Project Management Certification and Experience: The Impact on the Triple Constraint

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***Abstract*—Successful project management is primarily measured by the project manager's ability to meet the classic triple constraint. What impact does certification and experience have on meeting project scope, time, and cost goals? This research study examines these factors by eliciting data from practicing project managers, with and without certification, and with various years of experience.**

***Index Terms*—Project management, triple constraint, information technology, core competencies, certification, experience, knowledge-based, competency-based, commercial training**

I. INTRODUCTION

Managing information technology (IT) projects is oftentimes a daunting and difficult process, which seems to be the norm not the exception for the profession. This is evident by the fact that the vast majority of IT projects experience failures [13],[14],[12]. The types of failures reported range from project cancelations to the more common type of classic triple constraint problems, namely exceeded cost budgets, changed scope or requirements, and slipped delivery schedules [35],[20],[1]. Studies over a 15 year period report that failed projects, in terms of failure to meet the triple constraint, range from 68% to 84% [4],[16],[38],[39]. The published literature describes that the primary reasons for these failures are due to various inadequacies in the project management process as they relate to project scope, time, and cost management activities [27],[8]. Therefore, it stands to reason that to correct and/or improve the process we need a thorough understanding of what skill sets are required by IT project managers and how these professionals acquire, maintain, and improve these skills.

Various types of higher education institution and corporate training programs exist to educate and provide the skills needed by current and future IT project managers. In addition, project management governing bodies provide certifications to professional IT project managers indicating that their members are indeed qualified and possess the necessary skill sets to be effective. The skills possessed by IT project managers in an organization reflect the degree to which an organization can transform its IT investment into competitive advantage and new strategic opportunities [25]. Considering the global environment in which businesses compete, professional certification helps to provide project managers with a common baseline of skills [2].

What impacts does project management certification programs and experience have on project managers' abilities to successfully complete projects in terms of meeting the traditional triple constraint? To help answer this question and provide a better understanding of the issues at hand, the researchers performed a literature review and also collected data from project managers in the IT profession. Initial indications are that certification by itself does not improve a project manager's effectiveness. In addition, years of experience by itself also does not improve a project manager's effectiveness.

II. IT PROJECT MANAGEMENT PROFESSION

In contrast to many other professions; such as medicine, law, engineering, and accounting, research indicates that many IT project manager professionals are employed in that capacity, but lack formal academic project manager training [40]. He goes on to argue that this would not be tolerated in the aforementioned professions, but has been accepted in IT circles. The authors' personal experiences are that frequently employees take on the role of IT project managers simply

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because they are already employed within the organization and possess the domain knowledge that top managers believe is necessary to get the job done. Given the aforementioned overall dismal rate of successful projects, the job is not getting done well. Many top executives believe that it is easier to teach IT professionals the skills needed to be effective project managers than it is to teach existing project managers IT skills.

Perhaps the crux of many problems reported within the project management profession is due to lack of standardization involving the education and training required to work in the capacity as a project manager. The consensus from the literature indicates that there is a large gap in how project managers are trained academically and the core competencies required to be an effective professional project manager in the IT field. To improve the profession, it is necessary to narrow or close the gap as much as possible. Many academic undergraduate curricular offers a course in project management but not a specialized curriculum track [5]. "Reference [34]" concludes that most institutions lack a comprehensive project management curriculum. Academics argue that to improve the project management profession, it should be based on a theoretical basis, which represent a knowledge-based approach [40],[42]. This implies that a more comprehensive approach to project management involving more than a single course should be established. In contrast, working professionals seem to value more of a competency-based approach through actual practice and experiences in the field. The authors contend the approach taken should not be mutually exclusive, but instead should embrace both knowledge-based and competency-based approaches. Such a methodology represents both the academic and professional qualifications viewpoints and should be the best option to improve the project management profession. This type of an approach should help professionals obtain and maintain a significant level of theoretical knowledge as well as practical hands-on expertise [2]. Therefore, it is critical at the academic level to develop courses partnered with industry [11],[19]. Such a coupling should help to ensure that industry expectations are met thereby reducing the school-to-work gap. "Reference [28]" refers to this as the IT-User gap and points out that academic curricular and business practices are often disconnected and do not provide students with the necessary skill set to satisfy industry needs and expectations.

