a project as a function of their individual transactive memories (Lewis, 2003).

During the project execution, team members must rely on each other to be responsible for their subject matter knowledge; the project team consisting of multiple

SMEs possesses all of the knowledge needed to complete the project (Lewis, 2003). TMS research has shown that groups develop a unique and implicit structure for dividing responsibility based on the members' shared understanding of the SME of each team member (Lewis et al., 2007). TMS requires that individuals, on a project, utilize others expertise to supplement their own limited knowledge (Akgün et al., 2005). Researchers have identified three indicators of the existence of TMS (Akgün et al., 2005; Lewis, 2003) as follows:

1. Specialization: Knowing the expertise of each team member, "who knows what" and "who does what"
2. Credibility: Refers to each member's credibility, member's beliefs about the accuracy and reliability of other member's expertise, how much team members trust each other's expertise.
3. Coordination: Refers to the ability of team members to work together smoothly and efficiently while performing a task.

Lewis (2003) developed a TMS scale that consisted of these three components and has been frequently used in studies (Argote & Ren, 2012; Y. Wang et al., 2018).

Moreland and Myaskovsky (2000) provides a good example of the three TMS indicators in his radio assembling experiment: 1) specialization showed that the expertise of one person was knowing the location of components on a circuit board while another knew how the boards should be wired together; 2) credibility showed the degree of trust in the knowledge among the group members; 3) coordination explained how efficiently the group worked together using this knowledge (Akgün et al., 2005). How does TMS develop?

TMS develops through several mechanisms. Task and goal interdependence such as during the execution of the project towards the final outcome or deliverable of the project have been found to predict the formation of a TMS; relying on each other to pursue common goals (Brandon & Hollingshead, 2004; Ren & Argote, 2011; Y. Wang et al., 2018; Z. Zhang et al., 2007). Working together is a key mechanism for the development of TMS; while working together, members learn who is good at what (Liang, Moreland, & Argote, 1995). Communication among project members helps the formation of TMS especially if performed at the beginning of a project (Argote & Guo, 2016; Argote & Ren, 2012), such as during the proposal development of a project.

TMS takes time to develop. Factors that have shown to help develop TMS in a team are the experience of the team working together (Ren, 2011). Through performing tasks and providing information to others, a member establishes credibility causing other members to trust their expertise. In addition, members know whom to rely on for successfully completing assignments within a project and whom to request information from for a particular area of expertise; thus improving project coordination (Argote & Ren, 2012). TMS becomes more developed as project members gain experience working together (Argote & Guo, 2016; Argote & Ren, 2012). TMS research has shown that groups develop an implicit structure for dividing responsibility based on each members' shared understanding of each other's capabilities and expertise. TMS decreases the cognitive burden on each team member; they do not need to know everything and can rely on the other team members which increases the quantity and quality of information available to the project (Brandon & Hollingshead, 2004; Lewis et al., 2007).

Because transactive memory develops as individuals learn about each other's capabilities and expertise through working together, TMS is unique to that project and its members. Different projects, which according to the project management definition are unique, have different members with different needed expertise and thereby develop different transactive systems; furthermore, they are difficult to imitate or to move to a different project (Argote & Ren, 2012). How does TMS improve project performance is discussed next.

Research has shown that teams with a more developed TMS are more likely to have better performance than teams with a less developed TMS (Lewis & Herndon, 2011). TMS facilitates quick and coordinated access to specialized knowledge by using the expertise of the SME, so that the needed information can be efficiently brought to the project. Empirical research demonstrated that TMS has powerful positive effects on task performance, quick access to required information, and learning (Akgün et al., 2005; DeChurch & Mesmer-Magnus, 2010; Hollingshead, 1998a, 1998b; Y. Wang et al., 2018). Studies have also shown that TMS may provide benefits across a variety of project contexts (Lewis, 2003, 2004; Lewis et al., 2007). DeChurch and Mesmer-Magnus (2010) defined three types of teams: decision-making teams, action teams, and project teams. None of these three types of teams moderated the relationship between TMS and team performance (DeChurch & Mesmer-Magnus, 2010). Transactive memory systems facilitates knowledge retention (Liang et al., 1995) and knowledge transfer (Borgatti & Cross, 2003). The similarity between the tasks such as between the proposal and the project makes that transfer easier (Argote et al., 2003).

Team members rely on one another to be responsible for their specific expertise; collectively the team contains all of the information needed for completing the project. TMS provides quick and coordinated access to specialized knowledge via the member with the expertise, working together a greater amount of expertise can efficiently be used on project tasks (Lewis, 2003). TMS theory is predicated on the expectation that individuals in close relationships will rely on each other to accomplish collective tasks by dividing responsibility for learning, remembering, and communicating the expertise of each member (Wegner, 1987; Wegner et al., 1985). Information needed during the project can be retrieved from members most likely to possess that knowledge, typically called a subject matter expert (SME), increasing the amount and quality of information available to teams to tackle project issues, thus, increasing performance on that project (Bachrach et al., 2019; Moreland, 1999). In teams with a well-developed TMS, members know who the SME is that can best provide the required information. Due to this knowledge, work is assigned to the most qualified team member, and members know whom to consult for information regarding a particular expertise. TMS is thought to improve team performance because it provides ready access to diversified areas of knowledge that can be brought upon achieving the common objectives of the project (Bachrach et al., 2019; Hollingshead, 1998b; Lewis, 2003; Liang et al., 1995). In teams with a strong TMS, information search is faster due to knowing the source of the expertise, allowing members to apply knowledge more quickly and to quickly adapt to encountered project risks. In addition, task-critical information is less likely to be forgotten or overlooked, as it can be effectively assigned to the appropriate members with the expertise (Bachrach et al., 2019; Lee, Bachrach, & Lewis, 2014; Lewis & Herndon, 2011). TMS allows team members both to predict and anticipate one another's actions (DeChurch & Mesmer-Magnus, 2010). What disrupts TMS in a project?

Changes in the members of a project due to turnover, project availability, and transfers causes a disruption in the TMS of that project; such disruption is inevitable in today's dynamic project-based organizations (Lewis et al., 2007). Partial membership change also disrupts the TMS in projects due to combining familiar and unfamiliar members that threaten the TMS structures and processes on which familiar members have come to rely (Moreland & Argote, 2003). Therefore, changes in the team members weakens the TMS structure and consequently, the group's performance (Levine & Moreland, 2006). Change can be detrimental in that it requires members to spend time and effort rebuilding the TMS structures rather continuing the project execution (Moreland, 1999), it disrupts members' routines for accomplishing their tasks (Levine & Moreland, 2006) and eliminates access to the expertise that a departing member possessed (Lewis et al., 2007). Teams with partial membership change had significantly less efficient TMS processes compared to teams without membership change. Team performance was significantly lower in partially changed teams, compared to those without membership change. TMS process mediated the effects of membership change on group performance (Lewis et al., 2007). Abdullah and Verner (2012) did a case study of project failures. One project failed due to the transfer of project team members to other projects who had worked together and had knowledge about the system and operations. Experts were brought in to replace them but the project still failed. Critical risks to the project were the loss of key members of the project team (Abdullah & Verner, 2012). Ahonen and Savolainen (2010) did a post-mortem of failed five projects. The failure of one of the projects was due to the team that developed the proposal were not available when the project was started (Ahonen & Savolainen, 2010). Kotlarsky and Oshri (2005) did a case study of two successful globally distributed system (GDS) development projects with distributed project teams. The results of the study showed that human-related issues, such as rapport and transactive memory, were important for collaborative work in the teams studied and for successful project performance. Following are two quotes from the Kotlarsky and Oshri (2005) study that illustrate the importance of TMS.

"When a problem occurs it is important for the team, instead of finding the bug, to find quickly who knows best about the failing component." (Kotlarsky & Oshri, 2005, p. 42)

"What I did in the past was – this was in the very early phase of the project, I sent requests only to 'the manager' and he would distribute the issues between people. But by now, after 6 months, I know quite well what everybody is doing. So after a time, you just know who's doing what." (Kotlarsky & Oshri, 2005, p. 42)

TMS has been shown to develop with time (Ren & Argote, 2011). If the same project team that works on the proposal also works on the project, the team members having developed a TMS structure for the proposal can apply it to the project. TMS facilitates knowledge retention (Liang et al., 1995) and knowledge transfer (Borgatti & Cross, 2003). The similarity between the tasks such as between the proposal and the project helps maintain the TMS structure (Argote et al., 2003). TMS has also been shown to increase the productivity of the team if the team remains intact. Teams with partial membership change had significantly less efficient TMS processes compared to teams without membership change. Team performance was significantly lower in partially changed teams, compared to those without membership change (Levine & Moreland, 2006). Therefore, as the number of team members that worked on both the proposal and project is reduced, TMS will be disrupted and project performance will be negatively impacted. The number of team members that worked on both the proposal and project is defined as "proposal overlap".

The development of the RFP procurement documents includes specifying the requirements of the buyer's need. The proposal development team interprets these requirements and specifies how the requirements are to be satisfied in the resulting proposal which is then included in contract between the seller and the buyer (Porter-Roth, 2002). The proposal becomes the foundation for the corresponding project that the project team must deliver based upon the requirements specified in the proposal (Cobb & Divine, 2016; Porter-Roth, 2002).

A project is multi-functional requiring the specialized project members (Akgün et al., 2005). The interpretation of the buyer requirements as stated in the RFP documents is performed by the proposal team members with specialized expertise in each of their functional areas working together to develop an integrated solution for the buyer. For example, a specialist in software design would interpret the software requirements while a hardware specialist would interpret the hardware requirements; both working together they will develop a competitive solution for the buyer. Each specialist is responsible for and are experts in their specialized area of the proposal as well as the combined integrated solution. Developing a proposal requires tradeoffs to be made between cost, schedule, and quality and still be competitive. These decisions are made by the proposal development team (Paech et al., 2012).

If the proposal development team remains intact for the project execution, requirements risk is reduced on the project due to the team continuing with the project and with minimal TMS disruption. The continuation of the structure allows the team to know who does what and who is good at their specialty. But, due to the dynamic allocation of personnel to available projects, there is no guarantee that the proposal development team will be assigned to the project execution team once the buyer has approved the proposal (Lewis, 2003; Lewis et al., 2007; Maister, 1982). Studies have shown that if a team member is lost, TMS is disrupted and the productivity of the team is reduced (Lewis et al., 2007) thus increasing the risk of the project and reducing performance. The software specialist that interpreted the requirements and helped to develop the solution may be assigned to another project leaving the TMS structure disrupted. Who is the software specialists that can answer these questions (specialization factor), can this new person be trusted (credibility factor), and will this new person be able to work with the other team members (coordination factor)? The TMS structure must now be rebuilt. Thus requirements risk increases due to the disrupted TMS structure negatively affecting process performance which leads to the following hypothesis:

Hypothesis 2 (H2) - As the number of team members that work on the proposal development and the project execution increases (proposal overlap), the negative relationship between the project's requirements risk and process performance decreases.

CHAPTER 3 - RESEARCH DESIGN AND METHODOLOGY

This chapter provides a detailed explanation of the methodology used to test the research model and hypotheses of this dissertation. This section begins with an overview of the research study design followed by a discussion of the sample and data collection methods used. Next, the independent, dependent, moderator, and control measures are discussed.

3.1 Overview

Quantitative methods were used for this study (Creswell, 2017). Empirical studies in project management frequently use surveys for data collection, as did this study (Keil et al., 2013; Liu & Wang, 2014; L. Wallace et al., 2004a; Y. Zhang et al., 2018). The survey was administered electronically, using Qualtrics, to participants within the United States.

3.2 Sample

The study will primarily focus on current and former project managers. In the survey, they were asked to evaluate the last project they had completed as has been done in previous surveys (Keil et al., 2013; L. Wallace et al., 2004a). Demographic questions captured the participant's age and their primary function, such as project manager, on their last project. Project characteristic questions captured the size in terms of personnel and the duration of the project. Project managers from the local chapters of the PMI was the primary source for the survey.

3.3 Analysis

The testing of the project risk and performance hypothesis is considered confirmatory since the constructs and theories have been analyzed in previous empirical studies (Nidumolu, 1996; L. Wallace et al., 2004a). The general model was tested using linear regression with the latest version of the IBM SPSS Statistics software.

3.4 Data Collection

As previously discussed, the primary targets for the survey were the local chapters of the PMI. For data collection, the Qualtrics online survey software was used. This software has been used to provide millions of surveys every year (www.qualtrics.com). To verify the survey before full deployment, a pilot test of the survey was performed using multiple respondents from different project functions to ensure that the survey questions were interpreted correctly. The sample size was calculated using the G*Power statistical power analysis tool. A sample size of 61 was calculated using the following parameters: F tests, linear multiple regression with fixed model, effect size (0.35), alpha error probability (0.05), power (0.8), number of predictors (12).

