VITA OF EDWARD THOMAS PAULSON

General Background Overview

Edward Paulson's professional background spans over 25 years and includes ten years with startup companies in Silicon Valley and another ten years starting running, and selling his own technology training company in Austin, Texas. His experience includes executive level and project management, marketing management, sales management, computer hardware design and production, software programming, telecommunications management and data communications management. He was nominated for 1994 Austin, Texas Entrepreneur Of The Year Award and was included in the 1993 WorldWide Who's Who Platinum Edition. He is currently a Visiting Professor with DePaul University in Naperville, Illinois and a management consultant.

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Doctor of Philosophy in Technology Management (2008), Indiana State University

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Master of Science in Engineering (1978), The University of Illinois at Chicago Circle

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Publishing Experience (partial listing)

Inside Cisco: The Real Story of Sustained M&A Growth John Wiley & Sons. (2001*)*

The Technology M&A Guidebook, John Wiley & Sons, Inc. (2000)

The Complete Idiot's Guide To Starting Your Own Business, Alpha, MacMillan (1st Edition - 1995 , 2nd Edition – January 1998, 3rd Edition - May, 2000, 4th Edition – December, 2003, 5th Edition – January 2007)

EVALUATING THE PERCEPTION OF TECHNOLOGY PROJECT TASK COMPLETION SUCCESS BASED ON TASK ROUTINENESS AND WORKER EXPERIENCE

A Dissertation

Presented to

The School of Graduate Studies

College of Technology

Indiana State University

Terre Haute, Indiana

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

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by

Edward Thomas Paulson

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CERTIFICATE OF APPROVAL

DOCTORAL DISSERTATION

This is to certify that the Doctoral Dissertation of

Edward Thomas Paulson

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ABSTRACT

The failure of an information technology (IT) project creates direct and indirect costs, and research suggests that failures are common. Tasks of varying levels of complexity combine to create a project deliverable and personnel with various levels of experience are assigned to complete these tasks. This study used statistical analysis to investigate the relationship between successful task completion, the routineness of the task, and the experience level of the assigned personnel. Detailed task information was collected from professional technology personnel using an anonymous online survey. The findings were that matching task routineness to worker experience was not generally considered when assigning tasks, that matching experience to routineness increases the likelihood of successful completion, and that experience with the customer, the employer and the team were important to successful task completion.

ACKNOWLEDGEMENT

This project may have my name on it but many contributed to its conception and completion. First, I would like to thank my advisor and committee chair, Dr. David Beach, for his continued support of my research, my learning process and his guidance at times when it was most needed. Thanks, Dr. Beach. I would also like to offer a special thank you to Dr. Corinne Benedetto for getting me started on the path to my Ph.D. and for mentoring me along the way. Thank you Dr. George Maughan for joining my committee late in the process and for pushing me to move my research to the next level, Dr. Anthony Gilberti for your sage writing advice and to Dr. Tijani Mohammed for your ongoing support along the way. Thank you Helen Hoffa for helping me navigate what was often a Byzantine process.

I would also like to thank the many respondents who took the time to complete the survey, the numerous people who helped get the survey set up and running, and the technology industry professionals who shared their experiences with me as I developed the initial research concept. I also feel compelled to thank those researchers upon whose shoulders my work is based such as Perrow, Daft, Lengel and Remenyi. Finally I would like to thank my wife Loree for her continued willingness to listen to task routineness and experience ruminations, to my mother for keeping my edits on track and to my friends and family who knew I was someplace studying instead of at social functions.

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INTRODUCTION

Organizations that align their projects with a business strategy are better able to accomplish their goals (Milosevic & Srivannaboon, 2006; Morris & Jamieson, 2005). Fréry (2006) reported that the ability to sustain value creation was the goal of business strategy. He defined value as protecting the short-term interest of shareholders, demonstrating the best value for customers or a combination of both. Porter (1985) stated that information technology (IT) was important to value creation because value activities created and used information. He also noted that organizations that effectively manage their information systems projects were better able to achieve competitive advantage.

Ewusi-Mensah (1997) reported that project failures were a common occurrence within companies of all sizes. Sumner, Bock and Giamartino (2006) noted that large IT project cost and time overruns were a long accepted fact. Linberg (1999) wrote that software development failures had become common and were reported on an almost daily basis in newspapers and journals. Kanter and Walsh (2004) commented that despite the usage of new project management techniques, projects continued to come in over budget and late. Standish Group International (2004) illustrated that failures were commonplace by reporting that 18 percent of IT projects were never finished or implemented by their intended customer and 29 percent were successful, defined as on time, on budget and to intended specification. The remaining 53 percent of projects took longer to complete than expected, cost more than expected or did not deliver the intended functionality.

The Project Management Institute (PMI) provides industry-recognized project management certification and training. It published the Project Management Body of Knowledge (PMBOK), a reference manual for project management best practices. PMI (2004) defined a high quality project as one that delivered the required product, service, or result within scope, on time, and within budget. It stated that projects were divided into phases and that each phase had one or more deliverables. Personnel completed tasks to create deliverables. If all tasks were completed on time, within budget, and to specification, then the project would most likely have been successful.

Curtis, Krasner and Iscoe (1988) wrote that people determine project outcomes. They noted that "large software systems are still generated by human beings rather than machines [and] their creation must be analyzed as a behavioral process" (p. 1269). They noted that individual actions contributed to the group and eventually to the whole. They illustrated the impact of project personnel when they reported that project managers "consistently commented on how differences in individual talents and skills affected project performance" (p. 1271). Boehm (1991) wrote that the judgment and skill of people were important to the success of software development projects. Pinkerton (2003) reported that the success of a project was dependent on the project personnel and that problems occurred as a "direct result of people's actions or inaction" (p. 147). Jiang, Klein and Discenza (2002) wrote that the low success rates demonstrated a need for new management methods and controls.

Perrow (1967) presented a model for evaluating tasks based on their complexity and also made recommendations for matching personnel to tasks. He recommended that organizations design their structure around their respective task type. According to Perrow, task complexity can be ranked on a continuum between routine and non-routine. A routine task was one that had few unfamiliar events, and the events that did occur were addressed using standardized procedures. He defined a non-routine task as one that had many unfamiliar events and the events were not readily addressed using standardized procedures. He reported that non-routine tasks were best assigned to experienced workers who could 'feel' their way to a solution.

Remenyi (1999) presented five areas of worker experience for consideration when evaluating IT personnel. The areas were: the applied technology, the worker's company (performing organization), the project personnel group, the customer's company, and the customer's industry. Remenyi considered a worker experienced if that worker had been involved in at least one prior project for a given experience area. This investigation will improve the understanding of the role of worker experience as it pertains to the successful completion of IT project tasks of varying complexity.

Statement of the Problem

The problem of this study was to investigate the relationship between worker experience and the likelihood of successful IT task completion.

Statement of the Purpose

The purpose of this study was to provide information technology project managers with a structured model useful for improving the match between project personnel and project tasks. This study focused on the impact of worker experience in determining the likelihood of task success. The results of the study have implications for industry in that worker experience could become a key resource allocation decision factor for future project managers.

Research Questions

The following research questions were developed in pursuit of this study.

1. What is the relationship of the successful completion of IT project tasks, a task's routineness, and the total experience level of the person assigned to complete the task?
2. What is the relationship of the successful completion of IT project tasks, a task's routineness, and any of the five experience areas of the person assigned to complete the task?
3. What is the relationship of the successful completion of IT project tasks, a task's routineness, and the level of assigned person's experience within each of the five Remenyi (1999) designated experience areas?

Statement of the Need

Information system failures were reported in Western Europe to have totaled $40 billion and in the United States the cost of failure was estimated at $150 billion in any given year (Dalcher & Genus, 2003). Kanter and Walsh (2004) noted that late project delivery can cost a company competitive advantage by impeding its entry into a new market, losing its chance to differentiate a product or service, or missing its chance to become a low-cost producer. Dalcher and Genus (2003) cited the United Kingdom-based Libra project as a project that had experienced substantial cost overrun. The Libra project was contracted in 1998 for £184 and is expected to cost over £442 upon completion in late 2008 (Shifrin, 2007). Shifrin also reported that the C-NOMIS project has seen its budget increase from £240 to £950.

Glaser (2004) wrote about healthcare industry project management and noted that organizations incurred both direct and indirect costs when projects failed. There was the direct financial expense for equipment, personnel and software but there was also an intangible cost related to eroded management trust of IT personnel to successfully complete projects. This distrust within an organization could negatively impact the company's willingness to take on future projects and could eventually put the company at a competitive disadvantage compared to companies with a better project success rate.

Study Significance

The relationship shown of successful task completion, task routineness, and personnel experience provides project managers with another tool for evaluating the likelihood of successful project completion. Glaser (2004) indicated that improvements in IT project success rates provided tangible financial benefits as well as intangible benefits such as improved morale, confidence, and competitive business advantage.

Statement of Expectations

This study determined the relationship of the experience level of IT personnel performing project tasks, the likelihood of successfully completing a task, and the influence of task routineness. Task data was collected as was data pertaining to the responsible person's experience level in the five areas specified by Remenyi (1999). Task success outcome was analyzed in relation to the separate experience areas, the responsible person's total experience, and task routineness to determine how experience and routineness are related to success. It was expected that:

1. Less successful tasks would have a higher likelihood of being performed by a less experienced person independent of routineness.
2. Non-technical experience areas would show a higher level of relationship to success than the technical areas.
3. Routine tasks would have a higher likelihood of success independent of the experience level.
4. Non-routine tasks would have a higher likelihood of success if performed by a more experienced person.
5. Experience areas with a relationship to task success would also have a relationship to the level of experience within that specific area.

Study Limitations

1. Project data was provided from respondent memory instead of collected on a real-time basis from ongoing projects.
2. Respondent answers were based on their perception and not on collected data.
3. This study focused on the task and did not collect detailed overall project information.
4. The collected data was specific to the IT industry, and the results have limited transferability to other industries.
5. Data was collected over a several month period and may not be generalized to other time frames.
6. The initial respondent solicitation e-mail contact was to the researchers contact network who then referred others to the online survey instead of from a completely randomized sample.

Study Assumptions

1. It was assumed that IT task success can be improved through controllable management methods.
2. It was assumed that project failures are due to accumulated individual task failures.
3. It was assumed that project personnel are critical to individual task and the overall project success.
4. It was assumed that the experience level of the responsible person has the most impact on task completion.

