A PROJECT MANAGER'S PERSONAL ATTRIBUTES AS PREDICTORS FOR SUCCESS

THESIS

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AFIT/GEM/ENV/07-M16

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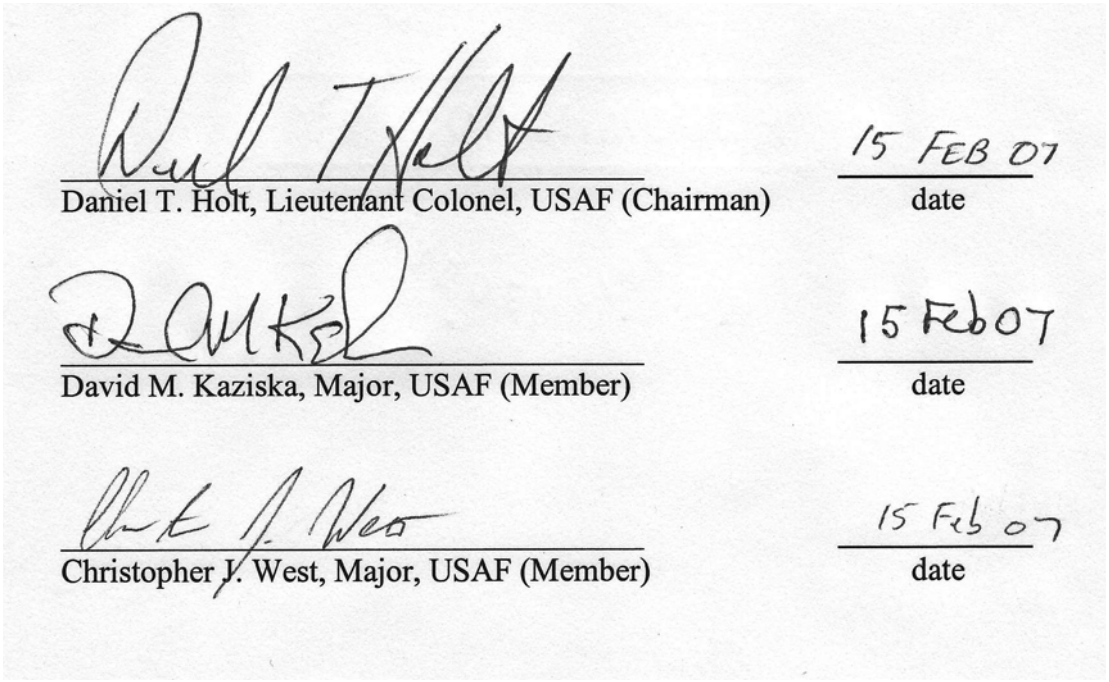

Abstract

The purpose of this research was to determine what personal attributes project managers (PMs) possess which leads them to project management success. Numerous attributes are identified in the literature through a variety of methods, but very few studies relate specific qualities to success. The traits identified in the literature were compiled and condensed into seven distinct skills and attributes: leadership ability, communication skill, decision making skill, administrative skill, coping ability, analytical thinking, and technical competence. A survey method was developed which involved the PM, to measure levels of each attribute, and the PM's supervisor and project data, to provide a level of PM success. PMs and their supervisors from the Air Force Center for Environmental Excellence, a project management firm within the United States Air Force, were invited to participate in the study. Through correlation and regression analysis, a sample of 23 PMs suggest that administrative ability is the single most important trait to possess. Leadership ability emphasizing teamwork, decision making skill with moderate levels of an adaptive decision making style, and moderate levels of technical competence were found to also contribute towards PM success. No conclusions could be drawn on communication skill, analytical thinking, and coping ability.

To my Wife, Daughter, and the little one.

As you always have and will always do,

You gave me the love, support, and distractions

needed to make it through.

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Vhance V. Valencia

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A PROJECT MANAGER'S PERSONAL ATTRIBUTES AS PREDICTORS FOR SUCCESS

I. Introduction & Literature Review

Many definitions have been created to explain the concept of a project (e.g., Jugdev & Müller, 2005; Meridith & Mantel, 2006; Munns & Bjermi, 1996; Turner & Müller, 2003; Smith 1995), but these definitions have converged around three main ideas. First, projects are one-time, unique endeavors to achieve some organizational goal. The objective can be a new product, new process, or any other type of planned undertaking as directed by the organization's leadership. Each endeavor is never the same as the one before it, nor will future endeavors exactly replicate the current process or outcome. Second, projects have a specific beginning and a clearly defined end. Project life-cycle descriptions typically begin with a conceptualization phase and end with either a handover phase to the client or the ultimate closedown of the project. Third, the entire process is limited such that it is constrained within two requirements. Projects are constrained such that they consume only the resources available, such as money and time; and the end product meets pre-determined, set specifications, that is they meet identified performance standards.

Ultimately, the worthiness of each project must be evaluated against some standard. While the determination of project success might seem to be a relatively straight-forward exercise, definitions of project success have evolved over the past 40 years from mechanistic definitions to a comprehensive, holistic view, linking the project's contribution to the fulfillment of the organization's overall strategy and success

(Jugdev & Müller, 2005). Jugdev and Müller found that the simple metrics such as time, cost, and scope (the "iron triangle") were the sole determinants of project success from the 1960s to the 1980s, the early decades of project management. As they progressed through their 40-year retrospective look, they discovered four distinct time periods regarding the evolution of the definition of project success. Close examination of their history will show that the "iron triangle" remains central to the definition of project success, and the definition of success has evolved to include factors such as: the level of senior management commitment to the project, the relationship of the project to the external environment (e.g. political, economical, social implications), and the contribution of the project to strategic organizational goals.

Although the outlook of success has changed over time, it is important for leaders to understand the factors that facilitate project success. Organizations often make considerable investments (in both financial and non-financial resources) as they embark on projects. One factor that would impact the success of a project would be the quality of management and leadership oversight provided by the project manager (PM). Although project management by itself cannot guarantee success, research has indicated that project management is central in the planning, production, and handover phases of the project (Jugdev & Müller, 2005; Munns & Bjeirmi, 1996). During these phases, project management is the entity that takes a concept and set of objectives that resides with a client to reality; and the PM is the central person responsible for facilitating these actions.

It is a difficult endeavor to create a comprehensive list of all the actions that a project manager must engage in to fulfill these responsibilities because his or her responsibilities are so vast. In the broadest terms, the PM is viewed as a direct

representative of the firm's senior managers and is responsible for the overall success of the project. From the project team perspective, the PM is expected to possess some level of technical competence regarding the project work (Grant, Baumgardner, & Shane, 1997) and at the same time possess the leadership skills needed to guide his or her diverse team of people (Turner & Müller, 2005). Other responsibilities include building the project team, planning and evaluating the work, interfacing with the client, and proper allocation of the firm's project resources (Bownekamp & Kleiner, 1987). The PM must also be able to forecast project needs, assess project risks, communicate plans and priorities, assess progress and trends, and get quality and value for the money invested in a project (Smith, 1995). As is shown, the responsibilities of the PM are incredibly comprehensive. However, a common thread among those that have tried to capture this list is the idea that these PMs are typically not given the same authority as that of traditional managerial positions (Keane, 1996; Bowenkamp & Kleiner, 1987) which creates a source of difficulty for the PM. Project management is said to be more organic, more complex, and more varied than functional management (Pettersen, 1991) adding to the difficulty of the job.