If a standardized comprehensive project management program can be established then the project management professional should be able to acquire the necessary core competencies required in the IT project management field. Such an approach represents a similar approach taken by the previously aforementioned professions. Consequently, the IT project management field should be more universally recognized and accepted as a profession. However, keep in mind that ultimately the goal is to improve the rate of successful IT projects and standardized training should be recognized as a step towards that direction.

III. IT Project Management Core Competencies

A standardized IT project management program would provide consistency in regards to material to be mastered. Therefore, the various project management communities need to converge to mutual consensus and agree to the actual core competencies required by IT project managers. "Reference [43]" provides extensive research based on four different project management governing bodies, namely The Project Management Institute (PMI), The International Project Management Association (IPMA), The Australian Institute for Project Management (AIPM), and The Engineering Advancement Association (ENAA). To summarize their findings, they identified that the core competencies needed by IT project managers should be built around the three dimensions of knowledge, personality, and experience through measured performance.

The knowledge competency dimension encompasses three categories:

- general management skills
- familiarity of tools and techniques to identify and track project scope, cost, and time constraints
- domain knowledge

General management skills such as concepts in leadership, team building, and communication are part of courses offered by business schools. Leadership and communication should not be underestimated and there is a plethora of literature discussing leadership style and project success. "Reference [42]" investigated the effects of leadership style as a factor in project success and identified the following four critical factors that involve the project manager's ability to:

- link a project to corporate business strategy
- align major stakeholders on key issues
- simplify project controls and metrics
- ensure effective communication

A brief review of several business schools indicates that general management skills are heavily addressed in the curricular, but the other two categories, personality and experience, are lightly addressed, if at all, as part of a project management course.

The dimension, personality, involves the social traits that makeup the project manager's attitude and disposition as it relates to managing projects. Some argue that the ability to work with and manage people is the most important dimension [43]. There is a growing body of literature coupling leadership ability with problem solving skills, and customer relations management and suggests that these are key influencing factors that help determine project success [15],[21]. Other researchers argue that personality attributes and leadership skills can be used as predictors to measure the likelihood of success for an IT project, however there is still lack of well-established studies that links project managers' personality to project success [44]. "Reference [44]" concludes that IT project managers

should be well versed in the traditional project management knowledge areas and must also understand socio-psychological aspects, which could affect project management endeavors. Personality attributes do appear to be an important factor for project management, but it does not unilaterally increase project success rates [25]. "Reference [46]" suggests that the profession needs to re-think project management and investigate and incorporate into training and certification programs these aforementioned social traits and cultural aspects that affect project management.

The experience dimension involves the time working as a project manager, project size and complexity, and references from prior projects. "Reference [43]" argue that time spent as a project manager does not always provide a good competency rating. Therefore other factors must be considered when measuring the experience dimension.

Based on the literature, experts agree that the traditional methodological approach to project management, which encompasses various knowledge areas, outlined by project management governing body institutions, are a necessary skill-set to possess and should be coupled with both cultural elements and socio-psychological aspects of project management to improve business performance. "Reference [15]" argues that the traditional project management methodology is not obsolete but is absolutely necessary as a foundation framework. Expanding the existing proven methodology to encompass more socio-psychological and cultural aspects of project management should help to enhance project managers' skill sets, which in turn should help to improve project success rates. However, the majority of the literature stills values the traditional triple constraint approach to the actual measure of project success.

IV. Comercial IT Project Management Certification Training

Industry-based project management training programs are designed to instruct in the core competencies required by project managers. Another goal of these training programs is to prepare students to pass an examination offered by a project management governing body. Upon successful completion of the examination, a student earns a certificate in project management. There are many organizations that provide IT project management training. To help identify the training preferred, 43 professionally employed certified project managers were asked the following question eliciting types of certifications possessed.

Type of Certification

Question 3: What certification(s) in project management do you currently have? Check all that apply.

- o CAPM
- o PMP from PMI
- o MPM
- o CPM
- o Other (please specify)

Of the 43 asked, 33 answered this question and the results are listed in table 1. The results clearly indicate that Project Management Professional (PMP®) certification offered by the PMI is the most widely sought after project management credential. Of the 33 respondents, 26 possessed the PMP® certificate, which represents 79% of the sample, and the remainder of this section will be based on the PMP® certificate training programs.