Statement of Methodology

This was a quantitative study of the relationship between IT task routineness, the likelihood of task success, and the responsible person's experience. Data was collected about previously completed IT tasks using an online survey. Collected data was related to task characteristics, task outcome, and the experience level of the primary person responsible for completing the task. Initial respondents represented a convenience sample taken from the researcher's own contact network. Potential respondents were initially contacted by email and encouraged to forward the email to colleagues and associates. This expanded the final respondent pool beyond that of the researcher's contact network. Potential participants completed pre-qualification questions after which participants completed the online survey. Qualified respondents must have participated in at least one prior project. The respondents were asked questions to determine their level of familiarity with the task and the background of the person responsible for completing the task. They may have provided data about tasks for which they were the responsible person.

Respondents were allowed to provide data for no more than one task. Data was collected for 68 tasks. Analysis of variance (ANOVA), factor and t-test analysis methods were applied to the collected data to investigate the presence of significant relationships. The study presented minimal risk to respondents and received Institutional Review Board (IRB) exempt status.

Summary

Projects are important to organizations in realizing the full value associated with their strategic goals. Information technology is integral to value creation because information is involved in each step of the process. Project failure costs an organization in tangible and intangible ways. Project deliverables are the combined result of tasks which vary in routineness level. Tasks are assigned to personnel with varying levels of experience in five areas specific to IT environments. This research investigated the relationship of the likelihood of successful task completion, the experience level of the assigned personnel, and the routineness level of a task.

Statement of the Terminology

Analyzable: An exception addressable using existing methods and procedures (Perrow, 1967).

Customer: The person or organization that will use the task or project's deliverable (Project Management Institute, 2004).

Deliverable: A measurable, verifiable work product (Project Management Institute, 2004).

Exception: An unexpected event that occurs while doing work (Perrow, 1967).

Experience area: One of five areas of experience that include the customer, the performing organization, the customer's industry, the technology, and the project team (Remenyi, 1999).

Experience level: A method for gauging the amount of experience a project worker has in a given experience area (Remenyi, 1999).

Non-routine Task: Work involving many exceptions that are not easily analyzable (Perrow, 1967).

Performing Organization: The enterprise whose employees are most directly involved in doing the project work (Project Management Institute, 2004).

Project: A temporary endeavor undertaken to create a unique product, service, or result (Project Management Institute, 2004).

Routine Task: Work involving few exceptions that are addressed using standardized procedures (Perrow, 1967).

Scope: The work that needs to be accomplished to deliver a product, service, or result with the specified features and functions (Project Management Institute, 2004).

Stakeholder: Individuals and organizations that are involved in the projects, or whose interests may be affected as a result of project execution or project completion (Project Management Institute, 2004).

Success: Completing a task or project on time, within expected budget, and to expected specifications (Project Management Institute, 2004).

Responsible Person: The person accountable for a component of a project's scope of work (Project Management Institute, 2004).

Total Experience: The aggregate of the five experience areas as described by Remenyi (1999).

Unanalyzable: An exception that is not addressed using existing methods and procedures and is solved using the experience of involved personnel (Perrow, 1967).

Chapter 2

LITERATURE REVIEW

Information technology projects are important to organizations because information is involved in almost every aspect of shareholder and customer value creation (Porter, 1985). Organizations that implement their business strategy by carefully aligning their projects are better able to accomplish their goals (Morris & Jamieson, 2005; Milosevic & Srivannaboon, 2006). Sumner, Bock and Giamartino (2006) noted that large information technology (IT) project cost and time overruns were a long accepted fact. The Standish Group (2004) reported that 71% of projects were not completed on time, on budget or to intended specification. The reported low information systems project success rate demonstrated a need for new management methods and controls (Jiang, Klein & Discenza, 2002).

People are important to software development projects (Boehm, 1991). To fully understand the role of personnel in determining the success of project success, it is necessary to establish the relationship between strategic programs, projects, definitions of success, the tasks that comprise a project, the unique characteristics of the personnel assigned to complete project tasks and the role of experience.

Programs and Projects

The Project Management Institute (PMI) provides industry-recognized project management certification and training. It publishes the Project Management Body of Knowledge (PMBOK) that is a reference manual for project management best practices. The Project Management Institute (1996, 2004) noted that projects are temporary, intended to achieve a specific set of unique objectives and then terminate. They may last for a few weeks or for several years, and may involve a few people or many thousands. Cost and staffing levels will vary over the project lifecycle with the bulk of the cost and staffing incurred during the later portion of the intermediate phase. Different industries will apply their own specific variations to this generic project lifecycle. Gray and Larson (2000) defined a project as a nonroutine, complex and one-time effort to deliver a specific outcome that meets a customer need using limited budget, resources and time. Atkinson (1999) wrote that the finite time requirement may be the primary factor that differentiates project management from other management types.

Jugdev and Müller (2005) noted that project managers were frequently involved with projects that are part of a larger program or group of projects. Pinto, Cleland and Slevins (2003) reported that a program is a group of projects temporarily organized to perform a higher complexity process that typically has duration of between six to thirty-six months. Project Management Institute (2004) wrote that a program is a group of projects that are related, coordinated and managed to achieve a result that is not as available when projects are individually managed.

Jiang, Klein and Discenza (2002) characterized IT projects as technically complex, funded by tight budgets, and with tight schedules. They reported that IT projects required a combined effort from many people from multiple disciplines. Ewusi-Mensah (1997) wrote that information technology projects are group oriented and require substantial capital and human resources. He noted that they are unique in that they require extensive collaboration between end users, the IT staff and management. Dalcher (2003) reported that software development project environments involve problem situations that are uncertain and ambiguous while working with incomplete knowledge. He commented that a primary software development output is the accumulation of skills and knowledge within the group. Belev (1990) noted that high technology programs uniquely involved advanced, complex, technological sophistication, are dependent on highly trained people with little prior applicable experience, must achieve technological success working for customers with limited funds, and high expectations and may involve a scientific breakthrough. He reported them as inherently risky. Day (2000) remarked that software projects are challenging in part because computer systems work successfully when they are cohesive and inflexible but they serve human populated organizational needs that are fluid, less cohesive and adaptive. Challenges arise from the need to define “hard rules, rigid concepts and precise definitions from a relatively uncohesive business environment” (p.352).

O’Donnell, DuRussell and Derry (1997) noted that the capture and articulation of client domain knowledge and needs must be performed to develop client-oriented software and that obtaining this information may require multiple client meetings. Kanter and Walsh (2004) commented that despite the usage of new project management techniques, projects continued to come in over budget and late. Assessing the success of a project depended on the definition of success applied.

Defining Success

Linberg (1999) wrote that there are different definitions for project success and that projects considered failed by users might be considered successful by IT staff because of the learning experience. Jiang and Klein (1999) reported that IT staff may consider a project a success primarily based on whether it meets IT standards for accuracy, data security, documentation, and compatibility. DeLone and McClean (1992) noted that IT users may consider a project a success based on the content and currency of provided information, imposed workload changes and job impact. Jugdev and Müller (2005) remarked that project success was related to expectations and managing expectations was an important aspect of project success. They wrote that defining project success was ambiguous and that the definition changed over the lifecycle of the product or project. They noted that program success resulted from combined project successes. Dalcher and Genus (2003) noted a purely economic definition of IT system success as when the returns obtained from a project exceeded the cost of development. They remarked that implementation delays add to costs and that losses on one project may create losses in other areas within the system. Bresner and Hobbs (2006) noted that defining project management success was complex and that the steps that lead to project success were still undetermined.

Kerzner (2001) defined a successful project as one that achieved project objectives within required time and cost constraints, met desired performance and technology levels, that utilized assigned resources effectively and was accepted by the customer. Ewusi-Mensah and Przasnyski (1994) defined project abandonment as the perceived inability of the IS development project to meet the requirements or expectations of various combinations of organization stakeholders. They defined stakeholders as those with a vested interest in the project and its successful completions or termination. They divided abandonment into three categories: total abandonment which constituted the complete termination of all project activities prior to full implementation, substantial abandonment which was a major truncation of the project to make it radically different from the original specification, and partial abandonment which was a scope reduction that did not involve major changes.

The Standish Group (1994, 2004) divided projects into three categories. The Standish Group model has been cited in academic articles (Al-Shehab, Hughes & Winstanley, 2005; Ewusi-Mensah, 1997; Linberg, 1999; Oz & Sosik, 2000; Sonnekus & Labuschagne, 2004; Verner et al, 2005). Sonnekus & Labuschagne (2004) used the Standish Group results as a basis of comparing the state of South African IT project management practices against those of the United States. Standish defined successful projects similarly to PMI (2004) and Aladwani (2002) as projects completed on time, on budget and with all initially specified functions. Challenged projects were completed and became operational but were over the initial time estimate, over the initial budget or offered fewer functions than originally specified. Failed projects were terminated before completed or projects that were delivered but never used. The Standish Group success classification model was used for this research project.

Ewusi-Mensah (1997) reported that IT project cost overruns “occur with some regularity in companies of all sizes” (p. 74). Linberg (1999) noted that software development failures were reported on an almost daily basis in newspapers and journals. The 2004 Chaos Report noted that 18 percent of IT projects were failed, 53 percent were challenged, and 29 percent were successful (Standish Group International, 2004). Sumner, Bock and Giamartino (2006) commented that large IT project cost and time overruns were a long accepted fact and that methods for improving project success rates would provide benefits to IT project stakeholders.

Task Characteristics

Perrow (1984) wrote that many smaller events, instead of a single major event, usually contributed to complex technological system failure. Ivory and Alderman (2005) commented that it is difficult to predict system failure when it arises from a combination of many minor failures that "yield unanticipated cost and time overruns and even suboptimal designs" (p. 6). Levitt, Thomsen, Christiansen, Kunz, Jin and Nass (1999) commented that it was difficult to understand a complex process as isolated, independent activities, and changes or errors arising from one activity impacted other interdependent activities. Their virtual design team (VDT) model was based on the premise that detailed actions by workers in performing their work in conjunction with interplay between workers combined to create project level performance. PMI (2004) wrote that projects are accomplished in phases and that each phase has its own set of deliverables. The summation of the project phases represented the project life cycle. A typical project life cycle will occur over time and have an initial phase, one or more intermediate phases and a final phase that leads to the finish of the project.

Campbell (1988) defined an interaction task complexity classification that involved both the task and the task-doer. He noted that the process by which a task would be completed was a combination of the alternatives associated with the task situation and the response options of the task-doer. He defined a complex task as one that placed a high cognitive demand on the task-doer. He provided an integrated task complexity evaluation framework that related increased complexity to increased information load, increased information diversity or increased rate of information change. He remarked that the essential nature of a task, its basic characteristics, can be distinguished from associated characteristics that are externally related with the task. He wrote that because task difficulty is associated with the relationship between the task-doer and the task complexity, tasks perceived as difficult for one doer with less experience may be perceived as simple to the more experienced doer.