Given the critical and challenging role the PM fills, it becomes extremely important for an organization to systematically select a PM to maximize opportunities for success. But PM selection can be difficult because, like the definition of project success and the views of PM responsibilities, the literature has provided many diverse and ever changing descriptions and lists of attributes that reflect a successful project manager. Some research has given leaders some insights into key attributes which help facilitate PM success (e.g., Carr, de la Garza & Vorster, 2002; Grantt et al., 1997; Anderson &

Tucker, 1994; Hauschuldt, Keim, & Medcof, 2000) and other research has attempted to compile these attributes into a profile specifically designed to facilitate PM selection (Pettersen, 1991). This study will extend the current literature that identifies the relationships between PM personal attributes and a PM's ability to successfully manage projects in order to facilitate better PM selection by organizations.

Before discussing the specific success attributes to be tested, a background on the unique nature of project management is provided. The development of this growing management style is discussed followed by a brief discussion on the differences between project management and traditional, or functional, management. Following this, seven key project manager attributes are identified from the literature and defined for the purposes of this study.

Project Management Development

Project management emerged as a unique discipline and organizational role in the late 1950's (Kloppenborg & Opfer, 2002; Meridth & Mantel, 2006; Morris, 1997; Urli & Urli, 2000). By and large, the military is credited with this as a result of its behemoth defense acquisition programs such as the Atlas, Minuteman and Polaris missiles (Meridth & Mantel, 2006; Morris, 1997). Early research in the field focused on technology and techniques to support project planning and control. Software tools were developed and network diagramming methods proliferated to help plan and control these large contracts.

Recently the project management literature has developed further (Jugdev & Thomas, 2000; Urli & Urli, 2000), emphasizing the unique roles that the individual charged to lead these endeavors must have. Human resource issues, such as team building and leadership, and general managerial topics, such as risk and quality

management have come to the forefront (Crawford, Pollack, & England, 2006; Kloppenborg & Opfer, 2002; Urli & Urli, 2000). These issues have been difficult to resolve because of the unique role the project manager plays within an organization.

Today's organizations typically have a hybrid structure that revolves around functional areas of expertise (e.g., accounting, engineering) and projects (e.g., technology development team). The project teams are often a group of individuals from functional areas that are brought together for the duration of the project. This structure (commonly termed a matrix) presents problems for the two types of managers in the organization, the project manager and the functional manager. Pitagorsky (1998) reports that both manager types find it common that conflicts arise in their partnership. Common sources of contention include acquisition and allocation of project resources; functional manager involvement in planning, performance, and direction; and project manager authority and accountability of functional resources (Pitagorsky, 1998).

Terming project management as the "accidental profession," Pinto and Kharbanda (1995) reinforce the notion of this adversarial relationship. Project managers rarely possess any formal authority and must usually work outside the firm's traditional hierarchy. Obstacles exist before the PM begins work and soon after beginning the PM discovers how little power he or she has. Focusing on the project manager, Pinto and Kharbanda offer two reasons why PMs encounter such difficulty: (a) lack of structure in PM selection and training; and (b) the unfamiliarity of the PM career path. These two reasons contribute to why the role of PM is generally forced onto people, rather than being sought after, thus the term the "accidental profession."

Project Manager Attributes

Given this unique, sometimes difficult role and organizational position, it is not surprising that the attributes necessary for success have garnered substantial attention. Table 1 depicts the literature's varied nature concerning PM attributes.

Table 1. Summary of PM Attributes Literature

	Problem Solving	Administration	Supervision and Team Management	Interpersonal Relationships	Other Personal Qualities	Knowledge	Experience	External Factors
Bowenkamp & Kleiner (1987)	✓	✓	✓	✓	✓			
Pitts (1990)				✓				
Pettersen (1991)	✓	✓	✓	✓	✓			
Goodwin (1993)	✓			✓		✓		
Anderson & Tucker (1994)		✓	✓	✓		✓	✓	✓
Pinto & Kharbanda (1995)	✓	✓	✓	✓	✓	✓		
Grant, et al. (1997)						✓	✓	✓
Tagger, et al. (1999)						✓	✓	
Brugger, et al. (2000)	✓	✓	✓	✓	✓			✓
Crawford (2000)	✓	✓	✓	✓		✓		✓
Hauschildt, et al. (2000)	✓		✓	✓	✓	✓		
Odusami (2002)	✓	✓	✓	✓		✓		✓
Hyväri (2006)			✓			✓		✓

Petterson's (1991) framework is used here as a basic guide to summarize these attributes because the process used to develop it was incredibly comprehensive (i.e., he synthesized approximately 60 publications qualitatively). Petterson identified 21 traits and suggested that they could be grouped into five distinct categories, namely, problem solving, administration, supervision and team management, interpersonal relationships, and other personal qualities. Through this review, these categories were supplemented with three additional areas titled knowledge, experience, and external factors. Although these three factors were addressed in Pettersen's study under administration and other personal

qualities, other authors indicated that these three factors are distinctively separate which warranted their own categories. Common across the articles selected is that they provide a trait and attributes listing for PMs and they were not included in Pettersen's study. Traits and attributes that the articles identified were placed in one of the nine categories outlined.

The studies presented in Table 1 are varied in the style of their development. In large part, the earlier studies are qualitative in nature and can be classified as either editorials where the author simple expresses his or her thoughts or a systematic qualitative review of the literature on PM attributes. More recent studies have started to apply quantitative measurement techniques, but these are often self-report measures where ranking techniques (i.e., a Delphi method) are used to identify the most important PM attributes. Crawford (2000) points out that the current state of the literature on PM attributes, with a few exceptions, is largely opinion based. Some of these exceptions might include articles similar to McDonough (1990) and Hauschildt et al. (2000) where specific attributes of PMs are measured and compared against variables of project management performance – but such studies are very few. Even though much of the work done in researching PM attributes lacks this empirical nature, the opinion-based and qualitative conclusions presented should not be discounted, serving as a strong basis for the systematic identification of key PM attributes. Bowenkamp and Kliener (1987), Einsiedel (1987), and Pinto and Kharbanda (1995), for example, capture the insights of senior practitioners in the project management field regarding the traits they feel as most important to the development of PMs. Crawford (2000) and Pettersen (1991) have consolidated and synthesized these to draw meaningful conclusions from the varied

sources that comprise the body of literature capturing PM attributes. And the opinion-based, ranking techniques used by El-Saba (2001), Odusami (2002), and Posner (1987) capture the general consensus of a wide sample of practicing PMs on those important PM attributes.

Regardless of the method, whether qualitative or quantitative, the many sources available serve as a springboard for this effort because there is a significant amount of overlap in the attributes suggested as important to the PM. They appear to converge around specific attributes that could clearly define the most important skills. Specifically, the following seven attributes of leadership ability, communication skill, decision making skill, administrative skill, coping ability, analytical thinking, and technical competence were identified and compiled into Table 2.