TABLE 1.
TYPES OF CERTIFICATIONS OBTAINED

Certification Type	Number
CAPM	0
PMP®	26 1 also had CSM,CSP 1 also had Certified SCRUM Master 1 also had 6 Sigma
MPM	0
CPM	0
Prince 2	5
Master's Certificate in PM	1
Certified SCRUM Master	1

The PMP® certification is globally recognized and represents that the certificate holder can effectively lead teams and deliver projects that meet scope, time, cost goals as well as other project management core competencies. The PMP® credential is the most widely recognized project management certification and one of the post popular [37],[9],[41]. The requirements to take the exam in order to obtain the certificate include at least 3 years of experience employed as a project manager, at least 4,500 hours of leading / directing projects, and at least 35 hours of project management education [33].

The requirements help to insure that candidates meet education, experience, and professional conduct requirements. Once earned, a PMP® certificate holder has the necessary background to manage projects for the entire life cycle of the project following guidelines outlined in the Project Management Book of Knowledge (PMBOK). However, obtaining the certificate is only half the story. To maintain a PMP® certification, holders must earn professional development units (PDUs) during three-year recertification cycles. PDUs are earned through a variety of ways, but it suffices to say that a PMP® certificate holder must be actively involved in the study, authoring, teaching, and practice of project management in order to maintain the credential. These regulations help to ensure that project managers that have earned and maintained PMP® certification stay current with the state-of-the-art project management practices and techniques.

Certification by itself does not qualify a candidate as a project manager. However, it can be used to demonstrate commitment to the profession and evidence of a certain level of knowledge [10],[43]. A certificate is a good indicator of a person's knowledge but is never a guarantee for the quality. The process of PMP® certification helps the professional establish proficiency

and knowledge of the necessary project management skills and techniques and is knowledge-based. The competency aspect associated with the certificate is indirectly incorporated in the process due to a minimum three years of actual and verifiable project management experience required prior to taking the exam and obtaining the credential. Therefore a PMP® certificate holder does possess two of the three core competencies needed by IT project managers, namely the dimensions of knowledge and experience. The personality dimension lies outside the scope of this research endeavor.

V. Project Management Triple Constraint

The three primary project management activities involve project scope, time, and cost management activities, which is referred to as the triple constraint. Of these three components, project scope is arguably the quintessential component and oftentimes drives whether time and cost goals are met [10]. Comprehensive project scope analysis allows projects to be decomposed into smaller more manageable pieces, which in turn can be further analyzed in terms of budget costs and time frames needed to realize the development process. Much of the research literature and current consensus among business professionals indicates that project scope cannot be identified clearly at the initial stage of development of most IT projects [35]. This is primarily due to developers having limited knowledge of the business domain [47]. Other researchers' indicate it is due to clients' inability to properly describe desired functionality [3],[20]. This is further justification as to the importance of certification, namely to better empower the project manager with tools to properly elicit business requirements at the project onset. One of the training techniques encompassing certification programs is to teach project managers how to divide the project into manageable components. Each component is a project deliverable and the aggregate comprises the entire project. To help guide the management process during the implementation of the components, one of the tools used is the Work Breakdown Structure (WBS). Prior to implementation, project managers generally create the WBS by decomposing the components into smaller atomic units. The WBS depicts the project as a collection of task-oriented activities showing the hierarchy or level of tasks. The lowest or atomic level of the WBS is a task referred to as a work package. A work package is assigned one owner and a time frame or duration to its completion. In this way, it is possible to accurately, easily, and effectively calculate the time needed to complete a project by summing up the time required to complete all work packages. Similarly, total project cost is also calculated in this way using the pay rate assigned to the owner of a work package. The authors contend that effective project scope management and the creation of a project WBS is essential to be able to accurately calculate project delivery time and cost. The WBS is a foundation document and provides the basis for planning and managing project schedules, costs, resources, and changes [35],[18]. In addition, project management tools such as Microsoft Project allow the user to easily perform critical path analysis and earned value management on a project provided it is decomposed into the WBS form [26]. These tools can be used to help generate snapshots of the project, in terms of completion, to monitor progress.