Charles Perrow (1967) presented a model for evaluating tasks based on their complexity, which he ranked on a continuum from routine to non-routine. He defined a routine task as one that had few unfamiliar events and the events that did occur were addressed using standardized procedures. A non-routine task was one that had many unfamiliar events and the events were not readily addressed using standardized procedures. He reported that non-routine tasks were best assigned to experienced workers who could "feel" their way to a solution (p. 199). He commented that the level of exception and analyzability of the exception is dependent on the perception of the affected individual. What might be routine to one person might be non-routine to another, with experience being the largest factor influencing the person's perception. Keller (1994) defined routine technologies as those with repetitive and predictable tasks.

Daft and Lengel (1984, 1987) based their medium richness theory on Perrow (1967) as did Rice and Shook (1990) and Rice (1992) who elaborated on medium richness theory. Keller's (1994) study of information processing in non-routine R&D project environments added support to both Perrow's (1967) analyzability concept and

Daft and Lengel's (1984) medium richness theory. Ahuja and Carley (1999) used the Perrow (1967) routineness model to describe task characteristics in their research related to virtual organizations. Withey, Daft and Cooper (1983) used the Perrow (1967) routineness and analyzability framework for their study that investigated the use of a common scale for measuring work unit characteristics. They noted that that the Perrow framework applied well to work unit level analysis. Their findings indicated that analyzability and exceptions can be adapted to questionnaire methodologies. They have generally been supportive of the Perrow task routineness construct. They reported a series of survey questions useful for determining task routineness and those questions were incorporated into the survey instrument used for this research study.

Glaser (2004) noted that a lack of familiarity with a technology within an IT staff group moved a technology project into the immature category for this particular group even if the technology is considered mature for others within the industry. Pinkerton (2003) stated that there are no rigid rules related to project task complexity and that task requirements will change over the life of the project.

An extension of the Perrow (1967) model is that a less experienced worker who is responsible for a non-routine situation is less likely to have the experience to feel the right solution and, as such, that particular task is placed in jeopardy of successful completion. Daft and Macintosh (1981) defined response uncertainty as the situation that arises from the worker's inability to understand the task adequately enough to evaluate alternate courses of action, benefits, costs, and outcomes. They commented that an experienced person was more likely to recognize a problem and to know how to address it.

Meyer and Curley (1991) performed a detailed analysis of expert systems and their likelihood of successful implementation. They represented technological complexity as related to the diversity of hardware and software platforms involved, the level of integration with other systems that is involved, the overall size and scope of the logic programming effort and other topics specifically related to artificial intelligence systems and not directly pertinent here. Their findings reinforced a positive relationship between the capabilities of an organization's personnel and the likelihood of effective implementation of a complex project such as an expert system.

Personnel Characteristics

Jiang, Klein and Discenza (2002) reported that projects were accomplished by a combination of team members who completed the project work and a project manager who managed the process. They noted that team members will have different levels of expertise. Ewusi-Mensah (1997) commented that IT projects were performed by groups with members coming from various backgrounds and that technical competence of involved staff members was important. He noted that the lack of directly applicable experience was mentioned as a reason for project cancellation by one of his studied case respondents. Pinto, Cleland and Slevin (2003) noted that project oriented organizations will create pools of experts that can be accessed as needed for individual projects. They commented that the traditional management approach assigned clearly defined work packages to individuals who worked within a centrally integrated hierarchical environment. They contrasted the traditional management approach to the project oriented organizational approach which was more dynamic, containing boundaries that changed rapidly with the number of project and programs. They indicated that individual learning contributed to team learning which contributed to organizational learning. Lackman (1987) noted that project team, application and technical risks can be reduced by using a knowledgeable team.

Reich (2007) reported that project team personnel come from diverse backgrounds and may or may not have experience with projects similar to the one to which they were assigned. She noted that not learning from prior projects and mismatching a project's knowledge needs with personnel selected were two major knowledge risks present at the beginning of a project. A lack of experience limited their knowledge about project risks and the impact these risks could have on project goals.

PMI (2004) remarked that personnel completed tasks that created deliverables. If all tasks were completed on time, within budget and to specification then the project would have a high likelihood of success. Curtis, Krasner and Iscoe (1988) commented that people determined project outcomes, that humans and not machines wrote software, and that software development should be analyzed as a behavioral process. They reported that individual actions contributed to the group and eventually to the whole. Their studied project management personnel commented that project performance was affected by individual skill differences. Boehm (1991) noted that people are important to any software development project, and that their skills and judgment were key to determining project outcomes. Pinkerton (2003) reported that the success of a project was dependent on the project personnel and that problems occurred as a "direct result of people's actions or inaction" (p. 147). PMI (2004) wrote that overall project success was tied to the successful completion of individual phase deliverables. Phase deliverables were themselves comprised of individual tasks which were assigned to project personnel.

Kanter and Walsh (2004) stated that an organization's skills, experience, track record, management climate and characteristics specific to a given project were important to its ability to develop and implement projects. Adam and O'Doherty (2000) reported that involving experienced personnel when implementing enterprise resource planning (ERP) systems both sped up the process and also diminished customer post-implementation disillusionment. They noted that ERP systems are complex and involve many different types of expertise.

Defining Experience

Morrow, Leirer and Altieri (1993) researched the relationship of experience and aging to narrative processing. Their findings indicated that experienced subjects, in this case airplane pilots, more quickly and accurately read aviation-related narratives than non-pilots. The researcher's interpreted the results to indicate that experience allowed subjects to interpret domain-relevant situations more effectively because their experience base reduced demands on working memory and providing more working memory to interpret the text narrative. Narrative processing was chosen for experiment purposes because it placed a heavier demand on working memory capacity. Fisher, Chengalur-Smith and Ballou (2003) noted that workers with experience working in a particular area for a longer period of time developed a feel for data nuances and intuitively compensate.

Pei and Renau (1990) reported that experts store a representation of domain knowledge in their memory that is qualitatively different from that of novices. They noted that these differences affect the way in which knowledge is used when devising a problem solving strategy. They commented that experts store more mental models in their memory and establish more linkages between the models than novices, leading to more complete activation between linked models and knowledge retrieval.

Esteves, Chan, Pastor and Rosemann (2003) specified that the knowledge types important to IT projects are business knowledge, technical knowledge, product knowledge, company-specific knowledge and project management knowledge. Riech (2007) noted that institutional and cultural knowledge were important, and that more complex environments and problems required the exploitation of more types of knowledge.

Remenyi (1999), a professor of information technology, indicated five areas of worker experience for consideration when evaluating IT personnel. The areas were: the technology, the worker's company (employer), the project team, the end user's company, and the end user's industry. He defined an experienced worker as one that had worked on one prior project involving the area in question. For example, if a worker had worked on a project using a specific technology, that worker would be considered experienced with that technology. Kuhlthau (1999) demonstrated in her multi-year case study of an information analyst from the securities industry that worker-perceived complexity of a task was a critical factor in whether the worker experienced uncertainty when completing the assigned task. Early in her subject's career, he perceived more tasks as complex where later as an expert he found fewer tasks complex. As an expert he found complex tasks to be those that "involved learning and constructing something entirely new" and that his aim was to "add value to the client's knowledge" with some new information or new interpretation of existing information (p. 409).

Finnegan and Willcocks (2006) lend support for the Remenyi (1999) model with their detailed historical case study of the United Kingdom city council (UKCC) call center upgrade project. Their study revealed that personnel were key at every level of this project, and that lack of technological experience, lack of customer experience and lack of industry experience were of top importance among the issues they reported as integral to the reported project challenges. They noted that "knowledge issues … are not just implicit in all systems implementations, but can be key reasons why a system optimizes or fails in light of its various stakeholders' interests" (p.586).

Current Study

The first objective of this research study was to determine the relationship between the total experience of a worker and the likelihood of that worker successfully completing an IT project task. The Remenyi (1999) five area experience model was used in conjunction with the PMI (2004) definition for project success, and the Standish Group (1994, 2004) success classifications. The level of experience in each area was determined using a variation of the Remenyi (1999) single project definition. Experience level within an area was based on the number of projects on which the worker was reported to have worked prior to the one for which the task data was collected. Total experience was a composite measure of the reported level in each of the five experience areas. The second objective of this research study was to determine whether one experience area was more significant than the others in determining successful task completion. The third objective of this research study was to determine whether the level of experience within an area was significant with respect to successful task completion. Each objective was evaluated with and without the influence of task routineness based on Perrow (1967).

Summary

This chapter contained information related to organizational use of projects and programs in creating value through the use of program and project management. The level of industry-reported project success rate was included as were several definitions of success. Several models for evaluating tasks were presented along with their applicability to evaluating information technology project tasks. The unique role of personnel involved with IT projects was included with special emphasis on creating an understanding of the importance of experience in dynamic, non-routine environments such as those associated with technology projects and tasks.

Chapter 3

METHODOLOGY

This chapter includes information related to the collection and analysis of historical data pertaining to task routineness, task success, and responsible worker experience. The participant selection procedure, survey question design, data encoding, and data analysis procedure is provided.

Online Survey Data Collection

Data was collected using an online survey. Surveys are useful for collecting data from a sample with the intention of determining something about a population (Creswell, 2003). Couper (2001) wrote that online surveys are useful for target populations with a high percentage penetration of Internet access. He noted that participants were often sent a solicitation e-mail, access was restricted by password and the participant was limited by the total number of times they could respond to the survey. In this study, prospective respondents were contacted by e-mail, access was restricted by both a password and an IP address which allowed only one submission per computer. Couper, Traugott, and Lamias (2001) remarked that whenever feasible, critical data should be collected using radio buttons in a click-to-answer type of question format because radio button questions are completed more often than questions requiring a fill-in-the-blank response. Radio buttons were used throughout the survey. They indicated that including a survey completion progress indicator will increase the likelihood of survey completion and reduce abandonment. This capability was not available with the WebForms online survey tool. Terminology in common use by the industry standard Project Management Institute was used to minimize terminology confusion and enhance survey consistency.

Data Collection and Manipulation Procedures

Data was collected using an online survey that was divided into four sections and contained 22 questions. The four sections were 1) respondent background used for pretest qualification during analysis, 2) task routineness information, 3) task completion success, and 4) responsible worker experience. Respondents typically completed the survey in less than fifteen minutes. The survey was hosted at the Indiana State University WebForms survey tool site. The questions are included in the Appendix.

Questions one and two were used to determine the experience level of the respondent. Question one was used to determine the respondent's number of years of professional experience and question two was used to determine the respondent's level of project experience. Data collected from respondents who answered 'None' to question two were excluded at the time of analysis. Question three collected a written description of the task being reported, and question four collected data pertaining to the phase of the project that the task occurred. Data collection from questions three and four was used to provide context for reported tasks during the analysis phase.