Table 2. Titles and Definitions of Selected PM Attributes

Factor	PM success attribute	Attribute definition
1	Leadership Skill	"Takes control and exercises leadership. Initiates action, gives direction, and takes responsibility."[1] Encourages others to act, perform at higher standards, and think for themselves.[2]
2	Communication Skill	"Communicates and networks effectively."[1] Displays behaviors of coordination, encouragement of communicative participation, and sympathetic expression.[3]
3	Decision Making Skill	Makes decisions based on one of two styles: adaptive ("do things better") or innovative ("do things differently").[4]
4	Administrative Skill	"Plans ahead and works in a systematic and organized way. Follows directions and procedures."[1]
5	Coping Ability	"Adapts and responds well to change. Manages pressure effectively and copes well with setbacks."[1]
6	Analytical Thinking	"Shows evidence of clear ability to analyze and interpret information. Gets to the heart of complex problems and issues."[1]
7	Technical Competence	"The ability to assimilate and use technical information."[5] "The ability to use project management tools and methods to carry out projects"[6]

Note. The following citations are provided: [1] Bartram (2005), [2] Van Dyne et al. (1994), [3] Hatfield & Huseman (1982), [4] Kirton (1976), [5] Miller (1987), [6] Hyväri (2005).

While arguments could be made for several other attributes (cf. Table 1), these attributes were chosen with three criteria in mind: (a) in order to be usable, the attribute list must be manageable in number; (b) the variables were chosen in order to achieve consensus across the articles reviewed; and (c) these variables were closely related to traditional management literature. The three criteria were used in order to address both practical and theoretical concerns. Balancing these two concerns led to the omission of many attributes yet these seven variables chosen, by and large, summarize the great majority of attributes identified by the project management literature. Each of the seven attributes is further discussed and their relationship to a PM's ability in successfully managing a project is defined in the following sections.

Leadership Ability.

Northouse (2004) explains that leadership is highly a researched topic with much written. Yet, a definitive description of this phenomenon is difficult to express because of its complexity. Even though leadership has varied descriptions and conceptualizations, Northouse states that the concept of leadership, at its core, is a process of influencing a group of individuals such that the group collectively agrees to and accomplishes a common goal. Leadership ability, then, is the ability for an individual to control that process. Within a project management context, the PM is charged with leading his project team through the successful completion of the lifecycle of a project which is in an increasingly complex and competitive project environment (Bowenkamp & Kleiner, 1987; Brugger, Gerrits, & Pruitt, 2000; Hyväri, 2006; Zimmerer & Yasin, 1998). The importance of leadership ability is highlighted by other authors throughout the project management literature. Odusami (2002) finds that construction

professionals rank leadership skill as one of the top four skills necessary for a PM and Crawford (2000) found that leadership was the most mentioned PM attribute among sixteen studies reviewed. Testing the contribution of leadership empirically, Thamhain (2004) found a significant positive relationship between the existence of team leadership and high performance of project teams. Given the general consensus among project management authors about the importance of leadership ability, it can be expected that a positive relationship exists between this PM attribute and project success.

Communication Skill.

A generalized definition of communication is offered by Samovar and Mills (1995) as the process of conveying any thought, idea, concept, feeling or opinion between two or more people. With regards to project management, this skill is used in the conveying of project information to others and must be done so with efficiency given the highly technical, detailed nature of the work (Pettersen, 1991). Bowenkamp and Kleiner (1987) and Einsiedel (1987) suggest that PMs deal with complex ideas and vast amounts of information. In addition, PMs must engage in constant coordination among multiple organizations and stakeholders, and all while working within the restrictions created by the conflicting relationship of complete project responsibility and little formal authority. Needless to say, these authors conclude that communication skill important tool that the PM must master.

Several studies emphasized the importance and contribution that communication ability makes within the context of project management success. Hauschildt et al. (2000) offers that effective communication is one of 24 factors related to PM success and Posner (1987) found that communication skill was the most frequently cited skill in a survey of

287 PMs. Similar to the studies on leadership ability, Odusami (2002) ranks communication skills as one of the top four skills perceived as necessary and Crawford (2000) reveals that communication is a frequently referenced skill in her review of 16 project management studies. Katz and Tushman (1979) report that communication patterns varied distinctly between high performing project teams and low performing project teams. Given the importance placed on communication skill and the results of studies investigating this attribute, it can be expected that a positive correlation exists between a PM's communication ability and the level of success he or she achieves.

Decision Making Skill.

Radecki and Jaccard (1996) define decision making as "how individuals use and combine information about a set of alternatives in order to make a decision" (p. 76). Gushgari et al. (1997), applying decision making to project management, defines it as the "ability to take appropriate action under the constraints of limited time, information, and resources" (p. 56). Posner (1987), in discussing the role of the PM as problem solver, states that the PM must understand the critical problems he or she faces, such as inadequate resources, insufficient time, and unclear goals and direction, and be prepared to manage them. Because the PM operates in a constrained resource environment, the management of these problems will always require decisions to be made among alternatives. Some work has been done in identifying decision making skill as an important attribute to possess (Gushgari, Francis, & Saklou, 1997; Pettersen, 1991; Odusami, 2002; Crawford, 2000; Bownekamp & Kleiner, 1987), but no studies have been found that directly link this skill to performance, warranting further investigation.

Kirton (1976) contends that decision making is a skill that everyone possesses and exercises in different ways. With this in mind, the measurement of decision making style (as opposed to decision making frequency or decision making quality) was deemed appropriate. Working in the field of applied psychology, Kirton establishes that everyone can be placed on a continuum of decision making style which ranges from adaptive to innovative. He postulates that those who view problems as having to be solved within existing paradigms and structures, the more adaptive a proposed solution will be. Those that view existing paradigms and structures as part of the problem itself, and that changing the structure surrounding the problem is possible, will be more likely to propose innovative solutions. Kirton terms adaptive decision makers as "doing things better" whereas innovative decision makers "do things differently" (p. 622). He describes the adaptor as in the following way: an organizational man who works in "reducing conflict, minimizing risks, and managing to solve problems by proceeding at a disciplined pace in a predictable direction" (p.624). As if he were describing a PM, it can be expected that a positive correlation exists between the extent to which a PM possess an adaptive decision making style and his/her project management success.

Administrative Skill.

Administrative skill comprises two facets – planning and organizing (Kim & Yukl, 1995). Bartram (2005) describes administrative skill as the ability to plan ahead and move forward in a systematic, organized fashion. Kim and Yukl state that this skill is the determination of objectives and strategies (planning), the use of priorities in allocating resources (planning), and the attempt to improve the processes of coordination, production, and organizational effectiveness (organizing). Administrative ability is

important to the PM because he is charged with the initial planning, constant performance monitoring, and periodic re-planning should project conditions change. These three aspects of the PM's responsibilities are not limited to himself, but he must also ensure that the functional managers that contribute to his project manage their portion in the same coordinated way (Bowenkamp & Kleiner, 1987).

The role that administrative skills play with regard to PM success is tested in at least three studies. Hyavri (2006) surveyed project stakeholders on PMs they recently conducted business with and found that planning and organizing ability were viewed by stakeholders as the best predictor of PM effectiveness. Hauschildt et al. (2000) surveyed supervisors of PMs and found that administrative skill was a significant factor in the most successful project managers. Anderson and Tucker (1994) found a strong correlation between administrative skill and PM success (but this relationship was mediated by the PMs use and knowledge of project management "best practices"). In sum, these three studies show that administrative skill is a significant factor towards performance and it can be expected that a positive correlation between this factor and project success exists.

Coping Ability.