Project time management involves delivering projects on time and is also one of the biggest challenges to project managers. In a study, approximately 50% of all IT projects exceeded their original delivery date by 82% [38]. This is a recurring theme with IT projects and the root cause is due to project requirements poorly or incorrectly prepared [45],[20]. In essence, project scope was not fully known, understood, or documented prior to project execution. During project implementation changes to project scope make it very difficult to accurately meet the original baseline end target date, consequently the project delivery end date is not met, i.e. it is difficult to hit a moving target. Modeling and simulation software help to improve project scheduling but only if scope is clearly defined [32]. Therefore, a strong relationship exists between project scope management and project time management. Scope and time management are consequentially tightly coupled.

The Project Management Institute Book of Knowledge 4th edition (PMBOK) defines six main processes within project time management: activity definition, sequencing activities, estimating activity resources, estimating activity durations, schedule development, and schedule control. Provided the WBS is properly created, activity scheduling and estimating can be easily realized. The WBS improves basic understanding of the entire project, which leads to improved prediction of effort needed to realize IT projects [31]. In addition, if project management tools such as Microsoft Project are used, sequencing can also be easily realized. Microsoft Project provides a means to develop network diagrams, Gantt charts, and critical path analysis, which help project managers develop and control project schedules. By itself, project management software is not the answer to solve or prevent failed projects. It is essential to train project managers to properly use project management software [23]. "Reference [23]" describes that successful project managers requires the understanding of the relationships between project management software and the underlying theoretical concepts of project management. Therefore, a healthy blend of theory and software tool usage seems to improve successful project outcomes [35].

Project cost management includes all the processes required to complete a project within an approved budget. Project cost overruns have been reported as high as 56% [38]. Many IT professionals believe that cost estimates for IT projects are based on unclear project requirements; consequently there will be cost overruns [29]. As with project time management, a strong relationship exists between project scope management and project cost management. The ability to estimate costs involves allocating cost estimates to individual work packages or scope elements. Each work package is depicted in the

WBS with an associated cost and the aggregate comprises the total cost. The WBS can be utilized as a common language to link project scope management and project cost management processes [6]. The better and more accurate WBS leads to better and more accurate cost estimates, which ultimately comprises the project budget. In addition to depicting work packages on the WBS, it is possible to also depict other costs to more easily track total project costs [36]. For example, training and equipment expenditures associated with the project can also be added to the WBS so that all project costs can be self-contained.

Traditional project cost estimation involves algorithmic models utilizing statistical equations based on cost drivers [7]. In addition, regression analysis and estimation by analogy are also used to predict project costs [30]. However, these aforementioned techniques have not been very successful at project cost estimation. The literature indicates that techniques, which tightly couple cost estimation to project scope management and project time management, are gaining more widespread acceptance. Newer methods, such as Earned Value Management (EVM) are project performance measurement techniques that integrate scope, time, and cost data that rely heavily on a project's WBS [26]. Spreadsheets help project managers develop, track, and control cost estimates, however more companies are using EVM to help control costs [17]. EVM has been integrated into project management software and has been shown to be very helpful during the project cost management processes [35]. Companies that utilize project management software receive a 6.5% return on investment (ROI) within the first year alone [24]. Therefore, it is advantageous to use project management software and the tools provided within the software help control project scope, time, and cost.

VI. Research Methodology

It has been well documented that many IT project failures are due to various inadequacies in the project management process. As mentioned earlier, knowledge is an important dimension in core IT competency for project managers. Certification programs help to establish proficiency and knowledge of the necessary project management skills and techniques. One way to help ascertain the effects of certification on the project management process is to compare the percentage of successful and unsuccessful projects of actual working project managers with and without certification. Therefore, we have the following research hypotheses:

H1: Certified project managers perform project scope management better than uncertified project managers.

H2: Certified project managers perform project time management better than uncertified project managers.

H3: Certified project managers perform project cost management better than uncertified project managers.

In addition, experience is an important dimension in core IT competency for project managers. In order to determine the effects of a manager's level of project management experience on the success of a project, the following research hypotheses will be tested:

H4: Certified project managers with a given level of experience perform project scope management better than uncertified project managers with the same level of experience.

H5: Certified project managers with a given level of experience perform project time management better than uncertified project managers with the same level of experience.