Task routineness was determined by the answers provided to questions five through nine which were based on the questions evaluated by Withey, Daft, and Cooper (1983). The most routine tasks were expected to have a total task routineness value of four based on the following question answers and weighting: Q5 None (1); Q6 To a great extent (1); Q7 To a great extent (1); Q8 To a great extent (1). The most non-routine tasks were expected to have a task value of twelve based on the following question answers and rating: Q5 Many (3); Q6 To a small extent (3); Q7 To a small extent (3); Q8 To a small extent (3). Question nine was included as a validation check on the routineness level determined from questions five to nine and was not used during the analysis phase.

Task success was evaluated from the answers to questions 10 to 15. A 'No' answer to either question 10 or question 11 was coded as a '1' and recorded as a failed task. 'Yes' answers were coded as '2'. Any one of the following answers indicated a challenged task: Q12 (timeframe) – Much later than expected; Q13 (functionality) – Much less functionality than expected; Q14 (budget) – Much more expensive than expected. Question 15 asked the respondent for a personal assessment of the task's success and was included as a validation check on the answers provided to questions 12 through 14. Question 15 was not used during analysis. All other answer combinations were recorded as successful tasks. A single task success category variable was used to record tasks as failed, challenged, or successful. Failed tasks were recorded as a 1, challenged tasks were recorded as a 2 and successful tasks were recorded as a 3.

Worker experience for the five areas of interest was determined by answers to questions 16 to 20 using a five-level Likert-like scale following the format tested and shown effective by Couper, Traugott, and Lamias (2001). For each question, a 0 answer indicated no experience in that area and was recorded as a 1 for analysis purposes to preclude divide-by-zero errors. A '4 or more' answer indicated much experience and was recorded as a 5 for analysis purposes. The intermediate 1, 2 and 3 response options were weighted as 2, 3 and 4 respectively. A total experience value was calculated by summing the individual experience area values. The lowest possible total experience value was 5, and the highest possible value was 25. Question 21 was included as an indicator of the respondent's level of knowledge about the reported responsible worker's experience. Question 22 was provided for respondents to comment in any way they believed pertinent.

Figure 1 graphically represents the relationship between the proposed variables, task routineness, and the various quotients. Detailed variable information is included in Table 1. The data type designations used by SPSS were used for this table.

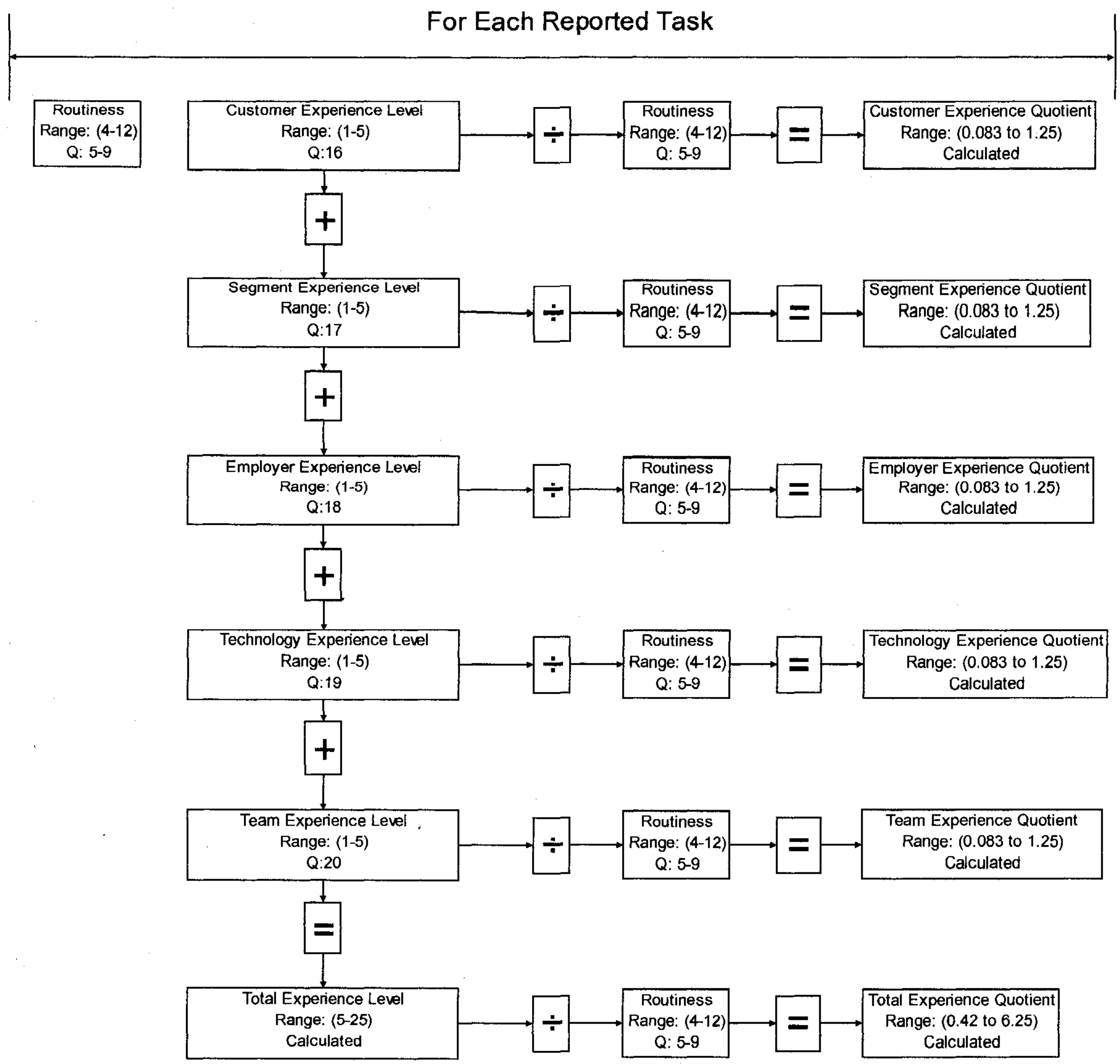

Figure 1. Variable relationships, ranges and respective survey questions

Table 1
Variable Information

Variable	Variable Type	Data Type	Calculations	Range	Comment
Task success category	Dependent	Ordinal	Q 10 or Q 11 (No) = Failed	1 (failed), 2 (challenged), 3 (success)	Questions 12 to 14. Question 15 for verification. See text for details.
Task Routineness	Independent	Scale	Sum of answers to questions 5 to8.	4 (routine), 8 (average), 12 (non-routine)	Questions 5 to 8. Question 9 for verification. See text for details.
Area experience level	Independent	Scale	Each of the five areas has its own level.	1 (least experience), 3 (avg.), 5 (most experience)	Questions 16 to 20.
Area experience quotient	Derived	Scale	Divide the area experience level by the task routineness.	0.083 (1/12 - lowest), 0.375 (3/8 - average), 1.25 (5/4 highest)	Represents the relative nature of worker area experience to task routineness.
Total experience rating	Derived	Scale	Sum of levels for all five experience areas.	5.0 (low), 15.0 (avg.), 25.0 (much)	Sum of answers to questions 16 to 20.
Total experience quotient	Derived	Scale	Divide the total experience rating by routineness.	0.42 (5/12 - lowest), 1.875 (15/8 - average), 6.25 (25/4 highest)	Represents the relative nature of total worker experience to task routineness.

Analyzing the Research Questions

Data analysis was performed using SPSS 16.0 and Microsoft Excel 2003. Data were retrieved from the online site and then processed to create numeric values consistent with the previously described variable manipulation process. Research question one was evaluated using analysis of variance (ANOVA) on the total experience variable and total experience quotient to determine if there was a difference between tasks categorized as failed, challenged, or successful. Research question two was evaluated by performing a factor analysis on the various experience areas and quotients to determine if any of them individually related to task success. Significant factor analysis variables were determined based on Eigenvalue results (SPSS, 2003). Research question three was evaluated by performing a t-test on the experience area or quotient variable shown significant from the factor analysis performed during research question two analysis. An alpha of 0.1 acceptance criteria was initially intended but relaxed when the ANOVA showed significance between 0.1 and 0.2. Otherwise, the premise of this investigation would have been rejected immediately and what turned out to be important findings would have been lost. Failed tasks typically had a mean value below that of challenged tasks, and challenged tasks typically had a mean value below that of successful tasks.

Sample Size

The estimated distribution of experience quotient values and minimum sample size for each task category is shown in Figure 2. The minimum sample size (n) for each category was calculated using the method proposed by Wagner (1992, p. 172) assuming a 90% confidence level, estimated means for failed, challenged, and successful tasks and confidence widths that do not violate the numeric upper and lower bounds set by the survey data collection process.

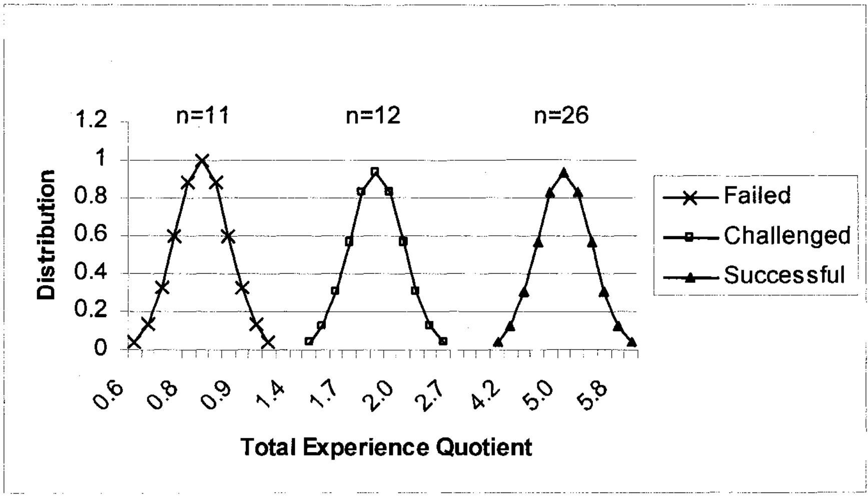

Figure 2. Expected distribution of total experience quotient by success category

Respondent Selection Process

A solicitation email was sent initially to the researcher's contact network which represented a convenience sample of potential respondents. E-mail recipients were encouraged to forward the solicitation e-mail to other industry colleagues which expanded the respondent pool beyond the initial convenience sample. The e-mail contained the URL of the survey site and a password allowing access to the survey. The survey was anonymous and collected no identifying information, but an IP address was collected as required by the WebForms survey tool to limit the number of times a response could be submitted from a particular computer workstation.