Coping ability is defined as the ability to control thoughts and behaviors used in managing a situation or condition evaluated as stressful (Lazarus & Folkman, 1984; Folkman & Moskowitz, 2004). This ability is necessary in several settings; Judge, Thoresen, Pucik, and Wellbourne (1999) describe one such situation where individuals must deal with organizational change or workplace ambiguity. Similarly, Bartram (2005) offers that coping is the capability of an individual to adapt and respond well to change, which includes dealing with ambiguity, pressure, and setbacks. The occupation of

project management is one in which the PM must constantly deal with change, ambiguity, pressures, and setbacks (Einseidel, 1987; Posner, 1987). The environment of the PM requires that he or she deal with changes in resources, shifting stakeholder expectations, problems resulting from ambiguous and unclear objectives, conflict among project team members, and conflict between organizational functions (Goodwin, 1993; Pitagorsky, 1998). Given this ever-changing and ambiguous environment, individual coping ability is regarded as a critical PM attribute (Einseidel, 1987; Goodwin, 1993; Pitagorsky, 1998; Posner, 1987).

Although the project management literature may consider coping ability as important, it fails to directly measure this trait and provide empirical evidence that relates it to project management success. Most work done in investigating the importance of coping ability are studies which detect the PM's perception on the importance of the trait. Examples include Gushgari et al. (1997), El-Saba (2001), and Hyavri (2006) who survey the views and opinions of PMs, generating a ranking or list of traits. Results indicated that this trait fell anywhere from the middle to the bottom of their lists. Although coping ability lacks empirical evidence to support a significant relationship with project success, it nevertheless has enough support within the literature to be included in this study.

Analytical Thinking.

Bartram (2005) argues that one important competency for any individual in the workplace is the ability to analyze and interpret information in order to solve complex problems and issues. He offers that this skill is related closely to general mental ability (GMA) which refers to an individual's capacity to process information which guides behavior, or, simply put is the capacity to learn (Le Pine, Colquitt, & Erez, 2000;

Schmidt, 2002). Given these two definitions, and for the purpose of this study, analytical thinking is an individual skill that centers on information processing for the purpose of solving complex problems and issues and is tied closely to GMA. Authors in the project management literature who address this skill reach a consensus that analytical thinking is important to the PM because of the complexities inherent with project management (El-Sabaa, 2001; Goodwin, 1993; Pinto & Kharbanda, 1995). The analysis of this skill and its link to project management success, though, is quite limited with only one study suggesting this link. Using the term "integrative thinking," Hauschildt et al. (2000) propose that this skill is one of seven factors which distinguish more successful PMs from the less successful.

Turning to the field of industrial-organizational (I/O) psychology, the study of GMA is found to have overwhelming empirical support that it as a valid, reliable predictor of job performance across many jobs (Schmidt, 2002; Robertson & Smith, 2001; Ree and Earles, 1991). Salgado et al. (2003) provide evidence that general mental ability has higher validity in skilled occupations, such as engineering, than non-skilled, occupations. Given this evidence, it is not unreasonable to expect that the project management literature would address GMA with more studies, but that is simply not the case. With the I/O literature providing strong evidence of the validity, reliability, and generalizability of GMA as a predictor for job performance, it can be expected that analytical thinking would show a strong correlation to project management success.

Technical Competence.

In her study of project management effectiveness, Hyavari (2006) defines technical competence as the "competency to use project management tools and methods

to carry out projects" (p. 217). In exploring the perceived importance of technical competence within defense acquisition, Grant et al. (1997) derives a similar definition of technical competence as the understanding of project management tools, techniques, and technologies. Hyavari and Grant et al. report that technical competence is perceived by their study's respondents as an important trait and Odusami (2002) and Crawford (2000) list technical competence within their rankings of important PM attributes. Like several of the attributes described in the preceding paragraphs, the significance of technical competence as it relates to a PM's success is unclear. Anderson and Tucker (1994), for example, advise that selecting a project manager with an appropriate technical background is essential, but caveat their statement saying that technical competence without managerial capabilities is not enough. Goodwin (1993) offers that PMs who have too strong a focus on the technical aspects of a project may fail to recognize organizational, political, and other external realities to the detriment of his work. Some offer studies that report that technical competence is related to success, or at least perceived to be related. Thamhain (2004), for example, finds that the use of project management tools and techniques has a strong influence on team performance. Although it appears that technical competence is not as significant as other PM attributes in predicting success, its importance within the literature still draws the expectation that the level of technical competence a PM possesses will positively influence the level of success he/she achieves.

Selection

Given this convergence of PM attributes around the seven distinct definitions, its utility can and should be applied in the systematic selection of PMs. Gatewood and Feild

(2001), offer a general definition of selection:

> Selection is the process of collecting and evaluating information about an individual in order to extend an offer of employment. Such employment could be either a first position for a new employee or a different position for a current employee. The selection process … addresses the future interests of the organization and of the individual. (p. 3)

The authors who research and write about PM attributes inherently address two aspects of the definition of selection. First, they address the information collection aspect by focusing decision makers on the information they should collect (e.g. attributes). Second, they address the future interest aspect of the definition because their underlying motivation as they undertake PM attribute research is to provide insights that will help achieve improved performance in project management, benefiting both the PM and the firm. Therefore, one could contend that research addressing PM attributes implicitly addresses PM selection.

Even though the underlying intention is to increase PM performance, the small body of work on PM attributes fails to provide much evidence of the empirical relationship between PM traits and performance. Crawford (2000) and Kloppenborg and Opfer (2002) point out this fact by stating that not only is there a relative scarcity of articles on the subject, but also that much of this work is largely opinion based or anecdotal. The shortage of empirically based research in this area is quite puzzling given the critical role the PM plays in the success of the project. Turner and Müller (2005) consider that maybe the PM has no impact on the project outcome; but they then conclude that this is in direct conflict to the traditional management literature.

In fact, much work has been done in the human resources management (HRM) arena which relates selection practices to performance. For example, Huselid (1995) provides empirical evidence that links the use of HRM practices, of which selection is a critical component, to reductions in turnover, increased productivity, and increased sales and profits for the firm. Ahmad and Schroeder (2002) found that recruitment and selection efforts by management have a positive, moderating effect on the relationship between the use of certain management practices and overall organizational performance. Farrell and Hakstian (2001) conducted a meta-analysis of the sales occupation literature and determined that the implementation of valid and reliable selection procedures, rather than training intervention programs, has a much greater influence on improving sales performance. Finally, in reporting the validity of 19 different types of selection procedures, Schmidt and Hunter (1998) discuss the practical value of improved selection systems to organizations stating that there is a great deal of economic value in implementing improved selection systems and that there is a direct relationship between the practical value and the selection system's validity. This sampling of studies provide evidence that valid and reliable selection programs are significant in influencing organizational performance and its implications are that management should invest well in such programs.

The HRM literature also provides a mature model that firms traditionally follow in the development of selection programs (Gatewood & Feild, 2001; Robertson & Smith, 2001). This model includes a detailed job analysis that is first conducted in order to gather information on the tasks, responsibilities, and outputs of the job. The data are combined with job performance measures in order to identify the knowledge, skills, and

abilities (KSAs) necessary for an individual to fill the job and then these identified KSAs are used to develop assessment instruments with the aim of determining the level of KSAs an applicant possess. The instruments undergo a validation process in order to determine its effectiveness in predicting a candidate's job performance and if validity and reliability are proved, the developed assessment instruments are utilized in the firm's selection process.