3.5 Measures

This section discusses the scales for each construct used in this survey as well as the moderators and control variables. The survey for this study utilized established scales for each of the two (2) constructs. As discussed previously, the participants were asked to apply the survey to their last completed project.

3.5.1 Independent Variable

The independent construct of interest in this study was based on the project risk scales developed by (L. Wallace et al., 2004a). Project risk consists of six reflective constructs: requirements risk, project complexity risk, user risk, organizational risk, planning and control risk, and team risk. This study concentrated on the requirements risk construct even though the survey included all six of the risk constructs. The requirements risk construct consisted of four items measured using a seven-point Likert-type scale (Strongly Disagree = 1, Strongly Agree = 7). Each construct consists of multiple items as is displayed in Table 8.

Table 8 Independent Variable Survey Items

Survey Item	Construct
Change in organizational management during the project	Organization
Corporate policies with a negative effect on the project	Organization
Unstable organization environment	Organization
Organization undergoing restructuring during the project	Organization
Users were resistant to change	User
Conflict between the users	User
Users with negative attitudes toward the project	User
Users not committed to the project	User
Lack of cooperation from the users	User
Continually changing system requirements	Requirements
System requirements were not adequately defined	Requirements
Unclear system requirements	Requirements
Incorrect system requirements	Requirements
Project involved the use of new technology	Complexity
High level of technical complexity	Complexity
High level of technical complexity	Complexity
Immature technology	Complexity
Project involves use of technology that has not been used in prior projects	Complexity
Lack of an effective project management methodology	Planning & Control
Project progress not monitored closely enough	Planning & Control
Inadequate estimation of required resources	Planning & Control
Poor project planning	Planning & Control
Project milestones not clearly defined	Planning & Control
Inexperience project manager	Planning & Control

Survey Item	Construct
Ineffective communication	Planning & Control
Inadequately trained development team members	Team
Inexperienced team members	Team
Team members lack specialized skills required by the project	Team

3.5.2 Dependent Variables

The dependent construct of interest used in this study was based on the project performance scales developed by (Nidumolu, 1995) and used by (Wallace, 2004). Project performance consists of two reflective constructs: process performance and product performance. Each construct consists of multiple items. This study concentrated only on the process performance construct even though the survey included both constructs. The process performance construct refers to the extent the project was completed within the estimated budget and estimated schedule. The process performance construct consisted of two items measured using a seven-point Likert-type scale (Strongly Disagree = 1, Strongly Agree = 7). The product performance construct refers to performance of the product actually delivered to the users including did the product meet the expectations of the users, meet the functional requirements, and is the quality of the delivered product is high. The process performance construct consisted of five items measured using a seven-point Likert-type scale (Strongly Disagree = 1, Strongly Agree = 7). Each construct consists of multiple items as is displayed in Table 9.

Table 9 Dependent Variable Survey Items

Survey Item	Construct
The project deliverable developed is reliable	Product
The project deliverable developed is easy to maintain	Product
The users perceive that the project deliverable meets intended functional requirements	Product

Survey Item	Construct
The project deliverable meets the user expectations with respect to response time	Product
The overall quality of the developed deliverable is high	Product
The project was completed within budget	Process
The project was completed within schedule	Process

3.5.3 Moderator

The research model in this study hypothesized that the number of project members that worked on both the proposal and project is a potential moderator of the relationship between project risk and project performance. A new measure, proposal overlap, not used in previous studies, was used in this study as the moderator. Proposal overlap was defined as the percentage of team members who worked on both the proposal and the project is developed in this study. The moderator consisted of a single item as displayed in Table 10.

Table 10 Moderator Survey Item

Survey Item
Please indicate the percentage of the project team including subcontractors, consultants, customers, users that also worked on the proposal for this project

3.5.4 Controls

This study included several control variables based on previous studies as well as several newly defined measures for the purpose of this specific investigation.

Project duration is an important reflection of the overall size of a project. Studies have shown that a long duration leads to the high probability of increased risk which negatively influences project performance (Keil et al., 2013; Y. Zhang et al., 2018). The total size of the project team is another indication of project risk; similarly, the number of individuals who are external to the division or organization such as consultants, subcontractors, and users is another indication of project risk (Rai & Al-Hindi, 2000; Y. Zhang et al., 2018). These measures were used for the project in previous studies and will also be applied to the proposal in this study. The elapsed time between the proposal and the project is a new measure for this study and for project research; it is based upon the previous measure that was discussed, project duration; the longer the duration between the proposal and the project, the higher the project risk.

Four demographic measures were included in the survey: age and gender, function on the project such as the project manager, and experience in years with that function (Keil et al., 2013; L. Wallace et al., 2004a; E. Wang, Ju, Jiang, & Klein, 2008). The purpose of these measures was to provide some additional background about the respondents. The survey items for the control variables are displayed in Table 11.

Table 11 Controls Survey Items

Survey Items	How Items were Measured
Your function on the most recently completed project	Select from a list
Years of experience have you had in this function	Numeric
The primary industry to be used by the project deliverable, product, service, or outcome	Select from a list
Type of project deliverable: 1) product; 2) service 3) R&D	Select from a list
The duration (months) of the project	Numeric
Gender	Select from a list
Age	Numeric
Level of education	Select from a list
Duration between proposal and project	Select from a list
The total number of people on the project team including subcontractors, consultants, customers, and users	Numeric

Survey Items	How Items were Measured
What percentage of the project that was performed by subcontractors, consultants, customers, or users NOT employed by the firm developing the project	Numeric

Table 12 contains the final independent survey items, Table 13 contains the dependent variables, Table 14 contains the final moderator survey item, and Table 15 contains the final controls.

Table 12 Final Independent Variables Survey Items

Independent Variables	Source	Risk
There was a change in the organizational management during the project.	Wallace	Org1
Corporate policies had a negative effect on the project.	Wallace	Org2
The organization environment was unstable during the project.	Wallace	Org3
The organization went through restructuring during the project.	Wallace	Org4
The project users were resistant to change.	Wallace	User1
There was conflict between the users during the project.	Wallace	User2
The users had negative attitudes during the project.	Wallace	User3
The users were not committed to the project.	Wallace	User4
There was a lack of cooperation from the users.	Wallace	User5
The project requirements were continually changing during the project.	Wallace	Req1
The project requirements were not adequately defined.	Wallace	Req2
The project requirements were not clearly defined.	Wallace	Req3
The project requirements were incorrect.	Wallace	Req4
The project involved the use of new technology.	Wallace	Cmp1
The project had a high level of technical complexity.	Wallace	Cmp2
Immature technology was used on the project.	Wallace	Cmp3
The project used technology that had not been used in prior projects.	Wallace	Cmp4
The project lacked an effective management methodology.	Wallace	P&C1
Project progress was not monitored closely enough.	Wallace	P&C2
The required resources for this project were inadequate.	Wallace	P&C3
There was poor project planning.	Wallace	P&C4
The project milestones were not clearly defined.	Wallace	P&C5
The project manager was inexperienced.	Wallace	P&C6
There was ineffective communication during the project.	Wallace	P&C7
The project team members were not adequately trained.	Wallace	Team1
The project team members were inexperienced.	Wallace	Team2

Independent Variables	Source	Risk
The project team members lacked the required specialized skills.	Wallace	Team3
The project deliverable, service, or outcome was reliable.	Wallace	Prod1
The project deliverable, service, or outcome was easy to use and maintain.	Wallace	Prod2
The users perceived that the project deliverable, service, or outcome met the intended requirements.	Wallace	Prod3
The project deliverable, service, or outcome met the user expectations.	Wallace	Prod4
The overall quality of the developed project deliverable, service, or outcome was high.	Wallace	Prod5
The project was completed within its budget.	Wallace	Proc1
The project was completed within its schedule.	Wallace	Proc2
Note: All sources are from (L. Wallace & Keil, 2004)		

Table 13 Final Dependent Variables Survey Items

Dependent Variables	Source	Type
The project deliverable, service, or outcome was reliable.	Wallace	Prod1
The project deliverable, service, or outcome was easy to use and maintain.	Wallace	Prod2
The users perceived that the project deliverable, service, or outcome met the intended requirements.	Wallace	Prod3
The project deliverable, service, or outcome met the user expectations.	Wallace	Prod4
The overall quality of the developed project deliverable, service, or outcome was high.	Wallace	Prod5
The project was completed within its budget.	Wallace	Proc1
The project was completed within its schedule.	Wallace	Proc2
Note: All sources are from (L. Wallace & Keil, 2004)		

Table 14 Final Moderator Survey Items

Moderator	Source
Please indicate the percentage of the project team including subcontractors, consultants, customers, users that also worked on the proposal for this project.	New Item

Table 15 Final Controls Survey Items

Controls	Source

Your function on the most recently completed project.	(L. Wallace & Keil, 2004)
Years of experience have you had in this function.	(L. Wallace & Keil, 2004)
The primary industry to be used by the project deliverable, product, service, or outcome	(L. Wallace & Keil, 2004)
Type of project deliverable, product, service, or outcome	(Pinto & Mantel, 1990)
What was the duration (months) of the project?	(Keil et al., 2013)
Gender	(L. Wallace & Keil, 2004)
Age	(L. Wallace & Keil, 2004)
Level of education	(Jitpaiboon, Smith, & Gu, 2019)
Duration between proposal and project	New Item
The total number of people on the project team including subcontractors, consultants, customers, and users.	(Y. Zhang et al., 2018)
What percentage of the project that was performed by subcontractors, consultants, customers, or users NOT employed by the firm developing the project	New Item

CHAPTER 4: RESULTS

This chapter provides the descriptive statistics of the data obtained by the survey, followed by the linear regression analysis the post-hoc results. All analyses was performed using SPSS statistics.

4.1 Survey Data Characteristics

Survey data consisted of four groups of respondents as follows: 1) Qualtrics, 2) employees from a division within a high-tech company, 3) PMI local chapters, and 4) other; all four groups will be described in this section. Table 4-1 contains the breakdown of the survey data. Only completed surveys were used in the data analysis; a survey was considered incomplete if not all of the questions were answered. In analyzing the incomplete surveys, respondents who did not complete the survey or did not provide enough useful information were not included in the analysis; hence, there were no missing data. Table 4-1 provides a summary of the collected survey data.

Table 16 Survey Data Characteristics

Table 16 Completed Survey Count

Respondents	Completed Surveys
PMI Chapters	295
Qualtrics	160
High-tech Company	36
Other	12
Total	503

The samples were reviewed and three surveys were removed due to inconsistencies such as a 21-year old project manager with seven years of experience or a project team that had 3000 members on both the proposal development and the project execution teams. To ensure that enough data for analysis would be available, Qualtrics was used to acquire survey data.

Qualtrics is an organization that not only provides survey tools but also will distribute the survey to a panel of respondents at a cost. One-hundred and sixty (160) surveys were acquired through this method. The surveys distributed by Qualtrics were restricted to only project managers. A potential limitation exists since the survey respondents were compensated by Qualtrics for participating in the study may have biased their answers

The second method for acquiring data was by surveying project managers within a division of a high-tech company. Three emails, approximately every two weeks, requesting that the survey be completed, were sent to 255 project managers within the division. Fifty-Six surveys were started; 36 were successfully completed. Another limitation may exist since all respondents were from the same group within an organization.

The third method, others, were existing or retired project managers that had been friends of the author. Eighteen (18) surveys were started, 12 were successfully completed.

The final method of acquiring data was from the 149 local chapters of the Project Management Institute (PMI) located within the United States. PMI is the world's largest organization dedicated to the advancement of project management for over 50 years and is the global standard for project management (Hughes et al., 2015); PMI, a not-for-profit organization, has nearly 600,000 members in approximately 210 countries on six continents with local chapters located in many nations such as the United States which has approximately 150 chapters (www.pmi.org). The board of directors of 27 local chapters were contacted by email and with a follow-up letter regarding distribution of the survey to their membership. Six (6) chapters responded; other chapters may have distributed the survey without notifying the author. To distribute the survey to the local chapter membership, requests to complete the survey with the survey link were included in the monthly chapter newsletter, an email to the membership, a link on their website, or a link on their LinkedIn or Facebook page. In addition to the board contact, every local chapter was contacted regarding allowing a link to be placed on their LinkedIn page. Sixty-seven (67) chapters allowed the survey link to be added to their LinkedIn or Facebook page, some were placed twice depending on the date of the chapter's approval. Using the local chapter's web page, a LinkedIn connection with the author was requested of the board members, directors, and volunteers of the chapter whose name appeared on the website. Once a LinkedIn connection was established, a request to complete the survey was issued via a LinkedIn message. Approximately 1450 LinkedIn connections were established and survey requests generated. Three-hundred and seventeen (317) surveys were started; 295 were successfully completed. A limitation may exist since the respondents are from the same organization.