Institutional Review Board

Special consideration was paid to protecting the privacy of survey respondents as well as providing them with some benefit from participating in this study. Respondents were informed in a solicitation e-mail that their participation was voluntary, and they were not required to answer any questions with which they are uncomfortable. The proposed research was classified as exempt by the Indiana State University institutional review board.

Participant identity was protected because no personally identifying information was collected or requested at the time of survey completion. Upon separate request initiated by the respondent as explained in the solicitation e-mail, participants received a summary of the investigation results along with an explanation of its implications and use. The respondents were professional project personnel who could benefit from applying the proposed model in their work. When feasible and asked, the researcher offered to make a presentation to members of the respondent's staff related to the model, theory, investigation results, and potential application within their environment.

Survey Validation

The survey was validated with the assistance of four experienced technology project personnel. The online draft survey URL and pretest password were provided to pretest participants who completed the survey and provided feedback with respect to clarity or points of confusion. The survey was modified to incorporate their feedback.

Chapter Summary

Project task data was collected from experienced IT project personnel using an anonymous online survey. Quotient values were calculated that relate task success to worker experience in five specific areas incorporating the influence of task routineness. The data was statistically analyzed using ANOVA, factor analysis and t-tests to determine the relationship between task success, task routineness, and the experience level of task personnel. The final respondent pool included many from outside of the initial convenience sample.

Chapter 4

FINDINGS AND ANALYSIS OF DATA

This chapter includes the results of a statistical analysis performed on collected survey task data. The findings pertain to the significance of the responsible worker's total prior experience and the task's routineness as they relate to successful task completion. Results are presented for failed, challenged and successful tasks. The impact of the responsible worker's prior experience level within each of the five separate experience areas is analyzed along with recommendations for future research.

Data Collection and Descriptive Statistics

Data was collected from June to August 2008 using an online anonymous survey. The 68 responses were classified as follows: 14 were for tasks classified as failed, 27 were for tasks classified as challenged and 27 were for tasks classified as successful. Sixty two respondents had experience with 4 or more projects and 4 or more years of professional industry experience. Four respondents had 1 to 3 years of professional industry experience and 4 or more projects. Two respondents had less than one year of professional industry experience but had experience with at least one project. The percent of failed and challenged tasks tends to support comments by Walsh (2004) and The Standish Group (2004) that projects are often not successful.

Table 2 includes a cross tabulation of the task success classification and the phase of the project within which that task was reported to have occurred. Half of proposal phase tasks were either successful or failed, 75% of requirements definition phase tasks were either challenged or failed, 100% of quality testing phase tasks were challenged and 100% of maintenance phase tasks were successful. Respondents reported that 39% of tasks were successful suggesting that the respondent group may be reporting on tasks performed by persons who function at a higher level than the 29% reported by The Standish Group (2004).

Table 2

Task Success by Project Phase Cross Tabulation

Success Category		Phase							
		Proposal	Requirements Definition	Design and Development	Quality Testing	Deployment	Maintenance	Other	Total
Failed	Count	2	6	3	0	2	0	1	14
	% within Category	14.3%	42.9%	21.4%	.0%	14.3%	.0%	7.1%	100.0%
	% within Phase	50.0%	50.0%	14.3%	.0%	8.7%	.0%	33.3%	20.6%
	% of Total	2.9%	8.8%	4.4%	.0%	2.9%	.0%	1.5%	20.6%
Challenged	Count	0	3	10	4	9	0	1	27
	% within Category	.0%	11.1%	37.0%	14.8%	33.3%	.0%	3.7%	100.0%
	% within Phase	.0%	25.0%	47.6%	100.0%	39.1%	.0%	33.3%	39.7%
	% of Total	.0%	4.4%	14.7%	5.9%	13.2%	.0%	1.5%	39.7%
Successful	Count	2	3	8	0	12	1	1	27
	% within Category	7.4%	11.1%	29.6%	.0%	44.4%	3.7%	3.7%	100.0%
	% within Phase	50.0%	25.0%	38.1%	.0%	52.2%	100.0%	33.3%	39.7%
	% of Total	2.9%	4.4%	11.8%	.0%	17.6%	1.5%	1.5%	39.7%
Total	Count	4	12	21	4	23	1	3	68
	% within Category	5.9%	17.6%	30.9%	5.9%	33.8%	1.5%	4.4%	100.0%
	% within Phase	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	33.8%	30.9%	1.5%	4.4%	5.9%	5.9%	17.6%	100.0%

The boxplot shown in Figure 3 indicates that the total experience median (21.66) and mean (19.16) for all tasks were at the high end of the overall range of 5 to 25. The experience groupings by success category appear relatively similar for failed and challenged tasks, and the successful category showed a tighter grouping at the higher end of the range.

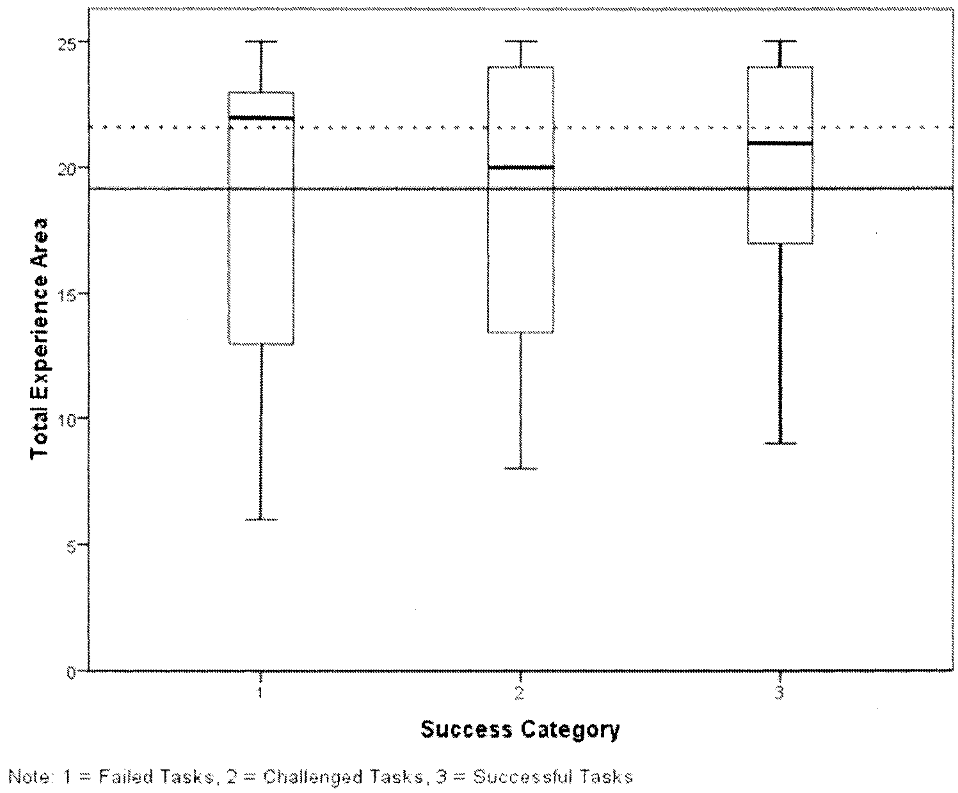

Figure 3. Boxplot of total experience area by success category

The Figure 4 boxplot shows that the routineness mean (7.63) and median (8.0) for all tasks were very close, that successful tasks had a lower median routineness level, and both challenged and failed tasks matched the overall median routineness level. There was less spread for successful tasks, tending toward the lower (more routine) level, when compared to challenged and failed tasks.

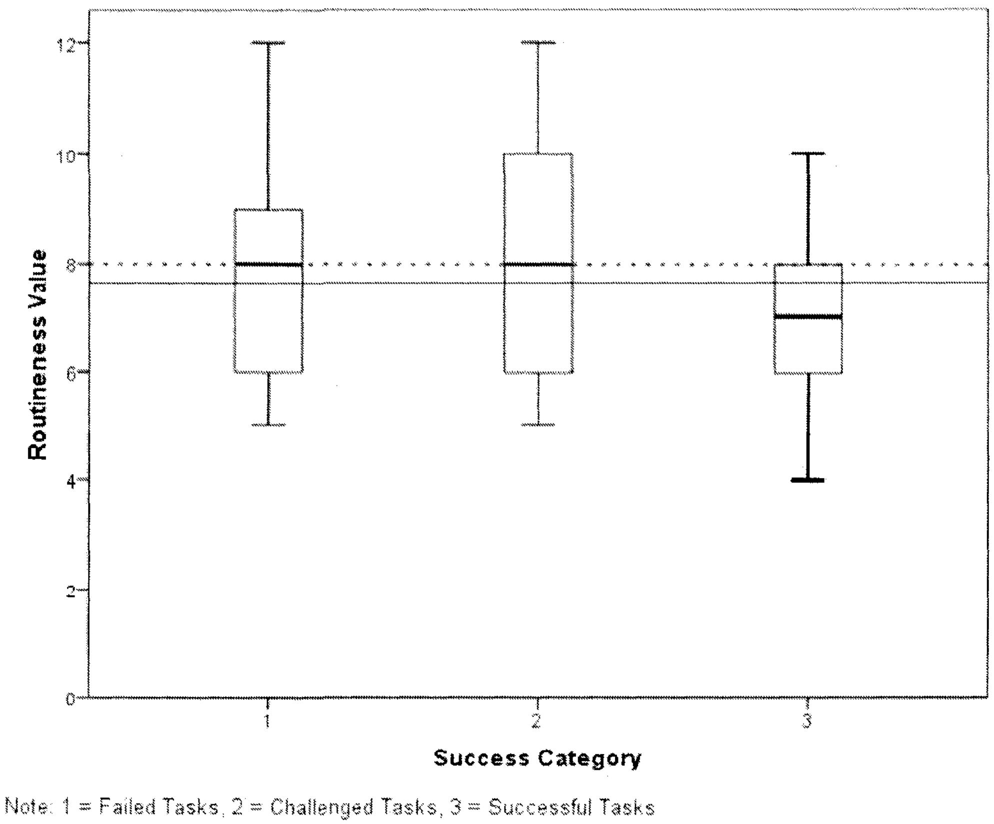

Figure 4. Boxplot of routineness by success category

The Figure 5 boxplot shows that failed and challenged tasks tended to have a lower total experience quotient while successful tasks tended toward a higher total experience quotient. An experience quotient is calculated by dividing the responsible person's prior area project experience level by the task routineness. Larger experience quotients represented more experienced persons performing more routine tasks, or some combination of the two. The chart shows that failed tasks were less routine (more non-routine) and were assigned to less experienced persons than successful tasks.