The PM selection process should be no different than the selection processes in other industries, but Pinto and Kharbanda's (1995) work on the "accidental profession" underscores the ad hoc, ill-defined, and happenstance nature of selection within the context of project management. They also illustrate the problems associated with this type of selection system, yet they fail to address fixes for PM selection, choosing to instead offer twelve success tips for PMs. With valid selection practices shown to have a significant impact on performance, project management organizations would be remiss in failing to implement valid and reliable selection programs. As outlined above, a critical step in the selection process is the identification of KSAs individuals should possess for a particular job. Some work has already been done in the project management literature regarding these KSAs (cf. Table 1). This study extends the literature by not only consolidating many of these KSAs into a short, manageable list of attributes, but by also empirically testing the relationships of these attributes to performance thereby providing scientific evidence which may aid in the development of reliable and valid PM selection procedures.

II. Method

Participants

Two specific groups were invited to participate in this study. First, seventy-six project managers were invited to complete a questionnaire that assessed seven personal attributes identified in the project management literature as important to PMs. Project managers were those individuals who were directly responsible for the management of one or more projects on a daily basis. Of these, thirty-eight agreed to participate with twenty-five providing usable surveys (i.e., 33% response rate). General demographic characteristics of the project managers included: gender (76 % male), age, (M = 45.5 years), and tenure (M = 5.4 years). The educational background and project management experience were also measured. Education was gauged by asking participants to indicate the highest level of education (e.g., bachelor's degree, master's degree) along with an open-ended item where the project manager specifies the discipline or specialty of each degree attained (e.g., undergraduate degree in civil engineering with a master's degree in business administration). Project management experience was measured with three items. First, PMs reported the total number of years they have worked as a project manager (M = 13.6 years). Second, PMs reported the number of projects that they have managed to completion (M = 111). Third, PMs reported the number of on-going projects they were currently managing with an average work load of 26.3 projects.

The second group of participants was each project manager's supervisor. Nine supervisors were invited and seven agreed to complete an appraisal of the project manager's performance. Supervisors were those personnel who directly oversaw one or more project managers. All participating supervisors had previous project management

experience and none were active project managers themselves. Along with the project manager appraisal, general demographic were measured with single items asking gender (83 % male), age (M = 52.7 years), and experience. Experience was measured with three items asking the number of years worked as a project manager (M = 15.4 years), the number of years in their current position (M = 1.7 years), and the number of projects managed to completion (M = 116 projects).

Organizational Setting

Participants were members of the Air Force Center for Environmental Excellence (AFCEE). Working directly under the Air Force Civil Engineer, the office of the Secretary of the Air Force responsible for facility design, construction, and maintenance throughout the world, AFCEE provides a complete range of technical and professional services to Air Force leaders in the areas of environmental planning, installation planning, engineering, military housing construction, and military housing privatization (AFCEE website, 2006). It is a project-based organization that employs 315 civilians and 46 military personnel, 76 of which were project managers. Recent years have seen the Center managing upwards of $2.1 billion in project contracts. These increases in project workload, as well Air Force wide initiatives in LEAN business, made this study timely for the organization.

Procedures

Participation in the study was advertised using several means. First, PMs and supervisors were invited to participate through a letter from the Center's director (see Appendix A). This letter explained the project's purpose, stressing that participation was completely voluntary. As well, the researchers published a brief announcement on the

organization's internal website which provided additional information regarding the research topic, researcher contact information, and details concerning the data collection visit to be conducted by the researchers. After these announcements were made and appropriate approvals garnered (see Appendices G and F), a researcher arrived on site and provided a packet consisting of a letter, informed consent document, and questionnaire directly to each PM and supervisor (see Appendices B and C). The letter explained the purpose of the study, affirmed confidentiality, and provided instructions regarding completion of the survey. PMs completed a single questionnaire whereas supervisors completed multiple questionnaires dependent on the number of PMs they oversaw. As surveys were completed, participants returned each survey and informed consent document directly to the researcher.

Project data of participating PMs were collected in order to obtain further information regarding the individual PM's performance. Access to an internal AFCEE project management database was granted to the researcher on site and assistance was provided from specialists belonging to AFCEE's information management directorate. The database provided the researchers with the specific projects a particular PM has worked on in order to facilitate the project file reviews. Cost data, schedule data, and PM assessments of each project's performance was used in the analysis of project information.

In order to match PM questionnaires to supervisor questionnaires and project information, names of the PMs were collected. All data that were gathered, however, were kept strictly confidential by the researchers. Once the individual assessments were matched, all identifying information was deleted and/or shredded.

Measures of PM Attributes

Seven PM attributes were measured. These attributes were leadership ability, communication skills, decision making skills, administrative skills, coping ability, analytical skills, and technical competence. Each variable was measured utilizing one or more scales from varying sources. Appendix D provides the complete list of items used and sources of these items.

***Leadership Ability*.**

Two dimensions of leadership ability were assessed utilizing two scales. The first scale was the International Personality Item Pool (IPIP) representation of the Hogan Personality Inventory (HPI) Ambition Scale which measured general leadership through 10 items (International Personality Item Pool, 2006). The IPIP is a public domain resource intended to provide free access to nearly 270 scales of individual differences (Goldberg, Johnson, Eber, Hogan, Ashton, Cloninger, & Gough, 2006). IPIP scales were developed in a four part process using empirical and psychometric methods and these scales served as proxies for the constructs measured by commercial inventories (Goldberg et al., 2006), such as the HPI. Hogan and Hogan (2002) describe the HPI Ambition Scale as the degree to which a person seems leader-like and exhibits leadership abilities. Therefore, the IPIP representation of the HPI Ambition Scale served as the measure for general leadership. Example items included: (a) I take charge, (b) I try to lead others, and (c) I find it difficult to approach others (reversed scored).

The second scale measured teamwork and citizenship behavior with the Advocacy Participation Scale developed by Van Dyne, Graham, and Dienesch (1994). The seven-item scale measured participation of the individual in an organizational setting and the

degree to which he or she encourages others to participate. This scale was modified to a six-item measure in order to increase internal consistency for this study. The following example items are provided: (a) I frequently make creative suggestions to coworkers and (b) I encourage others to speak up at meetings.

In total, leadership skill was measured with 16 items and participants responded to these items using a 5-point Likert-type response scale. Anchors for the responses were *strongly disagree, disagree, neither agree nor disagree, agree,* and *strongly agree.* The reported Chronbach's alpha was .82 for the IPIP Leadership Scale (International Personality Item Pool, 2006) and .86 for the Advocacy Participation Scale. For this study, the internal consistency of the measures was calculated to be .90 for the IPIP Leadership Scale (M = 3.92, SD = 0.63, n = 25) and .78 for the modified Participation scale (M = 3.67, SD = 0.39, n = 25). For the overall measure of leadership skill, the internal consistency of the 16-item measure was calculated to be .86 (M = 3.83, SD = 0.49, n = 25).

Communication Skill.