4.2 Descriptive Statistics

4.2.1 Dependent Variables

The dependent variable consisted of a 2-item process performance scale. A reliability analysis was performed to evaluate the multi-item scale by assessing scale reliability as measured by the coefficient alpha. Using SPSS, the alpha value for the scale was .775, which is above 0.7, and is, therefore, in the acceptable range suggesting the internal consistency of the items (DeVellis, 1991). For all both items were evaluated using, a seven (7) point Likert scale with the anchors being (1) “Strongly Agree” and (7) being “Strongly Disagree”. Table 17 contains the process performance items and statistics.

Table 17 Process Performance Statistics

Risk Item	Mean	Std. Deviation
The project was completed within budget.	2.88	1.79
The project was completed within its schedule.	3.00	1.86

4.2.2 Independent Variables (Requirements Risk)

The independent variable consisted of a 4-item risk requirements scale. A reliability analysis was performed to evaluate the multi-item scale by assessing scale reliability as measured by the coefficient alpha. Using SPSS, the alpha value for the requirements scale was .832, which is above 0.7, and is, therefore, in the acceptable range suggesting the internal consistency of the items (DeVellis, 1991). All risk requirements items were evaluated using a seven (7) point Likert scale with the anchors being (1) “Strongly Agree” and (7) being “Strongly Disagree”. Table 18 contains the risk requirements items and statistics.

Table 18 Requirements Risk Statistics

Risk Item	Mean	Std. Deviation
The requirements were continually changing during the project.	3.33	1.76
The requirements were not adequately identified	4.10	1.94
The requirements were not clearly defined	4.32	1.84
The project requirements were incorrect	4.85	1.64

4.2.3 Moderator (Overlap)

The moderator is the percentage of “overlap” between the proposal development team and project execution team, basically, the percentage of personnel that worked on both the proposal and the proposal. Sample values ranged from 0%, indicating no overlap between the proposal development and the project execution teams, to 100% indicating that the complete proposal development team were also part of the project execution team. The mean was 30.49 with a standard deviation of 30.83.

4.2.4 Control Variables

Gender – Respondents responses were Male (56.5%), Female (42%), and Prefer not to Answer was (1.4%). Analysis only included male and female since prefer not to answer respondents were insignificant in the total number of results.

Age – Respondent ages varied widely, ranging from 18, which was the minimum allowed for the survey, to a maximum of 80. The mean was 48.62 with a standard deviation of 11.40.

Primary Function on the Project (Question 1-3) – This question asked for the respondents primary function on the project. Since the survey was targeted towards project managers (PM), that category was predominant with (77.1%) of the responses. The next highest category was executive management (EM) (7.6%) followed by “other” (4.6%)”, and developer (3%) and Consultant (3%).

“Other” Functions on Project were mostly single function types or .2% of the total survey responses except for the program manager category which when consolidated with similar responses included 7 or .14% of the total responses. Interestingly, most program managers usually are prompted to that position after several years of experience as a project manager. For this dissertation, the respondent's primary functions were grouped as follows: project management (PM), executive management (EM), and all other categories were placed into "other." Table 19 provides the primary function statistics and Table 20 provides the "other" statistics. In order to consolidate the number of variables, two dummy variables were coded, PM and other. Other consisted of all functions except for project manager and executive management.

Table 19 Primary Function Frequencies

Project Function	Frequency	Percent	Cumulative Percent
Project Manager	388	77.1	77.1
Developer	15	3.0	80.1
Financial	4	.8	80.9
Contracts	2	.4	81.3
Sales	5	1.0	82.3
Executive mgt.	38	7.6	89.9
Sponsor	4	.8	90.7
Quality Assurance (QA)	4	.8	91.5
Manufacturing	1	.2	91.7
Consultant (external)	15	3.0	94.6
Subcontractor	1	.2	94.8
Other	23	4.6	99.4
Administrator	3	.6	100.0
Total	503	100.0	

Table 20 Primary Function "Other" Frequencies

"Other" Project Functions Entered	Frequency	Percent of Total Responses
Business Analyst	1	.2
Change Management Leader	1	.2
Consultant - Subject Matter Expert in Medical Device Risk Management per ISO 14971	1	.2
Consultant PM	1	.2

currently I do not work as a PM	1	.2
functional manager	1	.2
Implementation Director	1	.2
Manager of a PMO	1	.2
Owner and director of medical practice	1	.2
PMO Director	1	.2
Program Delivery	1	.2
Program Management Office (PMO)	1	.2
Program Manager	4	.8
Project Coordinator	1	.2
Project/Program Governance Manager	1	.2
Scrum Master	2	.4
Subject Matter Expert	1	.2
Vendor	1	.2

Experience – This question asked for the respondent's primary function experience (in years) as selected in Question 1-3. The responses varied widely from one (1) year to 56 years of experience. The mean was 15.22 with a standard deviation of 9.181.

Level of Education – This question asked for the respondent's level of education. The primary response was a master degree (43.5%) followed by a 4-year college degree (31.2%), and a doctorate (7.4%) for a total of 82.1%, making the respondents predominately college educated. Other categories included high-school graduate (1.6%), some college (6.4%), and professional degree (5.0%).

Primary Industry of the Project – This question requested the primary industry receiving the project service, deliverable or outcome. Other was the most popular with (13.9%) followed by manufacturing, healthcare, and finance with approximately 13% each. Other" were mostly single response at 0.2%; those with multiple responses are shown in the tables below. Table 21 provides the primary industry statistics and Table 22 provides the other industries that were entered. Industry consisted of 11 dummy variables.

Table 21 Primary Industry Frequencies

Project Primary Industry	Frequency	Percent	Cumulative Percent
Manufacturing	67	13.3	13.3
Finance	64	12.7	26.0
Education	28	5.6	31.6
Wholesale / retail	30	6.0	37.6
Media, arts, entertain	19	3.8	41.4
Gov. (non-defense)	29	5.8	47.1
Gov. (defense)	50	9.9	57.1
Utilities	38	7.6	64.6
Healthcare	67	13.3	77.9
Construction	27	5.4	83.3
Transportation	14	2.8	86.1
Other	70	13.9	100.0
Total	503	100.0	

Table 22 Primary Industry Other Frequencies

“Other” Primary Industry	Frequency	Percent of Total
Communications	2	.4
Consulting	3	.6
Information Technology (IT)	6	1.2
Insurance	2	.4
Hospitality	2	.4
Professional Services	2	.4
Technology	2	.4
Telecommunication	3	.6

Type of Project – This question requests the type project deliverable, providing a service (34.4%), R&D (6.2%), a delivery of a product or an application (50.3%), or other (9.1%). "Other" were mostly single responses at 0.2% that included architectural design, change management process, facility standup with technical architecture, new asset management system, operating system upgrade, production line, decommissioning, marketing, Process Change, and video. Type of project consisted of three (3) dummy variables as follows:

1. ProjServ (Service)
2. ProjRD (R&D)
3. ProjProd (Product or application)

Duration of the Project – This question asked for the duration of the project in months. There was a wide range of responses, with the minimum being one (1) month and the maximum, 132 months. The mean was 14.67 with a standard deviation of 15.793.

Project Size - Part and Full Time – This question asked for the number of full and part-time members of the project team. The total project size was calculated using the number of full-time members and number of part-time members, where two part time project members were equated to one full time project member. The survey asked for the number of part-time members who were on the team 50% of the time or less. Full time responses ranged widely from zero (0) to 3500 with a mean of 50.735 and a standard deviation of 222.462. Part time responses ranged widely from zero (0) to 676 with a mean of 21.37 and a standard deviation of 58.50.

Subcontractors – This question asked for the percent of the project team who were subcontractors or consultants not employed by the firm developing the project. The range was 0% to 100% with a mean of 31.45 and a standard deviation of 31.30.

Sample Source – Samples were received from four (4) different sources. In the analysis, each source was a dummy variable as follows:

1. IDDummy1 (PMI)
2. IDDummy2 (Leidos)
3. IDDummy3 (other)

Bivariate Correlations

In addition to the descriptive statistics, bivariate correlations between the variables in the study are provided in Table 23. There were several correlations that were greater than 0.7. These were expected, as they were mutually exclusive answers to two survey questions.

Table 23 Bivariate Correlations

		Mean	Std. Dev	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Q215 Indust1 (Manufacturing)	0.13	0.34	1																													
2	Q215 Indust2 (Finance)	0.13	0.33	-.150**	1																												
3	Q215 Indust3 (Educaton)	0.06	0.23	-.095*	-.093*	1																											
4	Q215 Indust4 (Retail)	0.06	0.28	-.099*	-.096*	-0.061	1																										
5	Q215 Indust5 (Media)	0.38	0.19	-0.078	-0.076	-0.048	-0.050	1																									
6	Q215 Indust6 (Gov - non Defense)	0.06	0.23	-.097*	-.094*	-0.060	-0.062	-0.049	1																								
7	Q215 Indust7 (Gov - Defense)	0.10	0.30	-.130**	-.127**	-0.081	-0.084	-0.066	-0.082	1																							
8	Q215 Indust8 (Utilities)	0.08	0.27	-.112*	-.109*	-0.069	-0.072	-0.057	-0.071	-.095*	1																						
9	Q215 Indust9 (Healthcare)	0.13	0.34	-.154**	-.150**	-.095*	-.099*	-0.078	-.097*	-.130**	-.112*	1																					
10	Q215 Indust10 (Construction)	0.05	0.23	-.093*	-.091*	-0.058	-0.060	-0.047	-0.059	-0.079	-0.068	-.093*	1																				
11	Q215 Indust11 (Transportation)	0.28	0.16	-0.066	-0.065	-0.041	-0.043	-0.034	-0.042	-0.056	-0.048	-0.066	-0.040	1																			
12	Q13 Project Manager (PM)	0.77	0.42	0.004	0.023	-0.012	0.017	0.058	-0.008	0.054	-.203**	0.032	.088*	0.063	1																		
13	Q13 Other Project Functions	0.15	0.36	0.028	-0.063	-0.031	-0.014	-0.026	-0.034	-0.031	.192**	-0.020	-0.077	-0.072	-.781**	1																	
14	Q13 Exec Mgt (EM)	0.45	1.59	-0.046	0.049	0.062	-0.008	-0.057	0.058	-0.045	0.061	-0.024	-0.035	-0.003	-.525**	-.122**	1																
15	Q239 Project Size	93.48	288.41	-0.028	-0.039	-0.038	-0.003	-0.026	0.042	0.035	-0.051	0.008	0.047	0.010	-0.052	0.034	0.037	1															
16	Q12 Male	1.45	0.56	.096*	-0.086	-0.067	-0.016	0.069	0.011	0.064	.099*	-.163**	0.085	-0.022	-0.087	0.006	.130**	-0.004	1														
17	Data Source ID1 (PMI)	0.59	0.49	0.056	0.030	-0.025	-0.044	-0.045	0.000	-0.031	0.011	0.056	-.212**	-0.005	-.198**	.155**	.103*	-0.043	-0.005	1													
18	Data Source ID2 (Leidos)	0.07	0.26	-0.086	-0.083	-0.067	-0.070	-0.055	.097*	.088*	.329**	-0.086	-0.066	-0.047	-.179**	.182**	0.037	0.061	.119**	-.331**	1												
19	Data Source ID3 (other)	0.24	0.15	-0.023	0.058	-0.038	0.016	-0.031	-0.039	0.079	-0.045	0.015	0.021	-0.026	-.194**	0.078	.202**	0.019	0.058	-.186**	-0.043	1											
20	Q11 Age	48.62	11.40	-0.032	0.030	-0.044	-0.037	-0.033	0.065	.127**	0.017	0.009	-0.073	0.010	-.109*	.113*	0.019	0.031	.151**	.219**	0.006	0.041	1										
21	Q14 Experence	15.22	9.18	0.016	0.056	-0.003	-0.028	0.085	0.065	0.066	-0.010	-.089*	-0.002	-0.032	-0.020	0.073	-0.068	.126**	.181**	0.052	-0.003	0.043	.583**	1									
22	Q15 Education	5.91	1.45	-0.040	.106*	0.063	-.141**	-.088*	0.021	0.030	.101*	0.008	-.180**	-0.040	-.187**	.110*	.147**	0.010	0.015	.282**	0.044	0.073	.188**	0.062	1								
23	Q216 Proj Service	0.34	0.48	-0.062	-0.038	-0.030	-0.041	0.010	0.018	-0.017	-0.017	0.024	0.032	0.005	-0.004	-0.006	0.015	0.012	0.036	-.114*	-0.022	0.079	-0.014	-0.006	-.111*	1							
24	Q216 Proj R&D	0.06	0.24	.119**	-0.023	0.010	0.005	-0.051	-0.028	0.025	-0.042	0.021	-0.061	0.007	0.061	-0.063	-0.011	0.026	-0.058	-.121**	-0.007	-0.040	-0.033	0.042	0.056	-.186**	1						
25	Q216 Proj Product	0.50	0.50	0.039	0.034	0.033	0.066	0.009	0.041	0.025	0.028	-0.043	0.007	-0.049	0.027	-0.041	0.013	-0.079	0.041	.102*	-0.017	-0.053	-0.020	-0.033	0.032	-.728**	-.258**	1					
26	Q214Prj Duration	14.67	15.79	-0.018	-0.061	-0.048	-.093*	-0.025	.104*	.122**	.105*	-0.033	-0.057	.143**	-0.077	0.001	.121**	.301**	0.085	.125**	.156**	-0.028	.188**	0.067	.131**	-0.004	0.014	-0.023	1				
27	Q239 SubC Percent	31.45	31.30	-0.032	0.047	-0.079	0.072	-.091*	0.048	-0.037	0.060	-0.067	.110*	-0.012	-0.033	0.045	-0.008	.218**	0.014	0.075	-0.082	0.018	.089*	0.071	0.044	-0.029	-0.024	0.022	.095*	1			
28	Project Requirements	4.15	1.47	-0.003	0.023	-0.041	0.016	-0.058	-0.030	0.061	-0.031	-0.033	0.011	.090*	-0.058	0.007	0.082	0.080	0.007	.094*	-0.026	0.079	0.002	0.003	0.070	-0.015	-0.079	0.063	.100*	.151**	1		
29	Moderator (Overlap)	30.49	30.83	-0.060	-0.010	0.078	0.054	0.038	-0.015	0.072	-0.028	-0.053	.132**	-0.019	.114*	-0.080	-0.073	-0.007	-0.028	-.301**	-.100*	-0.024	-0.083	-0.040	-0.047	0.054	.114*	-0.031	-0.039	.166**	-0.054	1	
30	Project Performance	2.94	1.65	-0.048	-0.021	0.065	-0.017	0.050	-0.012	-0.010	-0.063	0.071	.096*	0.005	.158**	-.141**	-0.058	-0.079	-0.005	-.284**	0.044	-0.002	-0.060	-0.023	-0.075	.132**	0.011	-.092*	-.125**	-.157**	-.357**	.181**	1