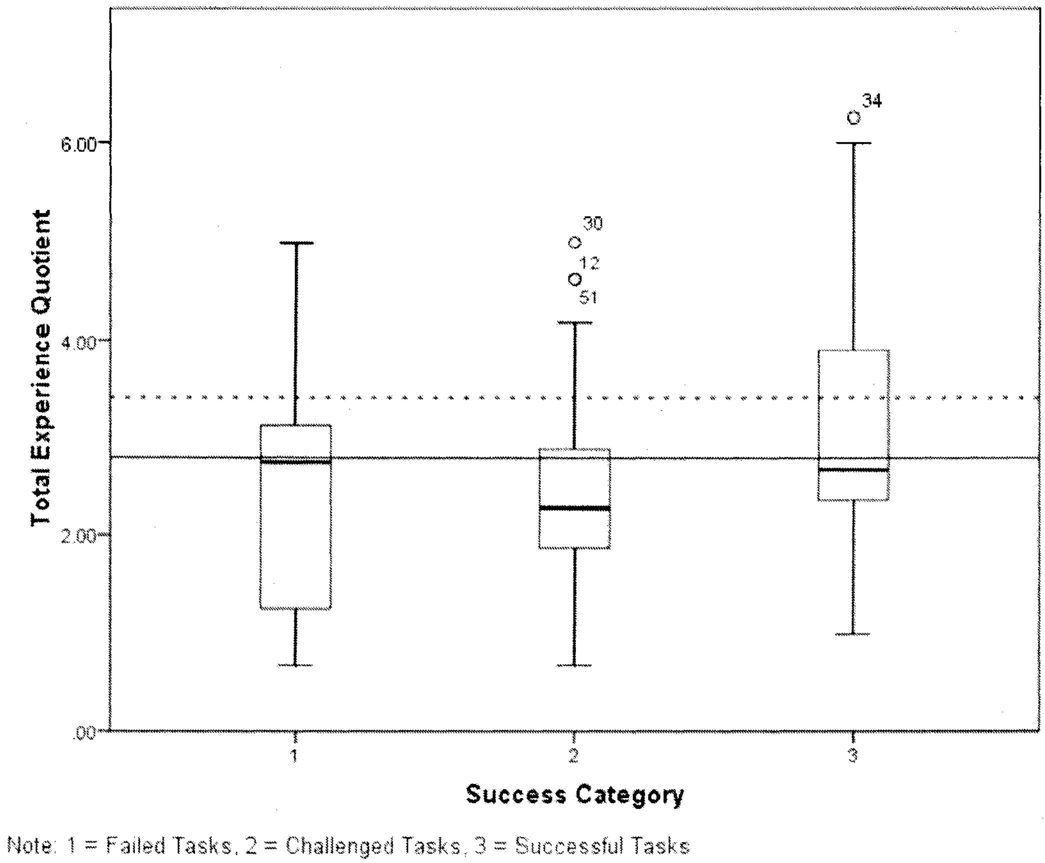

Figure 5. Boxplot of total experience quotient by success category

Tables 3 and 4 include the descriptive statistics for the various experience areas and quotients for all completed tasks, respectively. Skewness and Kurtosis values indicate that a normal distribution can be assumed for all quotient variables and for all experience areas except for the employer experience area which is just outside of the accepted -2.0 cutoff value. This variable was not shown significant in later analysis.

Table 3

Experience Area Descriptive Statistics

	N	Mean	Std. Deviation	Variance	Skewness	Kurtosis
Customer Experience	68	3.65	1.637	2.680	-.669	-1.231
Business Segment Experience	68	3.88	1.579	2.493	-.996	-.686
Employer Experience	68	4.47	1.152	1.327	-2.037	2.789
Technology Experience	68	4.06	1.444	2.086	-1.208	-.075
Team Experience	68	3.10	1.703	2.900	-.053	-1.699
Total Experience	68	19.16	5.471	29.929	-.733	-.659

Table 4

Experience Quotient Descriptive Statistics

Variable	N	Mean	Std. Deviation		Variance	Skewness	Kurtosis
Customer Experience Quotient	68	0.539	0.316	0.100	0.299	0.291	-0.595
Business Segment Experience Quotient	68	0.564	0.305	0.093	0.258	0.291	-0.458
Employer Experience Quotient	68	0.644	0.271	0.074	0.184	0.291	-0.241
Technology Experience Quotient	68	0.592	0.297	0.088	0.125	0.291	-0.666
Team Experience Quotient	68	0.456	0.305	0.093	0.624	0.291	-0.338
Total Experience Quotient	68	2.795	1.302	1.696	0.608	0.291	0.091

Table 5 includes routineness descriptive statistics by task success category. The mean routineness for all tasks was 7.63. The failed task category mean and the challenged task category mean were both larger than the overall mean indicating that these tasks were typically more non-routine. The successful task mean was lower than the overall mean and indicating that these tasks were typically more routine. The total experience quotient included in Table 6 shows that failed and challenged tasks had similar mean experience quotient values and the successful task category had a higher mean.

Table 5

Routineness Value Descriptive Statistics by Success Category

Success Category	Mean	N	Std. Deviation	Variance	Kurtosis	Skewness
Failed	8.21	14	2.119	4.489	-.194	.466
Challenged	8.19	27	2.237	5.003	-1.076	-.028
Successful	6.78	27	1.717	2.949	-.655	.126
Total	7.63	68	2.108	4.445	-.630	.277

Table 6

Total Experience Quotient Descriptive Statistics by Success Category

Success Category	Mean	N	Std. Deviation	Variance	Kurtosis	Skewness
Failed	2.546	14	1.234	1.523	-0.224	0.057
Challenged	2.534	27	1.184	1.402	-0.363	0.628
Successful	3.184	27	1.395	1.946	0.045	0.678
Total	2.795	68	1.302	1.696	0.091	0.608

ANOVA Analysis

Analysis of variance (ANOVA) was used to address research question one. ANOVA was performed on the total experience area and total experience quotient data, using task success as the grouping variable. The results are shown in Table 7. The Levene test results indicated that homogeneity of variances could not be rejected. The ANOVA results suggest that the total experience quotient which incorporates the influence of task routineness is more likely to explain a difference between failed, challenged and successful tasks than considering total experience alone. The initial $p < 0.1$ threshold for significance was relaxed to further investigate quotient relationships as they pertain to the other research questions using factor and t-test analysis. The Welch and Brown-Forsyth analysis was performed because of the difference in sample size between the failed category and the others. These analyses found similar significance values and were viewed as confirmation of the ANOVA results.

Table 7

ANOVA Results for Total Experience and Total Experience Quotient

		Sum of Squares	df	Mean Square	F	Sig.
Total Experience	Between Groups	9.922	2	4.961	.162	.851
	Within Groups	1995.299	65	30.697		
	Total	2005.221	67			
Total Experience Quotient	Between Groups	6.801	2	3.400	2.068	.135
	Within Groups	106.858	65	1.644		
	Total	113.659	67			

Factor Analysis

Factor analysis was performed using the various experience quotients as potential factor variables with the success category as the selection variable. The analysis results were used to investigate research question two. Table 8 includes the results of the factor analysis performed for the failed task category. The business segment experience quotient explains 75.6% of the variance, the customer experience quotient explains 12.7% of the variance and the technology experience quotient explains 5.9% of the variance, totally explaining 94.1% of the variance related to failed tasks. The KMO value of 0.830 and Bartlett significance statistic of 0.00 indicated that the underlying data were appropriate for factor analysis.

Table 8

Factor Analysis of the Experience Quotients for Failed Tasks

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Business Segment Experience Quotient	3.778	75.560	75.560	3.778	75.560	75.560
Customer Experience Quotient	.634	12.682	88.243			
Technology Experience Quotient	.294	5.875	94.117			
Employer Experience Quotient	.246	4.920	99.038			
Team Experience Quotient	.048	.962	100.000			

Note: Principal Component Analysis Extraction Method.

Table 9 includes the results of the factor analysis performed for the challenged task category. The team experience quotient explains 72.8% or the variance, the business segment experience quotient explains 13.4% of the variance and the technology experience quotient explains 7.9% of the variance, totally explaining 94.1% of the variance pertaining to challenged tasks. The KMO statistic of 0.784 and Bartlett test significance of 0.00 indicated that the underlying data were appropriate for factor analysis.

Table 9

Factor Analysis of the Experience Quotients for Challenged Tasks

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Team Experience Quotient	3.639	72.782	72.782	3.639	72.782	72.782
Business Segment Experience Quotient	.670	13.409	86.191			
Technology Experience Quotient	.395	7.893	94.084			
Employer Experience Quotient	.181	3.618	97.702			
Customer Experience Quotient	.115	2.298	100.000			

Note: Principal Component Analysis Extraction Method.

Table 10 includes the results of the factor analysis performed for the successful task category. The customer experience quotient explains 76.9% or the variance, the employer experience quotient explains 9.3% of the variance and the team experience quotient explains 7.3% of the variance, totally explaining 93.5% of the variance pertaining to successful tasks. The KMO statistic of 0.821 and Bartlett test significance of 0.000 indicated that the underlying data were appropriate for factor analysis.

Table 10

Factor Analysis of the Experience Quotients for Successful Tasks

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Customer Experience Quotient	3.845	76.904	76.904	3.845	76.904	76.904
Employer Experience Quotient	.465	9.295	86.199			
Team Experience Quotient	.365	7.296	93.495			
Business Segment Experience Quotient	.208	4.162	97.656			
Technology Experience Quotient	.117	2.344	100.000			

Note: Principal Component Analysis Extraction Method.

Table 11 includes a summary of the factor analysis results. The factor analysis results indicated that variance for successful tasks is primarily explained by the customer experience, employer experience and team experience quotients. Team experience was strongly related to explaining challenged task variance and business segment experience was strongly related to explaining failed task variance. Business segment experience and technology experience were factors that explained variance for both failed and challenged tasks but explained little of the variance associated with successful tasks. With respect to research question two, the results indicated that the responsible person's prior experience with the customer, the employer and the team when appropriately matched to task routineness had a strong influence on successful tasks.