Communication skill was measured using 14 items developed by Hatfield and Huseman (1982). The original study measured the frequency and perceived congruence of communications within superior-subordinate relationships. With slight modifications to each of the 14 items, the Hatfield and Huseman scale was made appropriate for this study (for example, the term "company" was changed to "project team"). Examples from this scale were: (a) I ask for suggestions about how work should be done, (b) My project team questions my instructions when they do not understand them, (c) I express sympathy to members of my project team when something unfortunate happens in their

personal life. The 14 items were scored on a five point Likert-type scale with anchors of *strongly disagree, disagree, neither agree nor disagree, agree,* and *strongly agree.* Hatfield and Huseman reported reliabilities for their communication scale as subscales of Coordination (.84), Participation (.70), and Expression (.60). In this study, due to poor reliability for the Participation subscale, communication skill was assessed with only the Coordination and Expression subscales. The Cronbach's alpha for these two measures were calculated to be .81 for Coordination (M = 4.00, SD = 0.50, n = 25) and .79 for Expression (M = 4.67, SD = 0.55, n = 25). For the overall measure of communication skill, the reliability of the modified 10-item scale was .83 (M = 4.11, SD = 0.46, n = 25).

Decision Making Skill.

The 13-item version of the Kirton Adaption-Innovation (KAI) Inventory developed by Foxall and Hackett (1992) was used to assess the project manager's decision making style. The KAI measures the extent to which an individual has either an adaptive ("doing things better") or innovative ("doing things differently") approach in decision making and problem solving (Bagozzi & Foxall, 1995). This scale was composed of three subscales of Rule Governance (four items), which measures an individual's propensity to follow rules, Efficiency (four items), which measures an individual's preference towards attention to detail and the manner in which he or she progresses towards a goal, and Sufficiency of Originality (five items), which measures the frequency and practicality of new ideas generated by the respondent (Bagozzi & Foxall, 1995). Samples of questions from each of the three subscales were: (a) I am prudent when dealing with authority or general opinion (Rule Governance), (b) I have fresh perspectives on old problems (Sufficiency of Originality), and (c) I enjoy detailed

work (Efficiency). These items were answered on a 5-point Likert-type scale with anchors ranging from *strongly disagree* to *strongly agree.* Although the original inventory was a 32-item instrument, two studies have found that the 13-item version achieves adequate levels of reliability (Bagozzi & Foxall, 1995; Foxall & Hackett, 1992). Bagozzi and Foxall report Cronbach's alpha for each subscale across three different populations. They found that the reliabilities range from .70 to .48 for Rule Governance, .74 to .71 for Efficiency, and .80 to .63 for Sufficiency of Originality. In this study, calculation of Cronbach's alpha achieved similar results with Rule Governance determined as .59 (M = 3.60, SD = 0.57, n = 25), Efficiency .76 (M = 3.72, SD = 0.56, n = 25), and Sufficiency of Originality as .63 (M = 3.77, SD = 0.56, n = 25). Aggregating all 13 items, the reliability of this scale was .62 (M = 3.70, SD = 0.34, n = 25).

Administrative Skill.

Two specific administrative skills of organizing ability and planning ability were measured. Organizing ability was measured using the IPIP representation of a scale developed by Hofstee, de Raad, and Goldberg (1992) which measures an individual's perception of his or her ability to organize. Sample questions from this 12-item scale were: (a) I complete tasks successfully, (b) I demand quality, (c) I detect mistakes, and (d) I don't pay attention (reverse-scored). Planning ability was measured with another IPIP representation of a scale. The IPIP version of a scale developed by Tellegen (in press) attempts to measure the extent to which an individual plans an activity and follows through on those plans. Sample items from this 10-item scale were: (a) I like to plan ahead, (b) I am exacting in my work, and (c) I make rash decisions. Both scales were answered on a 5-point Likert-type scale with anchors ranging from *strongly disagree* to

strongly agree. The reported reliabilities for both scales were .78 (International Personality Item Pool, 2006). For this study, the reliabilities were calculated to be .84 (M = 4.26, SD = 0.41, n = 25) and .79 (M = 3.87, SD = 0.47, n = 25) for the organizing ability and planning ability subscales, respectively. Combined, the two subscales created a 22-item measure of administrative skill with a calculated reliability of .88 (M = 4.08, SD = 0.38, n = 25).

Coping Ability.

Coping ability was assessed by measuring the participant's tolerance for ambiguity using items from Norton's (1975) 50-item Measure of Ambiguity Tolerance, MAT-50. The items come from two subscales within the MAT-50, Personal Philosophy on Ambiguity Tolerance (7 items) and Job-Related Ambiguity Tolerance (5 items). Two items were dropped from the Philosophy subscale and one from the Job-Related subscale in order to increase internal consistency of the measures. Samples of these items were: (a) Nothing gets accomplished in this world unless you stick to some basic rules, (b) I prefer the certainty of always being in control of myself, and (c) If I am uncertain about the responsibilities of a job, I get very anxious. The response anchors ranged from *strongly disagree* to *strongly agree*. The Chronbach's alpha for the entire MAT-50 was reported as .88 and test-retest reliability was .86 (reliability ratings for the two subscales were not provided). For this study, the 5-item Philosophy subscale had a calculated reliability of .68 (M = 3.82, SD = 0.55, n = 25) and the 4-item Job-Related subscale had a calculated reliability of .65 (M = 2.93, SD = 0.70, n = 25). Taken together, the two subscales created a 9-item coping scale with an internal consistency calculated at .72 (M = 3.43, SD = 0.49, n = 25).

Analytical Thinking..

Analytical thinking was assessed using the IPIP version of the Reasoning Scale taken from the Sixteen Personality Factor Questionnaire (16PF), a brief measure of general mental ability (Conn & Rieke, 1994). For this study, general mental ability served as a proxy for an individual's analytical skill. The IPIP Reasoning Ability Scale is composed of 13 items with the following samples provided: (a) I make insightful remarks, (b) I know the answers to many questions, and (c) I tend to analyze things. This scale was be scored on a 5-point Likert-type scale with response anchors ranging from strongly agree to strongly disagree. The reported reliability coefficient is .76 (International Personality Item Pool, 2006). For this study, the reliability coefficient was .84 (M = 3.93, SD = 0.47, n = 25).

Technical Competence.

Technical competence was measured with 17 items adapted from the Wagnor and Morse Sense of Competence Index (Wagnor & Morse, 1975). Three of four factors of the index were used: overall sense of competence, task knowledge / problem solving, and confidence. With some adaptation of the items to fit the project environment (for example, the phrase "this job" was changed to "the technical aspects of this job"), this scale measured the sense of competence an individual has towards the technical requirements of project management. Example items included: (a) The technical aspects of this job offer me a chance to test myself and my abilities, (b) Problems here are easy to solve once you understand the various consequences of your actions, a skill I have acquired, and (c) No one knows the technical aspects of this job better than I do. This scale was also scored on a 5-point Likert-type scale with response anchors ranging from

strongly disagree to *strongly agree*. Wagnor and Morse report a reliability of .96 for the original, 23-item version of their questionnaire. For this study, only 14 items were used and the Confidence subscale was eliminated due to low reliability. The overall sense of competence subscale (eight items) had a calculated Cronbach's alpha of .73 (M = 3.65, SD = 0.61, n = 25) and the task knowledge / problem solving subscale (six items) had a Cronbach's alpha of .72 (M = 3.93, SD = 0.51, n = 25). Together, the two subscales created the 14-item technical competence scale with a reliability of .80 (M = 3.75, SD = 0.49, n = 25).