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

Common method maybe one of main sources of measurement error. Common method variance refers to variance that is attributable to the survey rather than to the constructs and can have many causes such as effects produced by a common respondent providing the predictor and the criterion variable or the context in which the items are placed in the survey. One method to combat this bias is to obtain data from multiple sources (Podsakoff, MacKenzie, & Podsakoff, 2012). As will be discussed in Limitation Section, triangulation was not performed due to the cost of retrieving triangulated responses. Another method for controlling this bias is by creating a methodological separation of the measurements by using different response formats for the various measures (Podsakoff, MacKenzie, Jeong-Yeon, & Podsakoff, 2003). The survey interweaved the demographic, dependent, and control variables hoping to provide a separation between these scales. Another method for combating this bias is to use previously accepted and validated scales; this survey used validated scales for the dependent and independent (Podsakoff et al., 2012). Another method to combat this bias is to allow the respondents' answers to be anonymous which they were in this survey (Podsakoff et al., 2012). Finally, another method is to assure respondents that there are no correct answers and that they should answer the questions as honestly as possible which was repeated several times during the survey (Podsakoff et al., 2003). To determine if there is a bias, using the Harmon single factor test, all of the independent, moderator, control, and dependent variables were entered into a factor analysis (Podsakoff et al., 2003; Podsakoff et al., 2012). There were 16 factors with eigenvalues > 1.0, which accounted for 71.99% percent of the variance; the highest variance was

8.94%; since no single factor accounted for the majority of variance, a common method bias was unlikely to occur.

4.3 Regression Analysis

Prior to testing the research model and hypotheses, diagnostics were performed to ensure that the sample data met the assumptions of normality which can be determined statistically. Testing each independent and dependent variable for skewness and kurtosis. An extreme value for either would indicate that the data were not normally distributed. Skewness is a measure of deviation from a symmetrical distribution; kurtosis measures the deviation from normality and the flatness or sharpness of a distribution. Acceptable values for skewness and kurtosis are between 2 and -2. Analysis showed that the independent and dependent variables fell within that range (Hair, Black, Babin, Anderson, & Tatham, 1998)

In order to test the two hypotheses in the model, multiple regression analysis was performed with four models. In the first model (model 1), control variables were entered. In model 2, the main effect was entered. In model 3, the moderator (overlap) was entered. Finally, in model 4, the respective interaction term was entered. In all models, the study controlled for the variables also shown in Table 4-3 along with the results. The VIF and Condition index values were below the recommended guidelines for all variables (Hair et al., 1998). In model 1, the percentage of the project team than was executed by subcontractors or consultants, Q239SubCpercent, was significantly and negatively related to project performance ($\beta = -.113$, $p < .05$). Interestingly, the responses submitted by members of the local PMI chapters, IDDummy1 (PMI), was significantly and negatively related to project performance (β=-.256, $p<.001$). This significance might be attributed to that the respondents pessimistic due to a negative experience with the last project completed. The model was significant ($p<.001$) with an adjusted R^2 of 0.098 and suggests that as the number of subcontractors or consultants increases, project performance decreases. To test hypothesis 1, model 2 included the independent variable, requirements risk. Hypothesis 1 proposed that as requirements risk increased, project performance would be negatively impacted. Requirements risk was significantly and negatively related to project performance (β=-.321, $p<.001$). The model was significant ($p<.001$) with an adjusted R^2 of 0.197 suggesting that as the requirements risk increases, project performance decreases. Hence, hypothesis 2 was supported. Model 3 included the moderator, overlap. Overlap was significantly and positively related to project performance (β=.119, $p<.01$). The model was significant ($p<.01$) with an adjusted R^2 of 0.205. To test hypothesis 2, the interaction between the moderator (overlap) and the independent variable (requirements risk) was included in model 4. Hypothesis 2 proposed that as the overlap increased, requirements risk would decrease causing project performance to increase. The interaction was significantly and positively related to project performance (β=.114, $p<.01$). The model was significant ($p<.01$) with an adjusted R^2 of 0.216 suggesting that as the overlap increased, the relationship between project risk and project performance was moderated, supporting hypothesis 2. The results of the regression analysis are provided in Table 24.

Table 24 Regression Analysis

Variables	Dependent Variable Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Controls				
Q215Industry1 (Manufacturing)	.014	.016	.017	.015

Variables	Dependent Variable Model 1	Model 2	Model 3	Model 4
Q215Industry2 (Finance)	.025	.027	.024	.022
Q215Industry3 (Education)	.069	.059	.050	.055
Q215Industry4 (Wholesale / Retail)	.014	.019	.014	.023
Q215Industry5 (Media, Entertainment)	.044	.033	.027	.027
Q215Industry6 (Gov. – non-defense)	.023	.007	.005	.007
Q215Industry7 (Gov. – defense)	.021	.038	.025	.018
Q215Industry8 (Utilities)	-.003	-.020	-.026	-.031
Q215Industry9 (Health Care)	.103	.096	.096	.099
Q215Industry10 (Construction)	.075	.081	.074	.073
Q215Industry11 (Transportation)	.025	.055	.055	.056
Q216DelvService (Service)	.102	.123	.109	.104
Q216DelvR&D (R&D)	-.009	-.021	-.034	-.027
Q216DelvProd (Product / Application)	-.006	.027	.016	.022
Q214Duration	-.072	-.054	-.058	-.058
Q239Size	-.042	-.031	-.026	-.020
Q239SubCpercent	-.113*	-.054	-.092*	-.091*
Q11Age	.031	.007	.008	.017
Q12Male	.012	.006	.007	.003
Q13FuncPM (PM)	.051	.023	.022	.023
Q13FuncOther (Other)	-.044	-.068	-.073	-.072
Q14Experence	-.005	.006	.010	.014
Q15Education	.049	.064	.054	.059
IDDummy1 (PMI)	-.256***	-.225***	-.180***	-.176**
IDDummy2 (Leidos)	.000	.010	.037	.038
IDDummy3 (other)	-.050	-.026	-.013	-.005
Independent Variable				
Requirement		-.321***	-.317***	-.311***
Moderator				
Overlap			.119**	.118**
Interaction				.114**
R^2	.145	.240	.249	.262
Adjusted R^2	.098	.197	.205	.216
Delta R^2	.145	.095	.009	.012
F	3.097***	59.591***	5.911**	7.906**

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Specifically, Hypothesis 2 suggested that the overlap will reduce the negative relationship between risk and process performance as stated in hypothesis 1. The interaction results plotted in Figure 3 supported hypothesis 2.

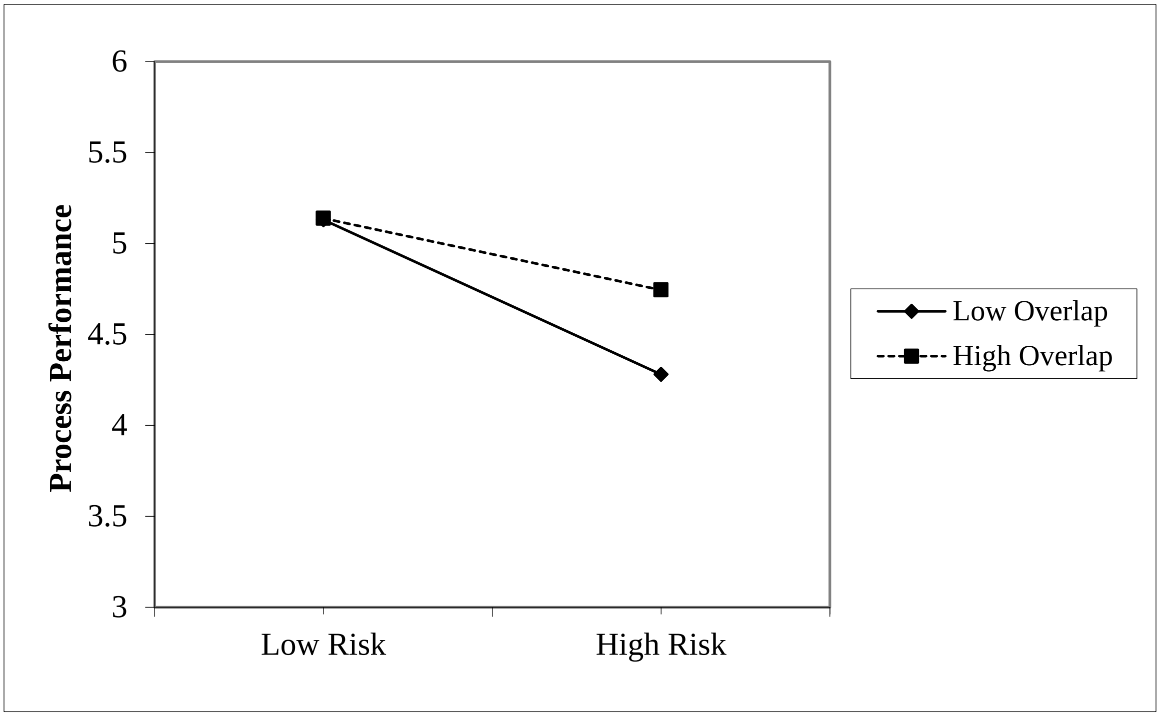

Figure 3 Significant Interaction Plot

4.4 Post-Hoc Analyses

Previously in this dissertation, analysis was performed on the independent variable (risk requirements) a 4-item scale, and the dependent variable (process performance) which is a 2-item scale. Post-hoc analysis was performed using the same risk requirements variable but with product performance, a 5-item scale, as the dependent variable. Process performance was determined if the schedule and budget estimates were met. Product performance is related to the deliverable and includes such attributes as if the deliverable was reliable, met the intended requirements of the customer, met the user expectations, and had a high-quality meaning that the deliverable worked without issues. The product performance items were evaluated using, a seven (7) point Likert scale with the anchors being (1) "Strongly Agree" and (7) being "Strongly Disagree". A reliability analysis was performed to evaluate the multi-item requirement scale by assessing scale reliability as measured by the coefficient alpha. Alpha values can range from 0.0 to 1.0, with unacceptable values less than 0.70 (DeVellis, 1991). The alpha value for the product performance scale was .832, which is above 0.7, and is, therefore, in the acceptable range suggesting the internal consistency of the items.

Regression analysis was performed using overlap as the moderator and the same control variables. In the first model (model 1), control variables were entered. Interestingly, industry was significant. This might be attributed to use of the product process which has an emphasis is on the delivered product which is typically evaluated by the variability of user perceptions on success or failure as opposed to the process performance which is evaluated by actual amounts. Model 1 was significant ($p<.05$) with an adjusted R^2 of 0.085. The requirements risk, in model 2, was significantly and negatively related to product performance ($\beta=-.356$, $p<.001$); model 2 was significant ($p<.001$) with an adjusted R^2 of 0.157. In model 3, the moderator, overlap, was significantly and positively related to project product performance ($\beta=.125$, $p<.01$); model 3 was significant ($p<.01$) with an adjusted R^2 of 0.168. In model 4, the interaction was significantly and positively related to product performance ($\beta=.103$, $p<.05$); model 4 was significant ($p<.05$) with an adjusted R^2 of 0.177. The regression results are presented in Table 25; only the significant control variables are shown in the table. In all models, the study controlled for the same control variables as was evaluated in the previous regression.