Table 11

Summary of Experience Quotients Factor Analysis

	Failed Tasks	Challenged Tasks	Successful Tasks
Business Segment Experience Quotient	75.6%	13.4%	
Team Experience Quotient		72.8%	7.3%
Customer Experience Quotient	12.7%		76.9%
Employer Experience Quotient			9.3%
Tech Experience Quotient	8.6%	7.9%	
Total Variance Explained	94.1%	94.1%	93.5%

T-tests for Experience Areas and Quotients

A t-test was performed on the experience areas between failed and successful tasks to investigate research question three. The area descriptive statistics were included in Table 12 and the t-test results were included in Table 13. None of the experience areas were significant. A t-test was performed on the experience quotients comparing failed and successful tasks. A few of the quotients were significant and that the descriptive statistics and t-test analysis are presented in tables 14 and 15, respectively. All failed task quotient means were smaller than successful task quotient means indicating a generally higher level of experience and a lower level of routineness for successful tasks, or a combination of the two. The Levene statistic showed that equal variances could be assumed for all quotients to the $p < 0.1$ level. Employer experience, technology experience and total experience quotient variables showed significance to the $p < 0.10$ single tailed t-test (1/2 the shown 2-tailed Sig. value generated by SPSS). Of the three significant variables, only the employer experience quotient variable was shown significant in the previous successful task factor analysis. Total experience quotient was also significant but was not included in the factor analysis because of the linear independence requirement.

Table 12

Experience Area Descriptive Statistics for Failed and Successful Tasks

	Success Category	N	Mean	Std. Deviation
Customer Experience	Failed	14	3.79	1.762
	Successful	27	3.89	1.423
Business Segment Experience	Failed	14	3.71	1.729
	Successful	27	3.93	1.517
Employer Experience	Failed	14	4.29	1.437
	Successful	27	4.52	1.221
Technology Experience	Failed	14	3.93	1.774
	Successful	27	4.22	1.281
Team Experience	Failed	14	3.21	1.718
	Successful	27	3.07	1.662
Total Experience	Failed	14	18.93	6.427
	Successful	27	19.63	4.805

Table 13

Independent Samples t-test for Experience Areas between Failed and Successful Tasks

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Customer Experience	Equal variances assumed	2.120	.153	-.203	39	.840	-.103
	Equal variances not assumed			-.189	22.024	.852	-.103
Business Segment	Equal variances assumed	.827	.369	-.404	39	.688	-.212
Experience	Equal variances not assumed			-.387	23.576	.702	-.212
Employer Experience	Equal variances assumed	1.102	.300	-.545	39	.589	-.233
	Equal variances not assumed			-.517	22.938	.610	-.233
Technology Experience	Equal variances assumed	4.026	.052	-.609	39	.546	-.294
	Equal variances not assumed			-.549	20.237	.589	-.294
Team Experience	Equal variances assumed	.173	.680	.253	39	.801	.140
	Equal variances not assumed			.251	25.666	.804	.140
Total Experience	Equal variances assumed	2.452	.125	-.394	39	.696	-.701
	Equal variances not assumed			-.359	20.757	.723	-.701

Table 14

Experience Area Quotient Descriptive Statistics for Failed and Successful Tasks

	Success Category	N	Mean	Std. Deviation
Customer Experience Quotient	Failed	14	0.524	0.304
	Successful	27	0.637	0.328
Business Segment Experience Quotient	Failed	14	0.518	0.308
	Successful	27	0.629	0.324
Employer Experience Quotient	Failed	14	0.562	0.259
	Successful	27	0.723	0.293
Technology Experience Quotient	Failed	14	0.518	0.283
	Successful	27	0.680	0.297
Team Experience Quotient	Failed	14	0.425	0.263
	Successful	27	0.515	0.349
Total Experience Quotient	Failed	14	2.546	1.234
	Successful	27	3.184	1.395

Table 15

Independent Samples t-test for Experience Quotients between Failed and Successful Tasks

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Customer Experience Quotient	Equal variances assumed	.006	.940	-1.070	39	.291	-0.113
	Equal variances not assumed			-1.096	28.290	.282	-0.113
Business Segment Experience Quotient	Equal variances assumed	.045	.833	-1.058	39	.297	-0.111
	Equal variances not assumed			-1.076	27.657	.291	-0.111
Employer Experience Quotient	Equal variances assumed	.051	.823	-1.738	39	.090	-0.162
	Equal variances not assumed			-1.808	29.459	.081	-0.162
Technology Experience Quotient	Equal variances assumed	.012	.913	-1.690	39	.099	-0.163
	Equal variances not assumed			-1.717	27.601	.097	-0.163
Team Experience Quotient	Equal variances assumed	1.960	.169	-.848	39	.402	-0.090
	Equal variances not assumed			-.927	33.578	.360	-0.090
Total Experience Quotient	Equal variances assumed	.370	.547	-1.442	39	.157	-0.638
	Equal variances not assumed			-1.500	29.469	.144	-0.638

Summary

The responsible person's previous project experience with the customer, business segment, employer, team or technology as an independent variable did not significantly relate to whether a task was more likely to be failed, challenged or successful. When the responsible person's experience was related to the routineness of the task, as indicated by the various quotients, a significant relationship did appear. Successful tasks typically had a higher total experience quotient which may have resulted from the tasks being more routine, the person having more total experience, or a combination of both. The area experience quotients that factor analysis indicated to be significant in explaining variance within the successful task category were the customer experience quotient, employer experience quotient and the team experience quotient. Only the employer experience quotient was shown significant using a t-test between failed and successful tasks.

Chapter 5

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Increasing the likelihood of successful technology task completion will contribute to the likelihood of overall project success. Tasks have varying levels of complexity and they are performed by personnel with different levels of experience. This study determined the relationship of the experience level of technology personnel performing project tasks and the likelihood of successfully completing a task considering the influence of task routineness. Task data was collected pertaining to task characteristics, task outcomes and the responsible person's prior experience level in the five areas specified by Remenyi (1999). Task success outcome was analyzed in relation to the separate experience areas, the responsible person's total experience, and task routineness to determine how experience and routineness are related to success.

Restatement of the Problem of the Study

Effective technology usage is important to business success and projects are usually required to define, develop and implement complex modern technologies. Projects are composed of smaller tasks which are performed by persons with various experience levels. The problem of this study was to investigate the relationship between worker experience and the likelihood of successful technology task completion.

Restatement of the Purpose of the Study

The purpose of this study was to provide information technology project managers with a model useful for improving the match between project personnel and project tasks. This study focused on the impact of worker experience in determining the likelihood of task success. The results of the study have implications for industry in that both worker experience and task routineness could become key future resource allocation decision factors for project managers. In pursuit of this goal, three research questions were examined.

1. What is the relationship of the successful completion of IT project tasks, a task's routineness, and the total experience level of the person assigned to complete the task?
2. What is the relationship of the successful completion of IT project tasks, a task's routineness, and any of the five Remenyi (1999) designated experience areas of the person assigned to complete the task?
3. What is the relationship of the successful completion of IT project tasks, a task's routineness, and the level of assigned person's experience within each of the five experience areas?

In addition to the research questions, several expectations were presented. They were that:

1. Less successful tasks will have a higher likelihood of being performed by a less experienced person independent of routineness.
2. Non-technical experience areas will show a higher level of relationship to success than the technical areas.
3. Routine tasks will have a higher likelihood of success independent of the experience level.
4. Non-routine tasks will have a higher likelihood of success if performed by a more experienced person.
5. It is expected that experience areas with a relationship to task success will also have a relationship to the level of experience within that specific area.

The remainder of this chapter includes a discussion of the results, conclusions drawn from the results, and recommendations for future research.

Discussion

Research question one was analyzed using analysis of variance (ANOVA) on both the total experience variable and the total experience quotient using task success as the separation factor. It was shown that total experience by itself did not significantly impact task success but that total experience when compared to task routineness in the form of the total experience quotient was significant. The lack of significance found between the task success category and total experience did not support expectation one. Support for the quotient indicated that task complexity should be considered when assigning tasks to personnel. Project managers should find task success improvements and increased overall efficiencies by assigning more routine tasks to less experienced workers and more complex tasks to more experienced workers.

Factor analysis was used to analyze the significance of the various experience areas on task success to address research question two. Again the findings were that the experience area by itself was not significant and that several of the experience quotients were significant. In particular, experience with the customer, the employer and the team were found to significantly relate to task success supporting the comment by Reich (2007) that institutional and cultural knowledge were important. These findings supported expectation two and indicated that non-technical experience should be an important consideration when assigning tasks. A possible rationale for this finding is that the more familiar the responsible person is with the customer's unique characteristics, the employer constraints and methodology, and the team capabilities, the more able that person is to adapt to unexpected events and achieve success. These findings supported the remarks by Boehm (1991), Pinkerton (2003) and others cited in chapter two related to the importance of personnel in determining project outcome. The proposal, requirements definition and deployment stages of a project often involve much customer and employer interaction. Project managers should find improved success by assigning personnel who are more experienced with both the customer and employer to complex tasks in these phases.

It was shown in Figure 4 that successful tasks were generally more routine than failed tasks which supported expectation three. The lower reported routineness level associated with successful tasks could be the result of the survey respondent perceiving successful tasks as being more routine and failed tasks as being more complex, or non-routine. It could also be the result of the respondent perceiving the task as more routine in relationship to the more experienced person who was generally assigned to the successful tasks. ANOVA analysis performed on routineness variable data using the success category as the separation criteria indicated that there was a significant difference between failed, challenged and successful task groups with $p = 0.023$ and successful tasks generally reported as more routine. The percentage success level reported in this study was higher than those reported by The Standish Group (2004) and the overall level of responsible worker was also high, lending support to the positive relationship between experience and success.

The scatterplot shown in Figure 6 displays the way in which tasks were classified by success category relating only to task routineness and total experience. This chart will be used to discuss expectation number four. The more non-routine tasks assigned to lower experience personnel are in the upper left quadrant and included mostly challenged and failed tasks supporting the data plotted in Figure 5. The more non-routine tasks assigned to more experience personnel are plotted in the upper right quadrant which included a mix of failed, challenged and successful. The more routine tasks that were assigned to more experienced personnel were mostly successful as plotted in the lower right quadrant again supporting the data plotted in Figure 5. Few routine tasks were assigned to personnel with less experience, the lower left quadrant, and included no failed tasks. These results supported the premise that routine tasks assigned to experienced personnel were more likely to be successful and non-routine tasks assigned to less experience personnel were less likely to be successful, but did not support the expectation that non-routine tasks assigned to experienced personnel were more likely to be successful. This result may be due to the intrinsic uncertainty associated with a non-routine task which makes them more difficult to complete successfully, even for experienced personnel as noted by Belev (1990). The large number of tasks in the upper left and lower right quadrants indicated that a routineness-to-experience match was not generally considered when assigning tasks.