Measures of PM Supervisor Ratings

Supervisors rated the PMs they supervised according to two performance measures as well as recording their observations regarding five of the seven PM attributes used in the PM attributes survey. The two performance dimensions are general employee performance and project manager performance. These two measures are adapted from two different sources. The scales measuring the PM attributes of leadership ability, decision skill, organizational skill, coping ability, and analytical skill were abbreviated and adapted from the PM attributes survey for use in the supervisor rating survey. Appendix E provides the complete list of items.

General Employee Performance.

General employee performance was measured with 13 items adapted from the Employee Performance Questionnaire scale developed by Lynch, Eisenberger, and Armeli (1999). The original, 16-item Employee Performance Questionnaire was composed of two subscales labeled In-Role Performance and Extra-Role Performance. In-role performance was described as employee actions which meet job description

responsibilities (Williams & Anderson, 1991) whereas extra-role performance was defined as employee actions which contribute towards workgroup effectiveness but are outside of the employee's job description (George & Brief, 1992). Three items pertaining to employee punctuality and attendance were dropped from the In-Role Performance subscale because the researchers determined that these characteristics were not relevant for the current study. Example items for In-Role Performace (six items) were: (a) This employee performs tasks that are expected of him/her and (b) This employee adequately completes assigned duties. Example items for Extra-Role Performance (seven items) were: (a) This employee makes constructive suggestions to improve the overall functioning of his/her workgroup and (b) The employee continues to look for new ways to improve the effectiveness of his or her work. These two scales were scored on a 5-point Likert-type scale with response anchors ranging from *strongly disagree* to *strongly agree.* Lynch et al. (1999) conducted two studies using the Employee Performance Questionnaire and reported Cronbach's alpha for the two subscales ranging from .87 to .88 for In-Role Performance and .90 to .91 for Extra-Role Performance. For this study, Cronbach's alpha was calculated to be .89 for In-Role Performance (M = 4.63, SD = 0.38, n = 25), .85 for Extra-Role Performance (M = 4.29, SD = 0.44, n = 25), and .89 when the two subscales are combined in assessing general employee performance (M = 4.45, SD = 0.36, n = 25).

Project Management Performance.

Project Management Performance was assessed with 22 items adapted from Hughes, Tippet and Thomas's (2004) work regarding construction project success. Through their instrument, Hughes et al. developed a method that quantitatively assessed

the overall success of a project. The original instrument contained six subscales for a total of 32 items. For the purposes of the current study, only the five subscales labeled as Cost (four items, one omitted), Schedule (five items), Quality (four items), Performance (three items, four omitted), and Operating Environment (six items) were used. The subscale of Safety, which contained five items, one item from Cost, and four items from Performance were omitted. The remaining items were adapted such that they assessed a project manager's overall performance instead of their original form which was written to assess a single project. For example, the item statement which read as "Overall project cost performance was met based on baseline goals, targets, or expectations" was changed to read as "Overall, this PM meets cost performance for his projects based on baseline goals, targets or expectations." Additionally, the scale labels were modified to reflect the project management environment (e.g., "Cost" was relabeled "Cost Management"). Example items from each subscale are provided: (a) Rework costs are well managed by this PM (Cost Management), (b) Material availability is well managed by this PM (Schedule Management), (c) This PM properly reflects the customer's true goals and expectations in contract performance incentives (Quality Management), (d) This PM uses a formalized method in managing project performance data (metrics) (Performance Management), and (e) Vendors and/or subcontractors working with this PM comply with project schedule requirements (Operating Environment). The items for this measure of Project Management Performance was scored on a 7-point Likert-type scale with anchors of *strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree,* and *strongly agree.* This response scale mirrors that of the original study. An internal reliability coefficient is not reported for the instrument by Hughes et al., but a

test-retest coefficient of .993 is provided indicating the instrument's stability. For this study, reliabilities for each of the five subscales were calculated to be .86 for Cost Management (M = 6.29, SD = 0.75, n = 25), .92 for Schedule Management (M = 6.19, SD = 0.83, n = 25) .80 for Quality Management (M = 6.49, SD = 0.58, n = 25), .66 for Performance Management (M = 6.16, SD = 0.58, n = 25), and .87 for Operating Environment (M = 6.12, SD = 0.64, n = 25). For all 22 items, Cronbach's alpha was calculated to be .96 (M = 6.24, SD = 0.62, n = 25).

Supervisor Observations of PM Attributes.

In order to test the perceptual congruence of some of the PM attributes between the PM's self-report and the supervisor's observations, scales measuring the attributes of leadership ability, decision skill, administrative skill, coping ability, and analytical skill were included in the supervisor's questionnaire. The measures for communication skill and technical competence were not included because these dimensions, to some extent, were captured in the General Employee or Project Management Performance sections of this survey. Appendix E contains the entire list of items and their sources.

Generally, the same scales used in the PM Attributes Survey were used in the Supervisor Rating Survey. Because a supervisor rated on multiple PMs, the numbers of items were abbreviated. Also, individual items were adapted such that the supervisor could record his or her observations on the PM supervised. As an example of an adaptation, the item which was part of the decision skills scale of the PM Attributes Survey that read "I never act without proper authority" was changed to "This PM never acts without proper authority." Only 24 items were used in the Supervisor Rating Survey as opposed to the 108 items that address the seven attributes in the PM Attributes Survey.

Table 3 compares the number of items used in the PM Attributes Survey to the number used in the Supervisor Rating Survey. The calculated reliabilities for the abbreviated scales or subscales are provided in Table 3. Table 4 provides the descriptive statistics for each scale used in the supervisor survey.

Table 3. Reliabilities and Number of Items for Scales used in PM and Supervisor Survey

PM Attribute	Scale	Subscale	PM Survey		Supervisor Survey	
			α	No. Items	α	No. Items
Leadership Ability	IPIP Leadership		.90	10	.82	6
	Advocacy Participation		.78	6	n/a	
Communication Skill	Hatfield & Huseman Communication		.78	14	n/a	
Decision Skill	KAI Inventory, 13-Item Version	Rule Governance	.59	4	.66	3
		Sufficiency of Originality	.76	5	.69	3
		Efficiency	.63	4	.95	2
Administrative Skill	IPIP Organization		.84	12	n/a	
	IPIP Planning Ability		.79	10	.71	3
Coping Ability	MAT-50	Personal Philosophy	.68	5	n/a	
		Job-Related	.65	4	.83	2
Analytical Skill	IPIP Reasoning Ability		.84	13	.66	5
Technical Competence	Wagnor & Morse Sense of Competence		.82	17	n/a	

Table 4. Descriptive Statistics for Scales used in Supervisor Survey

PM Attribute	Scale	Subscale	*M*	*SD*	*n*
Leadership Ability	IPIP Leadership		4.30	0.60	25
Decision Skill	KAI Inventory, 13-Item Version	Rule Governance	4.29	0.64	
		Sufficiency of Originality	4.25	0.71	
		Efficiency	4.58	0.49	
Administrative Skill	IPIP Planning Ability		4.41		
Coping Ability	MAT-50	Job-Related	1.64	.67	
Analytical Skill	IPIP Reasoning Ability		4.47	.40	

Project File Reviews

Assessment of project records was done numerically with data collected from AFCEE's internal project record database. 1,437 lines of data were provided on 21 of the 25 PMs participating in the study. Four PMs did not have any data for one of three reasons: (1) the PM was new to the organization and did not have any projects assigned (2) the PM was nearing retirement and all projects had been transferred to another PM or (3) the PM's functional unit did not utilize the organization's database for record keeping. Because there was no data from these four PMs regarding their project records, the sample size when analyzing project information dropped from $n = 25$ to $n = 21$. Cost and schedule data of individual projects managed by each PM was collected for this study.