H6: Certified project managers with a given level of experience perform project cost management better than uncertified project managers with the same level of experience.

The researchers collected data from project managers in the IT profession. Study participants completed an online survey, using Survey Monkey, and the results are discussed in the next section. In an effort to acquire the largest sample size possible, the survey subjects were elicited from the following diverse sources:

- Corporations partnered with the college's internship program
- Project managers actively involved sharing knowledge using an online discussion board, http://www.projectmanagementdiscussion.com
- Online community for IT project managers using an online discussion board, http://www.gantthead.com
- Survey participation request contained in a newsletter distributed by Cornelius Fichtner, PMP®, host of The Project Management Podcast™
- Survey participation request contained in an e-mail request by Josh Nankivel, PMP®, and author of http://pmstudent.com

Using these five sources, data were collected from June 1, 2011 until August 31, 2011. Although the researchers found this to be a very effective method of data collection, it is arguably a limitation of the study due to participants being self-selected.

The survey (Appendix A) was structured with branching capabilities, which allows data to be more easily collected from two different groups. Group 1 consists of subjects working as IT project managers without certification. Group 2 consists of subjects working as IT project managers with certification. Both groups answered the first three questions before the survey branch was encountered. The first question verified that the survey subject works in the capacity as a project manager, if not then the survey exits. In addition, Question 1 also recorded the length of time working as a project manager. Therefore, in addition to being able to create 2 different groups, namely uncertified and certified, it is also possible to categorize the sample based on length of time working as a project manager. The second question asks the survey subject to rate the importance of project management certification from their perspective.

Question 3 determined if the survey subject possessed a recognized certification in project management. If the response to Question 3 was no, then Questions 4 through 7 were asked and the answers from this group are based on project managers without certification. If the response to Question 3 was yes, then questions 8 through 15 were asked and the answers from this group are based on project managers with certification. Questions 4, 5, 6, and 7, asked and answered by Group 1, are identical to questions 12, 13, 14, and 15, asked and answered by Group 2. These questions involved project scope, time, and cost management as well as outsourcing topics. Therefore, both groups answered the same 7 identical questions. The project managers with certification answered 4 additional questions to elicit additional information, namely Questions 8, 9, 10, 11. Questions 8 and 9 were designed to ascertain the certification possessed by the survey subjects of Group 2. The responses to questions 2, 10 and 11 will not be discussed in this paper, instead will be used for future research.

VII. Findings, Results, And Analysis

Data were collected from 93 project managers in the IT profession, whereby 78 completed the survey fully and 87 answered most questions. Only 6 surveys where discarded due to those subjects not actually working in the capacity as a project manager. The results of the surveys are discussed in this section and divided into the following sub-sections:

- Project Management Experience
- Certification and Project Scope Management
- Certification and Project Time Management
- Certification and Project Cost Management
- Experience and Project Scope Management
- Experience and Project Time Management
- Experience and Project Cost Management

A. Project Management Experience

Question 1: How many years have you been employed as a project manager?

A Chi-Square test was used to determine if there was a significant difference between the distributions of uncertified and certified project managers with respect to years of experience. The sample consisted of 43 certified and 44 uncertified project managers. The frequency and (relative frequency) distribution of their responses are noted in Table 2.

Table 2.
Project Management Experience Rates for Uncertified versus Certified in Years

	Uncertified	Certified
Within the year	3 (7%)	3 (7%)
1 to 3 years	7 (16%)	9 (21%)
4 to 6 years	10 (23%)	6 (14%)
7 to 9 years	5 (11%)	6 (14%)
>10 years	19 (43%)	19 (44%)
Average Experience	7.58	7.59

The answer to this question is important since differences in years of experience between the two groups could impact the testing results of Research Hypotheses 1, 2, and 3, namely do certified project managers perform project scope, time, and cost management better than uncertified project managers, respectively. Table 2 shows that the mean years of experience of both uncertified and certified managers in our study are nearly identical, approximately 7.6 years. The Chi-square test also indicates there is not a significant difference between the distributions of the two groups (Chi-square value = 3.28, p-value = .5125). Since participants from uncertified and certified managers in our study are very similar with respect to years of experience, our analysis of Research Hypotheses 1, 2, and 3 focused on differences in success between uncertified and certified managers with respect to managing the triple constraint (a project's scope, time and cost) using independent samples means t-tests. The next three sections consider the effect the certification factor has on project management success rates.