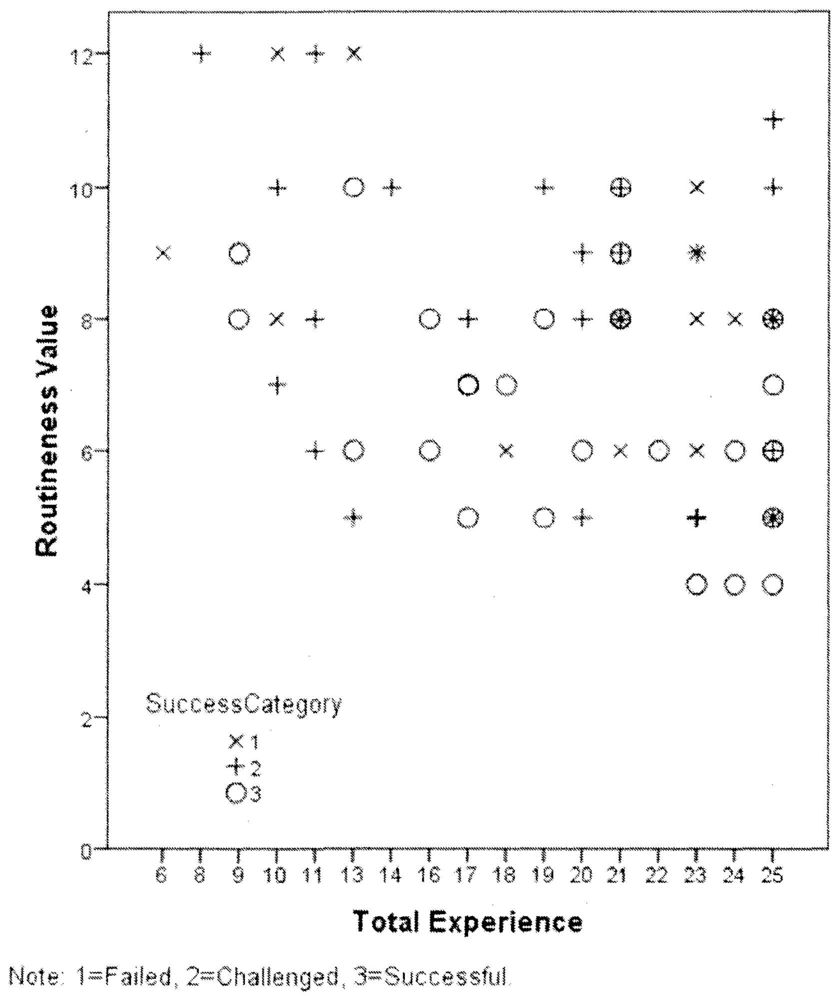

Figure 6: Scatterplot of total experience to routineness by success category

Support was not found for expectation five using t-test analysis for any of the experience areas and was found for only the employer experience quotient variable of the group found significant in the factor analysis. The employer experience area mean for successful tasks was a larger number than for the failed task suggesting that experience is positively related to success, which provided tepid support for expectation five with respect to this one experience area. The general lack of support for expectation five may have resulted from a lack of consideration for routineness when assigning tasks, as shown in Figure 6.

Conclusions

Technology projects are complex in nature and completed by groups of responsible persons with various experience levels. Successfully completing the individual tasks associated with a project increases the likelihood of overall project success, and those tasks will have various routineness levels. This study showed that matching task routineness to the experience level of the responsible person was not generally performed. It also found that routine tasks performed by experienced persons were more likely to be successfully accomplished. Prior project experience with the customer, the employer and the team were also found to contribute to task success.

Recommendations for Future Research

This study found that managers should benefit from considering routineness when assigning tasks to technology project personnel of varying experience levels. An area of further research could investigate a method for determining task routineness that does not rely on respondent perception or memory. One approach would be to define key project tasks and then assess them for routineness using a Delphi approach. Another area for research could involve collecting task data contemporaneously with the projects. Project managers could assess project personnel experience levels within each of the five areas before the start of the project, assess the routineness of their assigned tasks and then collect data related to the successful completion of the tasks. A statistical analysis similar to that performed in this study would then be performed and the results compared. This study found that prior experience with the customer, the employer and the team were significant to success. Research into the relationship of the various experience categories as they pertain to the different project phases would be interesting. It is possible that customer, industry and employer experience may be shown more significant during the proposal and requirements definition phases, and that the team and technology experience would be more significant during the development and quality testing phases. Showing a relationship between experience, routineness and project phase would provide project managers with another useful tool for allocating personnel resources. The role of mentoring or other communication tools as a process for passing experience from one team person to another could also be investigated.

Summary

The findings of this study supported the idea that worker technical experience alone was not a sufficient consideration in determining whether a technology task will be successfully completed. Experience matched to the routineness of the task did show a significant relationship to success that project managers can use when assigning personnel to tasks. In particular, the finding that experience with the customer, the employer and the team played a significant role with successful tasks indicated that these skills should be considered important when matching personnel to tasks. The finding that routine tasks were often assigned to experienced persons which resulted in a higher likelihood of successful task completion indicated that personnel were assigned tasks such that they were overmatched to routineness. The converse findings that non-routine tasks assigned to less experienced persons generally fell into the challenged or failed category indicated that assigned personnel are often under matched experientially to the demands of a non-routine task. Project managers who assign project tasks by matching responsible worker experience and task routineness should receive the double benefit of increased task success and more efficient allocation of resource personnel.

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APPENDIX

Technology Task Survey

Welcome

The following survey will ask for information pertaining to already completed technology project tasks. It should take no more than 15 minutes to provide the requested information.

IMPORTANT: You will only be allowed access to the survey one time. Please finish the entire survey once you click the "Agree" button and start the survey.

* No e-mail or other private information is collected but anonymity is not guaranteed when using the Internet.
* The results and accompanying data may be published in a doctoral dissertation and/or journal article.
* Survey results will be provided to you upon request by clicking the link included in the email solicitation letter.
* Your research summary request is not correlated with your survey answers.
* No compensation is provided for completing the survey.
* Risk to you are considered minimal because no identifying information is collected that relates your responses to your identity.
* If at any time you wish to exit the survey without saving your responses, simply click the "Cancel Survey & Exit" button. Your responses will not be saved.
* Please answer all questions to the best of your knowledge.

If you have questions, concerns or comments about this study, the informed consent process or your rights as a research participant, you may contact Ed Paulson at 630-960-3299 or by electronic mail at author@edpaulson.com. You may also contact the faculty adviser of this project, Dr. David Beach of Indiana State University, College of Technology at (812) 237-3400 or by electronic mail at dbeach@indstate.edu.

By clicking the "Agree" button you are acknowledging the survey risks, risks to confidentiality, and giving your informed consent to participate in this study. If you do not agree, please click "Exit and Do Not Save Data" to exit this survey and save no information.

Thank you for your participation with this important project.

Sincerely,
Ed Paulson
Doctoral Candidate
Indiana State University

Respondent Information

Please provide some general information about yourself.

1. How many years have you worked in an information, communication or telecommunication technology field?

Less than 1 year	1 to 3 years	4 or more years
O	O	O

2. How many projects have you worked on as a team member or manager?

None	1 to 3	4 or more
O	O	O

Task Characteristics

Please provide, to the best of your knowledge, the following information related to a project task.

To be an acceptable task:

* It must have been part of an information technology, data communication or a telecommunication technology project that was completed in the past 6 months.
* It must have been primarily assigned to a specific responsible person and have a deliverable such as a report, design, upgrade, implementation or overall team result,
* It must be one for which you have detailed knowledge about the prior experience of the person primarily responsible for completing the task.
* It may be a successfully completed task, one that had challenges or one that you consider a failure.

3. Describe the task and its deliverable. (text field)

4. Select the project phase within which this task occurred. (Select one.)

Requirements Definition	O
Proposal	O
Design and Development	O
Quality Testing	O
Deployment	O
Maintenance	O
Other	O

5. How many unexpected problems occurred when completing this task?

None	A few	Many
O	O	O

6. To what extent were established procedures and practices used to complete this task?

To a small extent	To an average extent	To a great extent
O	O	O

7. To what extent was an understandable sequence of steps followed to complete this task?

To a small extent	To an average extent	To a great extent
O	O	O

8. To what extent was there a clearly known way to complete this task?

To a small extent	To an average extent	To a great extent
O	O	O

9. To what extent was this task difficult to successfully complete?

To a small extent	To an average extent	To a great extent
O	O	O

Task Outcome

Please provide, to the best of your knowledge, specific task outcome information.

10. Was this task deliverable completed?

Yes	No
O	O

11. Was this task deliverable implemented?

Yes	No
O	O

12. With respect to timeframe, how was the task completed compared to initial expectations?

Much sooner than expected	About as expected	Much longer than expected
O	O	O

13. With respect to functionality, how was the task completed compared to initial expectations?

Much less functionality than expected	About as expected	Much more functionality than expected
O	O	O

14. With respect to budget, how was the task completed compared to initial expectations?

Much less expensive than expected	About as expected	Much more expensive than expected
O	O	O

15. To what extent was the task successfully completed?

To a small extent	To an average extent	To a great extent
O	O	O

Responsible Person Experience

Please provide information about the primary person responsible for completing this task. Answer all questions to the best of your knowledge.

The RESPONSIBLE PERSON is the person most responsible for either managing or completing this particular task. All questions refer to the same resource person.

CUSTOMER refers to the person or organization that was intended to use the deliverable of this task.

BUSINESS SEGMENT refers to the customer's general industry such as manufacturing, professional services, etc.

The EMPLOYER is the organization to which the responsible person reported either directly or indirectly.

DOMINANT TECHNOLOGY refers to the technology that was most critical to successfully completing this task.

PROJECT PERSONNEL are those persons who impact the success or failure of the project.

16. How many prior projects had the responsible person participated with for this particular CUSTOMER?

0	1	2	3	4 or more
O	O	O	O	O

17. How many prior projects had the responsible person participated with for this particular customer's BUSINESS SEGMENT?

0	1	2	3	4 or more
O	O	O	O	O

18. How many prior projects had the responsible person participated with working for this particular EMPLOYER?

0	1	2	3	4 or more
O	O	O	O	O

19. How many prior projects had the responsible person participated with using this task's dominant TECHNOLOGY?

0	1	2	3	4 or more
O	O	O	O	O

20. How many prior projects had the responsible person participated with as a team member with this PROJECT'S PERSONNEL?

0	1	2	3	4 or more
O	O	O	O.	O

21. To what extent are you familiar with the responsible person's prior experience?

To a small extent	To an average extent	To a great extent
O	O	O

22. Please enter any additional information you feel is applicable to the task, project or worker for which you provided data. DO NOT ENTER ANY PERSONAL DATA HERE. (Optional.)

Thank you for completing our survey. To receive an Executive Summary of the study findings click the URL link included in the survey invitation email and complete the form. Your request for the summary will not be correlated to your survey question responses in any way. The summary findings are expected available in the fall of 2008. Please forward the solicitation email to as many colleagues as possible. The study results become more reliable with more participants.
Thank you, Ed Paulson