Table 25 Post-Hoc Regression Results

Variables	Dependent Variable Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Controls				
Q215Industry1 (Manufacturing)	.130*	.133*	.135*	.133*
Q215Industry2 (Finance)	.132*	.133*	.130*	.129*
Q215Industry3 (Education)	.103*			
Q215Industry9 (Health Care)	.143*	.136*	.013*	.138*
Q215Industry11 (Transportation)	.097*	.130**	.131*	.131**
Q13FuncPM (PM)	.167*			
Independent Variable				
Requirement Risk		-.356***	-.351***	-.346***
Moderator				
Overlap			.125**	.133**
Interaction				.103*
R^2	.085	.202	.215	.225
Adjusted R^2	.035	.157	.168	.177
Delta R^2	.085	.117	.012	.010
F	1.17*	69.635***	7.382**	6.205*

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Hypothesis 2 suggests that the overlap will reduce the negative relationship between requirements risk and process performance as stated in hypothesis 1 and was supported previously in this study. Post-hoc analysis using product performance instead of process performance as dependent variable should have similar results. Indeed, the results are consistent. The interaction results plotted in Figure 4 corroborate this finding.

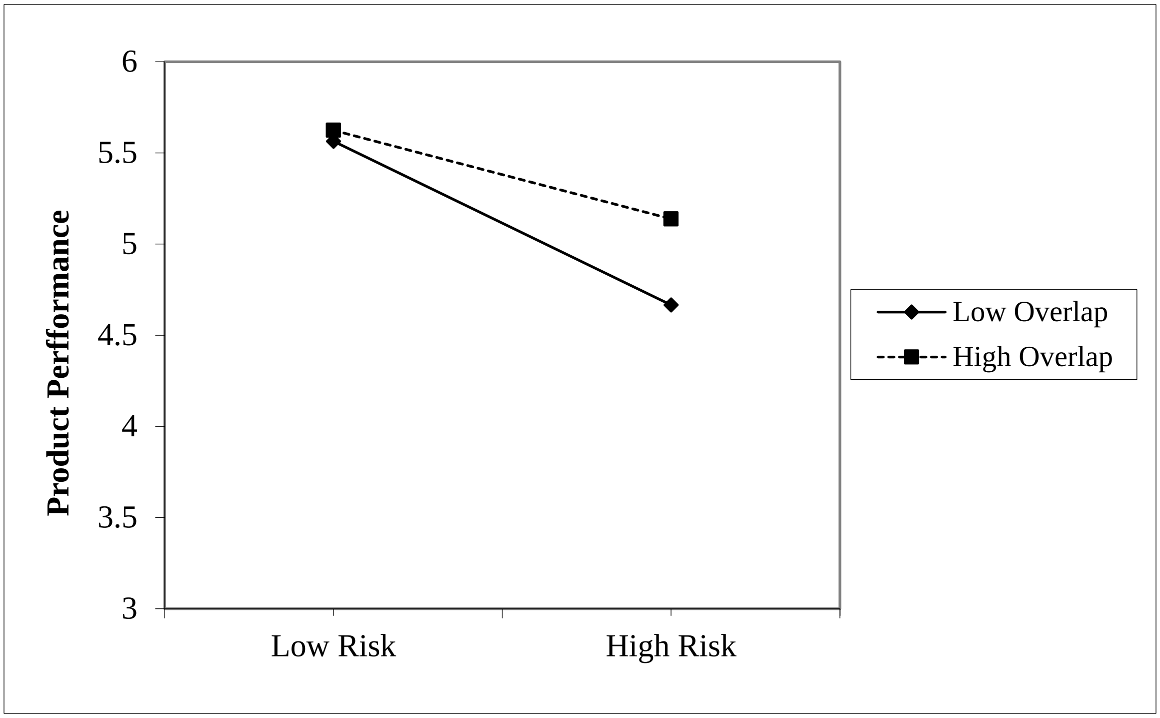

Figure 4 Significant Interaction Plot (Post-Hoc)

CHAPTER 5: CONCLUSION

This chapter presents a discussion of the research findings, limitations, contributions, implications for practice and for future research, and conclusion.

5.1 Findings

This dissertation analyzed two hypotheses. Hypothesis 1 (H1) proposed that requirements risk will have a negative impact on project process performance. The results supported this hypothesis. This is not a novel result as much of the project management literature has found similar results. Projects are essentially risky ventures (Boehm, 1991; Charette, 2005; Gemino et al., 2007; Kappelman et al., 2006; Menezes et al., 2019; Schmidt et al., 2001; Taylor, 2007; L. Wallace et al., 2004a; Y. Zhang et al., 2018). Project management literature has empirically determined project performance is negatively affected by a multitude of different project risks (Han & Huang, 2007; Liu, 2016; Liu & Wang, 2014; L. Wallace et al., 2004a; Y. Zhang et al., 2018). The magnitude of the requirement risk coefficient ($\beta=-.321$, $p<.001$) was by far the largest standardized coefficient in all of the regression models in this dissertation. Post-hoc analysis performed in this study regressed the requirements risk construct with project product performance ($\beta=-.356$, $p<.001$) and an adjusted R^2 of .157 and a R^2 of .202. Using the requirements and complexity risks combined as defined by (L. Wallace et al., 2004a), a similar study was performed by (Liu & Wang, 2014), regressing the combined requirements and complexity risk constructs as the independent variables with the dependent variable, project product performance. The results of her study had similar risk coefficients as this study ($\beta=-.36$, $p<.05$) and a R^2 of .51; the study had only two (2) controls which may have contributed to the higher R^2 when compared to the results obtained in this study. Using the same risk construct as (Liu & Wang, 2014) and again with two (2) controls, (Y. Zhang et al., 2018) regressed risk against project satisfaction and had similar risk coefficients (β=-.24, $p<.05$) and a R^2 of .569.

Hypothesis 2 (H2) proposed that as the number of team members that work on both the proposal development and the project execution increases (overlap), the negative relationship between the project's requirements risk and process performance is reduced. The results supported this hypothesis with approximately 2% of the model's variance being contributed to the overlap (adjusted R^2 in regression model 2 Table 4-9 vs. adjusted R^2 in regression model 4 Table 4-9). Two percent (2%) is a significant contribution to the project performance considering all of the possible risks and other interruptions and pitfalls can befall a project. When discussing the dissertation topic with multiple experienced project managers, they unanimously agreed that the proposal development team typically throws the proposal over the fence, are glad to be finished with the proposal, and are happy to be assigned to the next project. The project execution team typically executes this proposal without input or support from the proposal development team, as the team members typically are not available to support the project and answer questions about the proposal since they are busy on other projects.

Another interesting insight obtained from the results was the percentage of subcontractors who were not members of the firm developing the project that worked on the project, an indication of team composition. Specifically, this control defines the number of project team members that were subcontractors, consultants or other team members who were not employed by the firm developing the project. This control was significant in three (3) of the four (4) models (1, 3, 4) (β=-.092, $p<.05$) and had nearly the same coefficient as the moderator in models 3 and model 4. This finding indicates that a project team should be comprised of team members who are employees of the developing firm rather than team members who are consultants or subcontractors. The project manager experience of the author has also shown that employees are more dedicated to the success of the project than those from outside the firm. Future research could expand on this concept.

5.2 Contributions

This dissertation makes several contributions to the project risk and performance literature, theory, and practice. This study provides additional empirical evidence for the relationship between project risks and project performance (Liu, 2016); there is still relatively little empirical evidence that requirements risk contributes to project process performance (Bakker et al., 2010; Liu & Wang, 2014; Verner et al., 2014; Y. Zhang et al., 2018). This study has shown that requirements risk is a major contributor to decreasing both project product and process performance. This study also provides additional tools for project managers to mitigate requirements risk which is one of the major risks on a project that contributes to poor performance. One of the biggest challenges is to convert the research into practical tools that are easy to use and provide effective results (Bakker et al., 2010; Bannerman, 2008; Liu et al., 2009; Taylor et al., 2012; L. Wallace et al., 2004b). By increasing the number of project members who worked on both the proposal development and the project execution, requirements risk is reduced and project performance is increased. Similarity, ensuring that the project requirements are well defined and understood helps reduce risk and contributes to both improved project process and product performance. Understanding risks is crucial for managers because such an understanding allows them to identify and mitigate project risks effectively and increase project performance (Liu, 2016). In addition, using employees rather than using consultants and subcontractors also contributes to increased project performance. This study expands project management risk theory; it illustrates that risk and performance between projects are interdependent. As stated previously, most project risk and performance literature have studied the risk and performance of a single project; yet, portfolio research has called for the investigation of risk between projects; it is insufficient to consider only individual project risks (Olsson, 2008). This study also formally defines the concept of a proposal that may be used for future research. Finally, there has been minimal investigation of the RFP procurement process even though this process is widely used by both industry and government worldwide for procurement of products and services; this study continues that investigation.

5.3 Limitations

The results of this dissertation provides novel insights. But, due to its limitations such as self-reporting and single sourcing, the findings need to be cautiously interpreted. More research is needed to address these limitations that could lead to further improvement of the results. The limitations of this study are discussed in this section.

Because the survey required the respondents to reconstruct their project experience, the results may have been subject to recall bias (Akgün & Lynn, 2002; Avolio, Yammarino, & Bass, 1991; N. Gupta & Beehr, 1982). This bias may have been reduced by collecting data on the most recently completed project (Keil, 2013; Nidumolu, 1996). Due to the possible time lag between the completion of the project and the survey, this time lag might have also contributed to the recall bias. Similarly, because the survey was retrospective, risks occurring late in the project execution may have a better chance of being recognized as major determinants of project performance than those risks occurring earlier in the project (Akgun, 2005; Keizer, 2005; Nidumolu, 1996). To help reduce this bias, future studies might want to perform data collection during the different phases of the project such as the project phases as defined by the PMBOK, project initiation, execution, and closeout (PMI, 2018). This could provide further insight into why requirements are a major risk factor for projects. Another limitation due to reconstructing their memories may be is reverse causality; that perceived performance may affect project risk perceptions.

The results, based solely on the perceptions of single respondents, may have resulted in biased results; given the time constraints on this study, no attempt was made to broadly verify the informants' perceptions (Bannerman, 1998; Jiang, 2001; Akgun, 2002; Wallace, 1999; Gupta and Beehr, 1982; Aviolo et al., 1991). Although use of a single respondent is common in project management research (Liu & Wang, 2014; L. Wallace & Keil, 2004; Y. Zhang et al., 2018), it would have been desirable to have had multiple respondents from each project independently evaluate that project in order to triangulate the results of survey. The benefits of obtaining multiple respondents from the same project would be at the cost of severely compromising the ability to obtain a large number of responses from different industries, project sizes, and deliverables. The limited number of respondents that would have resulted from multi-response data would not have overcome the benefits provided by a broad samples from single respondents

(Wallace, 1999). The literature points out that simply assuming that single-source data is less valid than multi-source data is overly simplistic (Akgun, 2002; Aviolo et al., 1991).

The majority of the respondents were project managers. It should be recognized that assessing a project from the project leader perspective provides a one-sided evaluation of the project (Barki, 2001). Even though the distribution of the variables measured were not skewed nor centered near the top of the range which might be an indication of bias, potential biases should still be recognized as a qualification of the study (Jiang, 2001). To help reduce this bias, subsequent studies might want to include project members with different project functions including financial, technical developer, sponsor, and quality assurance.

The study was conducted in a single national context, the United States. Therefore, caution should be utilized when generalizing the results to a different cultural context (Akun, 2005; Schmidt, 2001; Liu, 2014). Different cultures have different risks as their major concern. Schmidt (2001) showed that many risks were general across each of the three cultures that were in the study (United States, Finland, Hong Kong), but each culture had project risks that were a priority and / or unique to that culture. For example, lack of user cooperation was ranked number four as a major project risk in Hong Kong but was not even ranked in the other two cultures, United States and Finland (Schmidt, 2001).

The risk and performance constructs were based upon previous studies. These are complex multidimensional constructs and using previously defined constructs may not have captured every attribute of project risk or performance. Future work in this area should help to establish the completeness of these constructs (Wallace, 1999; Barki, 2001; Keil, 2013). There are other measures that could have been used to evaluate project performance since each stakeholder may define success differently. Different stakeholders may be appropriate respondents for different measure of performance. Process performance (the extent to which a project is delivered on schedule and within budget) was chosen as the performance measurement for this study which may be appropriate for project managers. It is possible that the dissertation's results would have been different if another performance measure had been selected such as whether the expected requirements were actually delivered or whether the system actually worked without failure or interrupts when delivered; this measure may be appropriate for the users or customer. Project success is clearly a multidimensional construct and different stakeholders might have different perceptions of success (Keil, 2013). Post-hoc analysis was consistent with other empirical research, that requirements negatively affects product performance. Similarly, the results of the moderator (overlay) were consistent with the post-hoc results, that the overlap reduces the negative relationship between risk and project performance.