B. Certification and Project Scope Management

Questions 4, 12: What percentage of your projects exceeded original project scope?

A two independent samples means t-test was used to determine if certified project managers are better in managing project scope than uncertified project managers. The sample consisted of 40 certified and 38 uncertified project managers. The frequency and (relative frequency) distribution of their responses are noted in Table 3. The average success rate for managing a project's scope for uncertified and certified groups is 20.79% and 26.07%, respectively.

Table 3.
Project Management "Scope" Success Rates Uncertified versus Certified

	Uncertified	Certified
< 5%	9 (24%)	9 (23%)
5% to 10%	9 (24%)	10 (25%)
11% to 30%	10 (25%)	9 (23%)
31% to 50%	6 (16%)	4 (9%)
51% to 70%	3 (8%)	4 (9%)
71% to 90%	1 (3%)	1 (3%)
> 95%	0	3 (8%)
Average Success Rate	20.79%	26.07%

Results of the two independent samples means t-test indicate there is no evidence (t-value = -.95, p-value = .8277) that certified managers are better at managing project scope than uncertified project managers. The negative difference (-.95) indicates that uncertified project managers are better, on average, in managing projects in terms of scope than certified project managers; however this difference is not statistically significant. Therefore, the data does not support Research Hypothesis 1: Certified project managers perform project scope management better than uncertified project managers.

C. Certification and Project Time Management

Questions 5, 13: What percentage of your projects exceeded original project delivery date?

A two independent samples means t-test was used to determine if certified project managers are better in managing project delivery date than uncertified project managers. The sample consisted of 40 certified and 38 uncertified project managers. The frequency and (relative frequency) distribution of their responses are noted in Table 4. The average success rate for managing a project's time for uncertified and certified groups is 23.22% and 24.57%, respectively.

TABLE 4.
PROJECT MANAGEMENT "TIME" SUCCESS RATES
UNCERTIFIED VERSUS CERTIFIED

	Uncertified	Certified
< 5%	10 (26%)	9 (23%)
5% to 10%	9 (24%)	8 (20%)
11% to 30%	9 (24%)	9 (23%)
31% to 50%	4 (10%)	9 (23%)
51% to 70%	3 (8%)	2 (4%)
71% to 90%	1 (3%)	3 (7%)
> 95%	2 (5%)	0
Average Success Rate	23.22%	24.57%

Results of the two independent samples means t-test suggest there is not a significant difference between the two groups (t-value = -.24, p-value = .5942). A p-value of .5942 does not provide evidence that certified project managers are better at managing a project's delivery date than uncertified project managers. Therefore, the data does not support Research Hypothesis 2: Certified project managers perform project time management better than uncertified project managers.

D. Certification and Project Cost Management

Questions 6, 14: What percentage of your projects exceeded original project cost budget?

A two independent samples means t-test was used to determine if certified project managers are better in managing project cost than uncertified project managers. The sample consisted of 40 certified and 38 uncertified project managers. The frequency and (relative frequency) distribution of their responses are noted in Table 5. The average success rate for managing a project's cost for uncertified and certified groups are 17.10% and 20.44%, respectively.

TABLE 5.
PROJECT MANAGEMENT "COST" SUCCESS RATES
UNCERTIFIED VERSUS CERTIFIED

	Uncertified	Certified
< 5%	11 (29%)	14 (35%)
5% to 10%	11 (29%)	9 (23%)
11% to 30%	10 (26%)	5 (12%)
31% to 50%	3 (8%)	7 (18%)
51% to 70%	1 (3%)	4 (10%)
71% to 90%	2 (5%)	0
> 95%	0	1 (2%)
Average Success Rate	17.10%	20.44%

Results of the two independent samples means t-test indicate there is not a significant difference between the two groups (t-value =-.69, p-value = .7523). A p-value of .7523 does not provide evidence that certified project managers are better at managing a project's cost than uncertified project managers. Therefore, the data does not support Research Hypothesis 3: Certified project managers perform project cost management better than uncertified project managers.

In contrast to Research Hypotheses 1, 2, and 3, Research Hypotheses 4, 5, and 6 considers the experience level of a manager as a factor in the manager's success in managing projects. Does experience affect the success rates with respect to managing a project's scope, time and cost? To answer these questions we used the data collected from our survey. The data distribution collected from yielded an "unequal cell size" two-way ANOVA analysis, which is often the case from survey data, as shown in Table 6.

TABLE 6.
PROJECT MANAGEMENT CELL SIZES
EXPERIENCE LEVEL X CERTIFICATION

Experience Level	Uncertified	Certified	Total
< 3 yrs.	7	11	18
4 to 6 yrs.	10	6	16
7 to 9 yrs.	5	5	10
> 10 yrs.	16	18	34
Total	38	40	78

Traditional two-way ANOVA requires equal cell sizes. Therefore, our analysis used a one-way ANOVA to test differences in each experience level and to test differences in each experience level/certification combination. The next three sections consider the effect the experience factor has on project management success rates with respect to the triple constraint (i.e. scope, time, and cost).

E. Experience and Project Scope Management

Questions 4, 12: What percentage of your projects exceeded original project scope?

Results shown in Table 7 of a one-way ANOVA indicate there is no evidence (F-value = 1.07, p-value = .4072) that any experience/certification combination indicated a statistical difference in managing project scope. A one-way ANOVA using experience alone also (as shown in the column labeled "Average" in Table 7) did not produce significant results (F-value = .6561, p-value = .5817). Therefore, the data does not support Research Hypothesis 4: Certified project managers with a given level of experience perform project scope management better than uncertified project managers with the same level of experience. The relative small cell sizes and the large range of responses within each cell may have contributed to the results of the ANOVA analyses. Also, as shown in the table the most successful managers are those with 7 to 9 years of experience and of

those managers with certification have a slight edge, but these success rates are based on cell sizes of 5.

TABLE 7.
PROJECT MANAGEMENT "SCOPE" SUCCESS RATES
EXPERIENCE AND CERTIFICATION

Experience Level	Uncertified	Certified	Average
< 3 yrs.	33.0	19.3	24.72
4 to 6 yrs.	21.75	31.67	25.47
7 to 9 yrs.	14.5	12	13.25
> 10 yrs.	16.7	31.9	24.78
Average	20.79	26.07	23.5

F. Certification and Project Time Management

Questions 5, 13: What percentage of your projects exceeded original project delivery date?

Results shown in Table 8 of a one-way ANOVA indicate there is no evidence (F-value = .5009, p-value = .8308) that any experience/certification combination indicated a statistical difference in managing project time. A one-way ANOVA using experience alone also (as shown in the column labeled "Average" in Table 8) did not produce significant results (F-value = .8130, p-value = .4907). Therefore, the data does not support Research Hypothesis 5: Certified project managers with a given level of experience perform project time management better than uncertified project managers with the same level of experience. Once again, the relative small cell sizes and the large range of responses within each cell may have contributed to the results of the analysis. Also, as shown in the table the most successful managers are those with 7 to 9 years of experience and of those managers with certification have a slight edge.

TABLE 8.
PROJECT MANAGEMENT "TIME" SUCCESS RATES
EXPERIENCE AND CERTIFICATION

Experience Level	Uncertified	Certified	Average
< 3 yrs.	35.36	27.5	30.28
4 to 6 yrs.	25	26.25	25.47
7 to 9 yrs.	18	14.5	16.25
> 10 yrs.	18.44	25.28	22.06
Average	23.22	24.57	23.91

G. Certification and Project Cost Management

Questions 6, 14: What percentage of your projects exceeded original project cost budget?

Results shown in Table 9 of a one-way ANOVA indicate there is no evidence (F-value = .7150, p-value = .6595) that any experience/certification combination indicated a statistical difference in managing project cost. A one-way ANOVA using experience alone also (as shown in the column labeled "Average" in Table 9) did not produce significant results (F-value = .1514, p-value = .9285). Therefore, the data does not support Research Hypothesis 6: Certified project managers with a given level of experience perform project time management better than uncertified project managers with the same level of experience. As before, the relative small cell sizes and the large range of responses within each cell may have contributed to the results of the analysis.