Another limitation was the cross-sectional data acquisition process used by the study. As with similar studies, the use of cross-sectional data does not evaluate the phenomenon over time, although the development of projects is an ongoing process. Risk factors were measured at the conclusion of the project rather than as they were developing, thus losing the explanation as they occurred. An ideal empirical design for testing the proposed model would be longitudinal allowing for the capture of project risks capture as they developed during the project execution (Hung, 2014; Liu, 2011; Rai, 2012). Many project functions (technical, financial, sponsor, quality assurance) span different phases of a project. For example, quality assurance is typically brought into the project during later stages of the execution phase of the project when testing begins; therefore, their project perspective would be different due to their function on the project but as well as when they joined the project. Given the time restrictions imposed on this study, this option was not judged feasible for the purposes of this research, but it should be considered for subsequent investigations on the topic.

Another limitation is the use of the moderator (overlap) which is not a particularly adequate measure of TMS theory used in the hypothesis development. Use of the validated TMS construct might have provided a more adequate measure of TMS in this study.

5.4 Implications for Future Research

The primary investigation of project risk and performance has been the risk and performance of a single project; linkages between projects could also be investigated in future studies (Dye, 2000; Teller, 2013; Tikkanen, 2007). Portfolio research has determined that it is insufficient to consider only individual project risks; risk dependencies beyond the single project should be investigated (Olsson 2008). Portfolio theory has concentrated on the distribution of the firm's scarce resources to projects within a portfolio, but there has been a lack of investigation of the linkages between projects such as the risk factors between the proposal development and the project execution (Dye, 2000, Patanakul, 2009; Payne, 1995; Artto, 2008; Artto, 2005; Elonen, 2003; Tikkanen, 2007). Such investigations of these linkages between might improve the amount of scarce resources available within a firm since risk maybe reduced and project performance improved. As discussed in the introduction of this dissertation, approximately 70% of projects are either cancelled or to exceed the estimated budge or schedule of the project causing the firm to inefficiently use its scarce resources.

Additionally, the risk–performance relationship should be further empirically examined in different project contexts; additional empirical evidence on the relationships between different types of project risk and performance is needed (Liu, 2016; Bannerman, 2008; Rai, 2000; Wallace, 2004 how; Bakker et al., 2010; Liu & Wang, 2014; Verner, Brereton, Kitchenham, Turner, & Niazi, 2014; Zhang et al., 2018). To answer these calls for investigation, future research could investigate the risk-performance interdependencies between the proposal and the project. For example, would the requirements risk on a proposal correlate with the requirements risk on the project or has the proposal and / or project team mitigated the requirements risk, therefore, making the project less risky and therefore, increasing the project performance. Since requirements is such an important risk factor, future research could investigate when and how requirements risk occurs during a project. For example, during the proposal development, the requirements for the project execution are defined. When do the requirements get redefined in the project, at the beginning of the project or at the middle and what are the resulting performance implications?

Future research of the overlap as moderator should also be encouraged. Such investigation could include the influence of the different types of project functions of the team members in the overlap. For example, does a project manager as part of the overlap help decrease the risk? Similarly, does a member of technical staff, a contract specialist, or even a sponsor as part of the overlap help reduce the risk? Another future study could investigate the characteristics of the overlap team members such as the experience of the individuals in the overlap. For example, would a technical developer be more important, in reducing requirements risk during the project development than a financial person? The developer would have a specific technical expertise required for successful the execution of the project that might be difficult to replace by another technical person while the financial expertise might be easily replaceable.

Another practical insight, as discussed previously, was the percentage of the team performed by the consultants and subcontractors as a negative contributor to project performance; as the number of consultants and subcontractors increases on a project, project performance is negatively influenced. Therefore, managers may want to think about limiting the number of consultants and subcontractors during project execution. Could this percentage possibly be a moderator between project risk and performance?

The literature has yet to provide a comprehensive picture of the development risks within a project; a majority of studies has used survey methods involving only one person on a project, primarily the project manager (Keizer, 2005). Future studies could include other project functions besides the project manager such as members of the technical staff, contract managers, accountants, and executive management. This would provide a more comprehensive picture of the risk factors of a project.

Risk and performance factors could be developed specifically for the proposal including the reduction in the overall cost and schedule of the project submitted in the proposal to what management thinks is necessary for winning the contract without the corresponding reduction in project's requirements. For example, to increase the chances of winning a contract, management might decide to reduce the cost of the project to be submitted to the customer during the proposal development even though the proposal development team might consider the enforced reduction highly risky for the successful completion of the potential project. Developing a proposal requires tradeoffs to be made between cost, schedule, and requirements by the proposal development team (Chen, 2009; Nidumolu, 1996). Do these tradeoffs increase the risk of the proposal as well as affect the performance of the project? Such tradeoffs could be empirically investigated. Other risk factors that could be developed deal with the involvement of politics in projects. Often, decisions are made during both the proposal development and the project execution for political reasons rather than for the successful execution of the project. For example, such factors would include adding requirements due to political pressures without increasing the cost or schedule of the project or, similarly, the shortening of the schedule due to political reasons. In this author's experience, making the customer "happy" so that future opportunities maybe directed to the supplier is a common occurrence that often causes the degradation of the process performance of the project.

For each procurement, there is a winner and one or more losers. Some firms in the industry have a very successful record when competing in the procurement process. The factors that contribute to the winning of the procurement during the proposal process could be investigated. Another promising area of research in the procurement process would be the investigation of the re-compete process; this is the process when a contract is up for renewal and the incumbent is trying to win the re-compete while several other firms are trying to wrestle that contract away from the incumbent. This process is occurs quite often in the procurement process as the contract only is valid for a limited period. Does the incumbent have the advantage? What factors make for a successful defense the contract re-compete? Another aspect could be investigation of the procurement process when a contract is designated for only small businesses. Does contracts designated for a specified group actually support that group? These investigations would be a benefit to firms that must compete in the procurement process.

5.5 Implications for Practice

There are three major practical implications resulting from the results of this study. First, requirements can significantly and negatively affect project process performance. Therefore, the project team should ensure that the requirements are, as the risk factors indicated, adequately identified, clearly defined, all accounted for, and correct. As required for PMI training and certification and specified in the PMBOK, requirements definition should occur during the early phases of a project (PMI, 2018). If the requirements are not well defined at this time, the cost of redoing completed portions of the project to meet these requirements can be substantial; they are the hardest to fix or resolve later in the project (Boehm, 1983, Boehm, 1991). Another risk factor is a continual change in the requirements during the project execution. Changes to the requirements by the customer during the project execution can cause cost increases and schedule delays to the project as work completed must be either redone or additional work added to the project due to these changes (Boehm, 1983, Boehm, 1991). Second, as illustrated in the post-hoc analysis, requirement risk can also negatively affect product performance. Dissatisfaction of the project outcome by the customer might cause redoing of a portion of the project or even eventually losing the customer forfeiting possible future contracts. The author has audited many projects in which the developer and customer disagreed on the requirements of the project deliverable even after the project was delivered. Finally, as the number of subcontractors and consultants used on a project increases, risk on the project increases thereby negatively affecting project performance. Therefore, the project manager may want to try to ensure that projects use employees of the firm on the project rather than consultants and subcontractors.

5.6 Conclusions

As presented in the introduction of this dissertation, projects are used extensively by organizations to drive strategy, to drive change, and to create value, improve the competitive position of an organization, contributes to growth of the company though increased earnings, cost reductions and other aspects of the company's profitability, and differentiates itself from the competitors in the industry (PMI, 2018). Yet, projects are rarely developed within schedule or budget or meet the expectations of the users; there is only a 29% chance that the project will be successfully completed (Standish, 2018; Abdullah, 2012). The proposal procurement process is widely used worldwide by all levels of government and industry (Searcy, 2009; Lauderdale, 2009; Parvey, 2010; Sant, 2012; Saenz, 2015). This dissertation provides initial evidence that by increasing the overlap between the proposal development and the project execution team can reduce the negative relationship between the project's requirements risk and process performance, thus improving project performance.

This is one of the few studies to empirically analyze the linkage between projects and, even though the RFP procurement process is widely used worldwide, to empirically analyze the RFP procurement process. To the knowledge of the author, this is the first study to empirically analyze the linkage between the proposal development and the corresponding project execution. When the author asked multiple experienced project managers about the overlap of personnel between the proposal development and the project execution teams in determining a topic for this study, the response was unanimous, that project risk would be reduced, and project performance would improve because of this overlap. Such responses included “Of course this is true”, “No doubt about it”, “That is a no brainer”, and “Isn’t it obvious”. However, and despite their intuitive nature, these conjectures lacked broad empirical support from research. The present dissertation provides empirical evidence and an underlying framework to corroborate these assumptions. Thus, this dissertation hopes to contribute both strong theoretical and practical implications to the debate and hopes to trigger that future research on this important subject.

REFERENCES

Abdullah, L., & Verner, J. (2012). Analysis and application of an outsourcing risk framework. *Journal of Systems and Software, 85*(8), 1930-1952.

Abiri, M., & Kirpekar, N. (1997). Designing a request for proposal for picture archiving and communication system. *Journal of digital imaging, 10*(Suppl 1), 20.

Addison, T., & Vallabh, S. (2002). *Controlling software project risks: an empirical study of methods used by experienced project managers.* Paper presented at the Proceedings of the 2002 annual research conference of the South African institute of computer scientists and information technologists on Enablement through technology.

Ahonen, J., & Savolainen, P. (2010). Software engineering projects may fail before they are started: Post-mortem analysis of five cancelled projects. *Journal of Systems and Software, 83*(11), 2175-2187.

Akgün, A., Byrne, J., Keskin, H., Lynn, G. S., & Imamoglu, S. (2005). Knowledge networks in new product development projects: A transactive memory perspective. *Information & management, 42*(8), 1105-1120.

Akgün, A., & Lynn, G. (2002). Antecedents and consequences of team stability on new product development performance. *Journal of Engineering and Technology Management, 19*(3-4), 263-286.

Aloini, D., Dulmin, R., & Mininno, V. (2007). Risk management in ERP project introduction: Review of the literature. *Information & management, 44*(6), 547-567.

Aloini, D., Dulmin, R., & Mininno, V. (2012). Modelling and assessing ERP project risks: A Petri Net approach. *European journal of operational research, 220*(2), 484-495.

Alter, S., & Ginzberg, M. (1978). Managing uncertainty in MIS implementation. *Sloan Management Review (pre-1986), 20*(1), 23.

Andrea, J. (2003). *An agile request for proposal (RFP) process.* Paper presented at the Proceedings of the Agile Development Conference, 2003. ADC 2003.

Anthopoulos, L., Reddick, C. G., Giannakidou, I., & Mavridis, N. (2016). Why e-government projects fail? An analysis of the Healthcare. gov website. *Government Information Quarterly, 33*(1), 161-173.

Argote, L., & Fahrenkopf, E. (2016). Knowledge transfer in organizations: The roles of members, tasks, tools, and networks. *Organizational Behavior and Human Decision Processes, 136*, 146-159.

Argote, L., & Guo, J. (2016). Routines and transactive memory systems: Creating, coordinating, retaining, and transferring knowledge in organizations. *Research in Organizational Behavior, 36*, 65-84. doi:10.1016/j.riob.2016.10.002

Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes, 82*(1), 150-169.

Argote, L., McEvily, B., & Reagans, R. (2003). Managing Knowledge in Organizations: An Integrative Framework and Review of Emerging Themes. *Management Science, 49*(4), 571-582. doi:10.1287/mnsc.49.4.571.14424

Argote, L., & Ren, Y. (2012). Transactive memory systems: A microfoundation of dynamic capabilities. *Journal of Management Studies*, *49*(8), 1375-1382.

Arnstein, D. (2002). *Project managing the RFP process for software acquisition, a structured approach*. Paper presented at the Project Management Institute Annual Seminars & Symposium, San Antonio, TX.

Arnuphaptrairong, T. (2011). *Top ten lists of software project risks: Evidence from the literature survey.* Paper presented at the Proceedings of the International MultiConference of Engineers and Computer Scientists.

Artto, K., & Wikström, K. (2005). What is project business? *International Journal of Project Management, 23*(5), 343-353.

Artto, K., Wikström, K., Hellström, M., & Kujala, J. (2008). Impact of services on project business. *International Journal of Project Management, 26*(5), 497-508.

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management, 17*(6), 337-342.

Avolio, B., Yammarino, F., & Bass, B. (1991). Identifying common methods variance with data collected from a single source: An unresolved sticky issue. *Journal of management, 17*(3), 571-587. doi:10.1177/014920639101700303

Avots, I. (1969). Why does project management fail? *California Management Review, 12*(1), 77-82.

Baccarini, D., Salm, G., & Love, P. E. (2004). Management of risks in information technology projects. *Industrial Management & Data Systems*.

Bachrach, D., Lewis, K., Youngsang, K., Patel, P., Campion, M., Thatcher, S., & Kim, Y. (2019). Transactive memory systems in context: A meta-analytic examination of contextual factors in transactive memory systems development and team performance. *Journal of applied psychology, 104*(3), 464-493. doi:10.1037/apl0000329

Baker, B., Murphy, D., & Fisher, D. (1997). Factors affecting project success. *Project management handbook,* 902-919.

Bakker, D., Boonstra, & Wortmann. (2010). Does risk management contribute to IT project success? A meta-analysis of empirical evidence. *International Journal of Project Management, 28*(5), 493-503.

Bannerman, P. (2008). Risk and risk management in software projects: A reassessment. *Journal of Systems and Software, 81*(12), 2118-2133.

Barber, R. (2005). Understanding internally generated risks in projects. *International Journal of Project Management, 23*(8), 584-590.

Barki, H., Rivard, S., & Talbot, J. (1993). Toward an assessment of software development risk. *Journal of Management Information Systems, 10*(2), 203-225.

Barki, H., Rivard, S., & Talbot, J. (2001). An integrative contingency model of software project risk management. *Journal of Management Information Systems, 17*(4), 37-69.

Bodziak, B., Koster, K., & Plexico, K. (2012). *Government Contracting For Dummies*: John Wiley & Sons, Inc.

Boehm, B. (1991). Software risk management: principles and practices. *IEEE software, 8*(1), 32-41.

Borgatti, S., & Cross, R. (2003). A Relational View of Information Seeking and Learning in Social Networks. *Management Science*, *49*(4), 432-445. doi:10.1287/mnsc.49.4.432.14428

Brandon, D., & Hollingshead, A. (2004). Transactive Memory Systems in Organizations: Matching Tasks, Expertise, and People. *Organization science, 15*(6), 633-644. doi:10.1287/orsc.1040.0069

Burek, P. (2009). *Closing the gap between project requirements, RFPs, and vendor proposals.* Paper presented at the PMI Global Congress 2009, Orlando, FL.

Charette, R. (1996). The mechanics of managing IT risk. *Journal of Information Technology, 11*(4), 373-378.

Charette, R. (2005). Why software fails [software failure]. *Ieee Spectrum, 42*(9), 42-49.

Chen, C., Law, C., & Yang, S. (2009). Managing ERP implementation failure: a project management perspective. *IEEE transactions on engineering management*, *56*(1), 157-170.

Chua, A. (2009). Exhuming it Projects from Their Graves: An Analysis of Eight Failure Cases and Their Risk Factors. *Journal of Computer Information Systems, 49*(3), 31-39. doi:10.1080/08874417.2009.11645321

Cobb, N., & Divine, C. (2016). *Writing Business Bids and Proposals for Dummies*: John Wiley & Sons.

Congressional Research Service: Report. (2018). US Congressional Research Service Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=126319376&authtype=shib&site=ehost-live&scope=site&custid=s5822979

Contracting Data Analysis - Assessment of Government-wide Trends. (2017). United State Government GAO

Cooke-Davies, T. (2002). The “real” success factors on projects. *International Journal of Project Management*, *20*(3), 185-190.

Creswell, J. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches.*: Sage publications.

Cule, P., Schmidt, R., Lyytinen, K., & Keil, M. (2001). Strategies for heading off IS project failure. In *New Directions in Project Management* (pp. 47-62): Auerbach Publications.

Da Silva, F., Santos, A., Soares, S., França, A. C., Monteiro, C., & Maciel, F. (2011). Six years of systematic literature reviews in software engineering: An updated tertiary study. *Information and Software Technology, 53*(9), 899-913.

De Bakker, K., Boonstra, A., & Wortmann, H. (2010). Does risk management contribute to IT project success? A meta-analysis of empirical evidence. *International Journal of Project Management, 28*(5), 493-503.

De Bakker, K., Boonstra, A., & Wortmann, H. (2011). Risk management affecting IS/IT project success through communicative action. *Project management journal, 42*(3), 75-90.

DeChurch, L., & Mesmer-Magnus, J. (2010). The cognitive underpinnings of effective teamwork: a meta-analysis. *Journal of applied psychology, 95*(1), 32-53. doi:10.1037/a0017328

Dedolph, F. (2003). The neglected management activity: Software risk management. *Bell Labs Technical Journal, 8*(3), 91-95.

DeLone, W., & McLean, E. (1992). Information systems success: The quest for the dependent variable. *Information systems research, 3*(1), 60-95.

Delone, W., & McLean, E. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems, 19*(4), 9-30.

DeVellis, R. (1991). Guidelines in scale development. *Scale Development: Theory and Applications. Newbury Park, Calif: Sage, 5191*.

Dongus, K., Ebert, S., Schermann, M., & Krcmar, H. (2015). *What determines information systems project performance? A narrative review and meta-analysis.* Paper presented at the 2015 48th Hawaii International Conference on System Sciences.

Dvir, D., Raz, T., & Shenhar, A. (2003). An empirical analysis of the relationship between project planning and project success. *International Journal of Project Management, 21*(2), 89-95.

Elonen, S., & Artto, K. (2003). Problems in managing internal development projects in multi-project environments. *International Journal of Project Management, 21*(6), 395-402.

Fairley, R. (1994). Risk management for software projects. *IEEE software, 11*(3), 57-67.

Federal Acquisition Regulation. (00976326). (2019). United States Government GAO Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=90615471&authtype=shib&site=ehost-live&scope=site&custid=s5822979

Flyvbjerg, B. (2006). From Nobel Prize to project management: Getting risks right. *Project management journal, 37*(3), 5-15.

Freed, R., & Roberts, D. (1989). The nature, classification, and generic structure of proposals. *Journal of technical writing and communication, 19*(4), 317-351.

Gemino, A., Reich, B., & Sauer, C. (2007). A temporal model of information technology project performance. *Journal of Management Information Systems*, *24*(3), 9-44.

Gharakhani, D., Jalalifar, S., & Behdadfar, R. (2018). Identifying and Evaluation of Risk Types in New Product Development Projects and Project Risk Management. *Journal of American Science, 14*(1).

Gransberg, D., & Barton, R. (2007). Analysis of federal design-build request for proposal evaluation criteria. *Journal of Management in Engineering, 23*(2), 105-111.

Greenly, R. (1985). Technical writing and illustrating strategies for winning government contracts. *IEEE transactions on professional communication*(2), 7-12.

Gupta, N., & Beehr, T. (1982). Test of the correspondence between self-reports and alternative data sources about work organizations. *Journal of Vocational Behavior, 20*, 1-13.

Gupta, S., Gunasekaran, A., Antony, J., Bag, S., & Roubaud, D. (2019). Systematic literature review of project failures: Current trends and scope for future research. *Computers & Industrial Engineering, 127*, 274-285.

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (1998). *Multivariate data analysis* (Vol. 5): Prentice hall Upper Saddle River, NJ.

Han, W., & Huang, S. (2007). An empirical analysis of risk components and performance on software projects. *Journal of Systems and Software, 80*(1), 42-50.

Heemstra, F., & Kusters, R. (1996). Dealing with risk: a practical approach. *Journal of Information Technology, 11*(4), 333-346.

Heemstra, F., & Kusters, R. (2004). Defining ICT proposals. *Journal of Enterprise Information Management, 17*(4), 258-268.

Hirst, G. (2009). Effects of membership change on open discussion and team performance: The moderating role of team tenure. *European Journal of Work and Organizational Psychology, 18*(2), 231-249.

Hollingshead, A. (1998a). Communication, learning, and retrieval in transactive memory systems. *Journal of Experimental Social Psychology, 34*(5), 423-442. doi:10.1006/jesp.1998.1358

Hollingshead, A. (1998b). Retrieval Processes in Transactive Memory Systems. *Journal of Personality and Social Psychology*, *74*(3), 659-671. doi:10.1037/0022-3514.74.3.659

Hollingshead, A. (2001). Cognitive Interdependence and Convergent Expectations in Transactive Memory. *Journal of Personality and Social Psychology, 81*(6), 1080-1089. doi:10.1037//0022-3514.81.6.1080

Hu, Y., Zhang, X., Ngai, E., Cai, R., & Liu, M. (2013). Software project risk analysis using Bayesian networks with causality constraints. *Decision Support Systems, 56*, 439-449.

Huang, S., & Han, W. (2008). Exploring the relationship between software project duration and risk exposure: A cluster analysis. *Information & management, 45*(3), 175-182.

Hughes, L., Dwivedi, Y., Simintiras, A., & Rana, N. (2015). *Success and failure of IS/IT projects : A state of the art analysis and future directions*: Springer.

Hughes, L., Rana, N., & Simintiras, A. (2017). The changing landscape of IS project failure: an examination of the key factors. *J. Enterp. Inf. Manage. Journal of Enterprise Information Management, 30*(1), 142-165.

Jiang, J., & Klein, G. (2000). Software development risks to project effectiveness. *Journal of Systems and Software, 52*(1), 3-10.

Jiang, J., Klein, G., & Discenza, R. (2001). Information system success as impacted by risks and development strategies. *IEEE transactions on engineering management, 48*(1), 46-55.

Jiang, J., Klein, G., & Ellis, T. (2002). A measure of software development risk. *Project management journal, 33*(3), 30-41.

Jitpaiboon, T., Smith, S., & Gu, Q. (2019). Critical Success Factors Affecting Project Performance: An Analysis of Tools, Practices, and Managerial Support. *Project management journal, 50*(3), 271-287.

Johnson, D., & Johnson, R. (2005). New developments in social interdependence theory. *Genetic, social, and general psychology monographs, 131*(4), 285-358.

Kappelman, L., McKeeman, R., & Zhang, L. (2006). Early Warning Signs of it Project Failure: The Dominant Dozen. *Information Systems Management, 23*(4), 31-36. doi:10.1201/1078.10580530/46352.23.4.20060901/95110.4

Keil, M., Cule, P., Lyytinen, K., & Schmidt, R. (1998). A framework for identifying software project risks. *Communications of the ACM, 41*(11), 76-83.

Keil, M., Rai, A., & Liu, S. (2013). How user risk and requirements risk moderate the effects of formal and informal control on the process performance of IT projects. *European Journal of Information Systems, 22*(6), 650-672.

Keizer, J., Vos, J., & Halman, J. (2005). Risks in new product development: devising a reference tool. *R&D Management, 35*(3), 297-309.

Kellermanns, F., Floyd, S., Pearson, A., & Spencer, B. (2008). The contingent effect of constructive confrontation on the relationship between shared mental models and decision quality. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior, 29*(1), 119-137.

Kennedy, P., & Cannon, M. (2004). Government procurement basics. *The CPA Journal, 74*(5), 60.

Kerzner, H. (1987). In search of excellence in project management. *Journal of Systems Management, 38*(2), 30.

Kotlarsky, J., & Oshri, H. (2005). Social ties, knowledge sharing and successful collaboration in globally distributed system development projects. *European Journal of Information Systems, 14*(1), 37-48. doi:10.1057/palgrave.ejis.3000520

Lacity, M., & Willcocks, L. (1998). An empirical investigation of information technology sourcing practices: lessons from experience. *MIS quarterly,* 363-408.

Lauderdale, J. (2009). *The Complete Idiot's Guide to Getting Government Contracts*: Penguin Group.

Lauesen, S. (2004). *COTS tenders and integration requirements.* Paper presented at the Proceedings. 12th IEEE International Requirements Engineering Conference, 2004.

Lauesen, S., & Vium, J. (2004). *Experiences from a tender process.* Paper presented at the International workshop on requirements engineering, REFSQ.

Lauesen, S., & Vium, J. (2005). Communication gaps in a tender process. *Requirements Engineering, 10*(4), 247-261.

Lee, J., Bachrach, D., & Lewis, K. (2014). Social network ties, transactive memory, and performance in groups. *Organization science, 25*(3), 951-967. doi:10.1287/orsc.2013.0884

Levina, N., & Ross, J. W. (2003). From the vendor's perspective: exploring the value proposition in information technology outsourcing. *MIS quarterly*, 331-364.

Levine, J., & Moreland, R. (2006). Small Groups: An Overview. In J. M. Levine & R. L. Moreland (Eds.), *Small groups.* (pp. 1-10). New York, NY: Psychology Press.

Lewis, K. (2003). Measuring transactive memory systems in the field: scale development and validation. *Journal of applied psychology, 88*(4), 587.