Table 9.
Project Management "Cost" Success Rates
Experience and Certification

Experience Level	Uncertified	Certified	Average
< 3 yrs.	26.79	12.27	17.92
4 to 6 yrs.	17	28.75	21.41
7 to 9 yrs.	12	19.5	15.75
> 10 yrs.	14.53	22.9	18.96
Average	17.10	20.44	18.81

VIII. CONCLUSIONS

Although some of the literature suggests that IT project failures are due to inadequate project managers, other literature suggests it is simply the nature of IT projects. It is a reasonable assumption that an earned certificate and experience performing the job should yield a qualified IT project manager. Such a combination should consequently result in the increased likelihood of successful projects in terms of meeting the triple constraint. However, the literature provides no evidence to support that claim. In fact, several researchers have reported that there is no difference in project success rates between PMP® certified and uncertified IT project managers [10],[37]. Unfortunately, there is also a growing body of literature that states certification is undermined by commercially-motivated training organizations [40].

This research study indicates that certification is too small a component of the knowledge dimension to be significant. In addition, results based solely on years of experience, is also too small of a component to judge whether a project manager will be successful in managing a project. More studies are needed to identify factors and their combinations to help measure the effectiveness of IT project managers. At this point it is only possible to contend that certification ensures that an IT project manager possess the necessary skills of the profession but does not guarantee expertise nor significantly impact increased likelihood of successful projects in terms of meeting the triple constraint.

IX. FUTURE RESEARCH

As identified in the literature, the dimensions knowledge, experience, and personality are core competencies required by project managers to be effective. The focus of this study is on the knowledge and experience dimensions. Surprisingly, the results of this and other studies indicate that these two dimensions due not significantly impact increased likelihood of successful projects in terms of meeting the triple constraint. Therefore other factors must be influencing the rate of successful projects.

The current state of the project management profession is tilting towards the improvement of interpersonal competencies, relationship management, resource management, and strategic alignment [22],[44]. These factors are part of the personality core competency. Our future research will scientifically address these factors as they relate to project management.

APPENDIX A PROJECT SURVEY

The following survey was accessible on Survey Monkey from June 1, 2011 to August 31, 2011.

1. How many years have you been employed as a project manager?
- o Within the year
- o 1 to 3 years
- o 4 to 6 years
- o 7 to 9 years
- o More the 10 years
- o I have no work-related experience in project management

2. Please rate the importance of a project management certification on managing projects. (1 is least important and 7 is most important)
- o 1
- o 2
- o 3
- o 4
- o 5
- o 6
- o 7

3. Do you currently hold a recognized certification in project management?
- o No
- o Yes

If No is selected from question 3, then questions 4 through 7 were asked and the answers are based on project managers without certification.

4. What percentage of your projects exceeded original project scope?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

5. What percentage of your projects exceeded original project delivery date?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

6. What percentage of your projects exceeded original project cost budget?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

7. What percentage of your projects were partially or fully outsourced?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

End of survey based on project managers without certification.

If Yes is selected from question 3, then questions 8 through 15 were asked and the answers are based on project managers with certification.

8. Have you worked as a project manager prior to earning your certification?
- o No
- o Yes

9. What certification(s) in project management do you currently have? Check all that apply.
- o CAPM
- o PMP from PMI
- o MPM
- o CPM
- o Other (please specify)

10. How many years have you had your first or primary certification?
- o Within the year
- o 1 to 3 years
- o 4 to 6 years
- o 7 to 9 years
- o 10 or more years

11. What was your PRIMARY motivation for acquiring project management certification?
- o Financial incentive
- o Job requirement
- o Personal satisfaction
- o Other (please specify)

The answers to questions 12 through 15 are based on experience after certification. If an individual worked in the capacity as a project manager prior to earning a

certification, the individual is not to base their answers on those experiences.

12. What percentage of your projects exceeded original project scope?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

13. What percentage of your projects exceeded original project delivery date?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

14. What percentage of your projects exceeded original project cost budget?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

15. What percentage of your projects were partially or fully outsourced?
- o <5%
- o 5% to 10%
- o 11% to 30%
- o 31% to 50%
- o 51% to 70%
- o 71% to 90%
- o >90%

End of survey based on project managers with certification.

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In loving memory of Shadow.

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