Lewis, K. (2004). Knowledge and Performance in Knowledge-Worker Teams: A Longitudinal Study of Transactive Memory Systems. *Management Science, 50*(11), 1519-1533. doi:10.1287/mnsc.1040.0257

Lewis, K., Belliveau, M., Herndon, B., & Keller, J. (2007). Group cognition, membership change, and performance: Investigating the benefits and detriments of collective knowledge. *Organizational Behavior and Human Decision Processes, 103*(2), 159-178.

Lewis, K., & Herndon, B. (2011). Transactive memory systems: Current issues and future research directions. *Organization science, 22*(5), 1254-1265.

Liang, D., Moreland, R., & Argote, L. (1995). Group versus individual training and group performance: The mediating factor of transactive memory. *Personality and Social Psychology Bulletin, 21*(4), 384-393. doi:10.1177/0146167295214009

Liu, D. (2016). How the user liaison's understanding of development processes moderates the effects of user-related and project management risks on IT project performance. *Information & management, 53*(1), 122-134.

Liu, D., & Wang, Q. (2014). Understanding the impact of risks on performance in internal and outsourced information technology projects: The role of strategic importance. *International Journal of Project Management, 32*(8), 1494-1510.

Liu, D., Wang, Q., & Xiao, J. (2009). *The role of software process simulation modeling in software risk management: A systematic review.* Paper presented at the 2009 3rd International Symposium on Empirical Software Engineering and Measurement.

Longstaff, T. A., Chittister, C., Pethia, R., & Haimes, Y. Y. (2000). Are we forgetting the risks of information technology? *Computer, 33*(12), 43-51.

Lyons, T., & Skitmore, M. (2004). Project risk management in the Queensland engineering construction industry: a survey. *International Journal of Project Management, 22*(1), 51-61.

Maister, D. (1982). Balancing the professional service firm. *Sloan management review, 24*(1), 15-29.

Mandell, S. (1986). The Request for Proposal (RFP). *Journal of medical systems, 10*(1), 31-39.

McFarlan, F. (1981). Portfolio approach to information-systems. *Harvard business review, 59*(5), 142-150.

McFarlan, F., & Nolan, R. (1995). How to manage an IT outsourcing alliance. *MIT Sloan Management Review, 36*(2), 9.

McLeod, L., & MacDonell, S. (2011). Factors that affect software systems development project outcomes: A survey of research. *ACM Computing Surveys (CSUR), 43*(4), 1-56.

Menezes, J., Gusmão, C., & Moura, H. (2019). Risk factors in software development projects: a systematic literature review. *Software Quality Journal, 27*(3), 1149-1174.

Moreland, R. (1999). Transactive memory: Learning who knows what in work groups and organizations. In L. L. Thompson, J. M. Levine, & D. M. Messick (Eds.), *Shared cognition in organizations: The management of knowledge.* (pp. 3-31). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Moreland, R., & Argote, L. (2003). Transactive memory in dynamic organizations. *Leading and managing people in the dynamic organization,* 135-162.

Moreland, R., & Myaskovsky, L. (2000). Exploring the performance benefits of group training: Transactive memory or improved communication? *Organizational Behavior and Human Decision Processes, 82*(1), 117-133. doi:10.1006/obhd.2000.2891

Moynihan, T. (1996). An inventory of personal constructs for information systems project risk researchers. *Journal of Information Technology, 11*(4), 359-371.

Moynihan, T. (1997). How experienced project managers assess risk. *IEEE software, 14*(3), 35-41.

Nakatsu, R., & Iacovou, C. (2009). A comparative study of important risk factors involved in offshore and domestic outsourcing of software development projects: A two-panel Delphi study. *Information & management, 46*(1), 57-68.

Nidumolu, S. (1995). The effect of coordination and uncertainty on software project performance: residual performance risk as an intervening variable. *Information systems research, 6*(3), 191-219.

Nidumolu, S. (1996). A comparison of the structural contingency and risk-based perspectives on coordination in software-development projects. *Journal of Management Information Systems, 13*(2), 77-113.

Olsson, R. (2008). Risk management in a multi-project environment: An approach to manage portfolio risks. *International journal of quality & reliability management, 25*(1), 60-71.

Overview of the Federal Procurement Process and Resources. (2015). GAO

Pa, N., Bokolo, A., Nor, R., & Murad, M. (2015). Risk assessment of IT governance: A systematic literature review. *Journal of Theoretical & Applied Information Technology, 71*(2).

Paech, B., Heinrich, R., Zorn-Pauli, G., Jung, A., & Tadjiky, S. (2012). *Answering a request for proposal–challenges and proposed solutions.* Paper presented at the

International Working Conference on Requirements Engineering: Foundation for Software Quality.

Parsons, V. (2006). Project performance: How to assess the early stages. *Engineering Management Journal, 18*(4), 11-15.

Parvey, M., & Alston, D. (2010). *The Definitive Guide to Government Contracts: Everything You Need to Apply for and Win Federal and GSA Schedule Contracts*: Red Wheel/Weiser.

Patanakul, P., & Milosevic, D. (2009). The effectiveness in managing a group of multiple projects: Factors of influence and measurement criteria. *International Journal of Project Management, 27*(3), 216-233. doi:https://doi.org/10.1016/j.ijproman.2008.03.001

Pattikawa, L., Verwaal, E., & Commandeur, H. (2006). Understanding new product project performance. *European Journal of Marketing*.

Payne, J. (1995). Management of multiple simultaneous projects: a state-of-the-art review. *International Journal of Project Management, 13*(3), 163-168. Retrieved from http://www.sciencedirect.com/science/article/pii/0263786394000199

Pennypacker, J. S., & Dye, L. D. (2002a). *Project portfolio management and managing multiple projects: two sides of the same coin*: New York: Marcel Dekker.

Pennypacker, J. S., & Dye, L. D. (2002b). Project portfolio management and managing multiple projects: two sides of the same coin.

Perminova, O., Gustafsson, M., & Wikström, K. (2008). Defining uncertainty in projects–a new perspective. *International Journal of Project Management, 26*(1), 73-79.

Persson, J., Mathiassen, L., Boeg, J., Madsen, T., & Steinson, F. (2009). Managing risks in distributed software projects: an integrative framework. *IEEE transactions on engineering management, 56*(3), 508-532.

Pinto, J., & Mantel, S. (1990). The causes of project failure. *IEEE transactions on engineering management, 37*(4), 269-276.

Pinto, J., & Prescott, J. (1988). Variations in critical success factors over the stages in the project life cycle. *Journal of management, 14*(1), 5-18.

Podsakoff, P., MacKenzie, S., Jeong-Yeon, L., & Podsakoff, N. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of applied psychology, 88*(5), 879. doi:10.1037/0021-9010.88.5.879

Podsakoff, P., MacKenzie, S., & Podsakoff, N. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual review of psychology, 63*, 539-569.

Porter-Roth, B. (2002). *Request for proposal: A guide to effective RFP development*: Addison-Wesley Boston.

Porter, R. (2007). Why Academics Have a Hard Time Writing Good Grant Proposals. *Journal of Research Administration, 38*(2), 37-43.

Prahalad, C., & Ramaswamy, V. (2004). Co-creating unique value with customers. *Strategy & leadership, 32*(3), 4-9.

Project Management, I. (2017). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Sixth Edition,* . Newtown Square, PA: Project Management Institute.

Project Management, I. (2018). *Project Management Institute Pulse of the Profession*. Retrieved from www.pmi.org/learning/thought-leadership/pulse/pulse-of-the-profession-2018

Rai, A., & Al-Hindi, H. (2000). The effects of development process modeling and task uncertainty on development quality performance. *Information & management, 37*(6), 335-346.

Raz, T., Shenhar, A., & Dvir, D. (2002). Risk management, project success, and technological uncertainty. *R&D Management, 32*(2), 101-109.

Ren, Y., & Argote, L. (2011). Transactive memory systems 1985–2010: An integrative framework of key dimensions, antecedents, and consequences. *The Academy of Management Annals*, *5*(1), 189-229. doi:10.1080/19416520.2011.590300

Ropponen, J., & Lyytinen, K. (1997). Can software risk management improve system development: an exploratory study. *European Journal of Information Systems, 6*(1), 41-50.

Saenz, M. (2018). *Secrets To Winning Government Contracts*: Powerhouse Publishing.

Sant, T. (2012). *Persuasive business proposals: writing to win more customers, clients, and contracts*: Amacom.

Santos, F. (2004). *Applying PMI best practices to proposal development projects*. Paper presented at the PMI Global Congress 2004—Latin America, Buenos Aires, Argentina.

Savolainen, P., Ahonen, J., & Richardson, I. (2012). Software development project success and failure from the supplier's perspective: A systematic literature review. *International Journal of Project Management, 30*(4), 458-469.

Schmidt, R., Lyytinen, K., Keil, M., & Cule, P. (2001). Identifying software project risks: An international Delphi study. *Journal of Management Information Systems, 17*(4), 5-36.

Searcy, T. (2009). *RFPs Suck!: How to Master the RFP System Once and for All to Win Big Business Or an All-inclusive RFP How-to Guide with Samples and Tips for Writing RFP Responses that Win Government and Corporate Contracts*: Channel V Books.

Sedano, T., Rengasamy, A., & Péraire, C. (2016). *Green-Lighting Proposals for Software Engineering Team-Based Project Courses.* Paper presented at the Software Engineering Education and Training (CSEET), 2016 IEEE 29th International Conference on.

Shenhar, A., Dvir, D., Levy, O., & Maltz, A. (2001). Project success: a multidimensional strategic concept. *Long range planning, 34*(6), 699-725.

Song, H., Cai, C., Li, M., & Wu, D. (2009). *Software risks correlation analysis using meta-analysis.* Paper presented at the International Conference on Multiple Criteria Decision Making.

Stanberry, S. (2012). *Federal contracting made easy*: Berrett-Koehler Publishers.

Standish, G. (2018). *Manifesto, CHAOS*. Retrieved from www.standishgroup.com

Stanley, R., & Uden, L. (2013). *Why projects fail, from the perspective of service science.* Paper presented at the 7th international conference on knowledge management in organizations: service and cloud computing.

Sumner, M. (2000). Risk factors in enterprise-wide/ERP projects. *Journal of Information Technology, 15*(4), 317-327.

Taylor, H. (2007). Outsourced IT projects from the vendor perspective: different goals, different risks. *Journal of Global Information Management (JGIM), 15*(2), 1-27.

Taylor, H., Artman, E., & Woelfer, J. (2012). Information technology project risk management: bridging the gap between research and practice. *Journal of Information Technology, 27*(1), 17-34.

Teller, J. (2013). Portfolio risk management and its contribution to project portfolio success: An investigation of organization, process, and culture. *Project management journal, 44*(2), 36-51.

Tikkanen, H., Kujala, J., & Artto, K. (2007). The marketing strategy of a project-based firm: The Four Portfolios Framework. *Industrial marketing management, 36*(2), 194-205.

Verner, Brereton, Kitchenham, Turner, & Niazi. (2014). Risks and risk mitigation in global software development: A tertiary study. *Information and Software Technology, 56*(1), 54-78.

Wallace. (1999). *The development of an instrument to measure software project risk*: Georgia State University.

Wallace, L., & Keil, M. (2004). Software project risks and their effect on outcomes. *Communications of the ACM, 47*(4), 68-73.

Wallace, L., Keil, M., & Rai, A. (2004a). How software project risk affects project performance: An investigation of the dimensions of risk and an exploratory model. *Decision sciences, 35*(2), 289-321.

Wallace, L., Keil, M., & Rai, A. (2004b). Understanding software project risk: a cluster analysis. *Information & management, 42*(1), 115-125.

Wang, E., Ju, P., Jiang, J., & Klein, G. (2008). The effects of change control and management review on software flexibility and project performance. *Information & management*, *45*(7), 438-443.

Wang, Y., Huang, Q., Davison, R., & Yang, F. (2018). Effect of transactive memory systems on team performance mediated by knowledge transfer. *International Journal of Information Management*, *41*, 65-79.

Wegner, D. (1987). Transactive memory: A contemporary analysis of the group mind. In *Theories of group behavior* (pp. 185-208): Springer.

Wegner, D., Giuliano, T., & Hertel, P. (1985). Cognitive interdependence in close relationships. In *Compatible and incompatible relationships* (pp. 253-276): Springer.

White, R., & Bales, K. (2018). *Grab the Federal Contracting Apple*: Fedmarket.

Zhang, Y., Liu, S., Tan, J., Jiang, G., & Zhu, Q. (2018). Effects of risks on the performance of business process outsourcing projects: The moderating roles of knowledge management capabilities. *International Journal of Project Management*, *36*(4), 627-639.

Zhang, Z., Hempel, P., Han, Y., & Tjosvold, D. (2007). Transactive memory system links work team characteristics and performance. *Journal of applied psychology*, *92*(6), 1722-1730.