Two indices were created in order to assess cost performance and schedule performance of PMs. The first index, the cost performance index (CPI), compared the final cost of a project with the project estimate. It was simply the final project cost divided by the estimated project cost. CPIs were first calculated for each individual project and then an average was determined for each PM. CPIs less than 1.0 indicated

that a PM had a propensity to manage projects under-budget while CPIs greater than 1.0 indicated a propensity to manage projects over-budget.

The second index that was used was a schedule performance index (SPI). Calculated in a similar fashion to CPI, SPI compared the final project length to the estimated project length in months. Final project length was divided by the estimated project length for each project and an average was taken for each PM. SPIs less than 1.0 indicated that a given PM would, on average, manage projects ahead of schedule while SPIs greater than 1.0 indicated that a PM would manage projects beyond stated time estimates. Together, calculation the two indices of CPI and SPI for a particular project manager indicated the extent to which a PM manages projects that were under-budget, on-budget, or over-budget or had early, on-time, or late completions.

III. Results & Analysis

The data collected from the group of practicing PMs and their respective supervisors are summarized in this chapter. Principal component analysis, generally used to assess the structure of the data, was used in this study to detect and eliminate outliers. Descriptive statistics and a correlation analysis of the dependent and independent variables are presented followed by models resulting from regression analysis.

Principal Component Analysis (PCA)

Principal component analysis is generally used to assess the underlying structure of data. PCA reduces the dataset into a smaller number of different variables while still retaining the variation from the original dataset (Jolliffe, 1986; Dunteman, 1989). One result of PCA is the ability to detect outlying data points. This was done by plotting the first two principal component scores for each PM. Because the first two principal components (PCs) from the set contain a significant portion of the variation (49.4%), a two-dimensional plot of these components could be examined for outlying data. Table 5 provides the first two principal components, their eigenvalues, and the percentage of total variation that is accounted for by each.

The first component (PC1) can be interpreted as a "general sense of PM attributes and demographics" because all but two of the coefficients are both sufficiently large and positive (scores ranged from .19 to .35). The second component (PC2) accounts for the variance caused by a contrast between most of the PM attributes (range from .15 to .38) and "experience" variables (age, -.43; tenure, -.35; and years of experience, -.33). The scores from these two principal components for each PM are plotted in Figure 1.

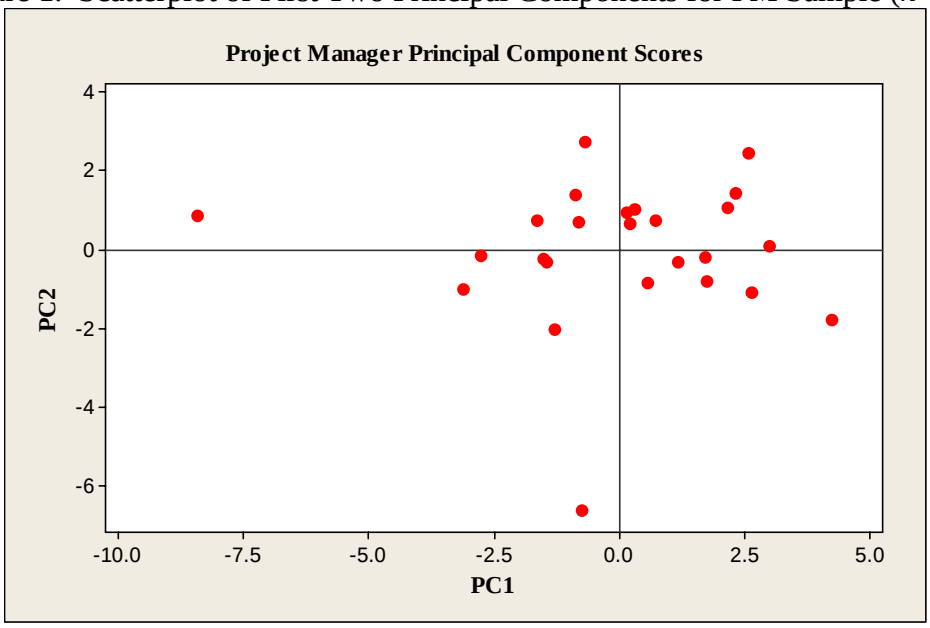
Table 5. First Two and Last Principal Components of PM Attributes and Demographic Variables

Component Number	*PC1*	*PC2*	…	*PC20*
Project Manager Attribute Variables				
Leadership Ambition	.33	.18		.73
Citizenship Behavior	.22	.25		.13
Coordination	.30	.06		-.09
Expression	.24	-.10		-.24
Rule Governance	.09	.38		-.12
Sufficiency of Originality	.31	-.04		-.14
Decision Making Efficiency	.19	-.32		-.17
Organization	.35	.03		-.01
Planning	.24	-.26		.31
Job Ambiguity Tolerance	-.04	.02		.11
Philosophy on Ambiguity Tolerance	.20	.15		-.13
Analytical	.30	.01		-.15
Sense of Competence	.23	.28		.04
Problem Solving	.33	.00		-.34
Demographic Variables				
Age	.10	-.43		.07
Sex	.02	-.23		.00
Tenure	.11	-.35		.16
Education Level	.15	.08		.06
Years of Experience	.14	-.33		.04
Project Workload	.18	.04		-.17
Eigenvalue	6.60	3.28		0.00
Proportional percentage of total variation	33.0	16.4		0.0
Cumulative percentage of total variation	33.0	49.4		1.0

Visual inspection of figure 1 shows that there are two clear outliers, one with respect to PC1 and the other with respect to PC2. Further investigation revealed that one PM consistently scored below the mean for all PM attributes and demographic data. For this PM, nineteen out of a possible twenty measures scored below the mean. With respect to PM attributes, this PM ranged anywhere from 0.1 to 2.1 points below the mean (M = 1.1 points below). Demographic data was similar: this PM was younger (13.2 years younger), shorter tenured (5.0 fewer years), less experienced (13.3 fewer years), managed fewer projects over his career (121 fewer projects), and had a smaller workload (11.7

fewer projects) than the average PM. Because of the consistent low scores, this led to the extremely low PC1 score of -8.43.

Figure 1. Scatterplot of First Two Principal Components for PM Sample (*n* =25)



The second PM corresponded with an extremely low PC2 score of -6.61. This indicated that this PM had an extremely large variance with respect to attributes and experience (e.g., this PM had high age (16.8 years older) and high experience (9.6 years more tenure, 11.1 years more experience, and 180 more career projects) while scoring average on attributes as compared to the average PM). The corresponding PMs were dropped from the study because their data did not fit the general pattern of observations.

Correlation Analysis

Table 6 shows the means, standard deviations, reliabilities, and correlations for the variables of the study using the remaining *n* = 23 PMs. Variables were grouped into

variable sets of demographics, project manager attributes, supervisor observations, and performance measures. (The PCs developed in the principal component analysis were not used due to problems with their interpretability after the first two PCs.) Within the set of performance measures, three PMs did not have cost performance or schedule performance information and therefore were listwise deleted for correlation analysis and subsequent regression analysis on these indices.

In assessing performance measures, the bi-variate correlations gave a general sense of relevant variables. First, two demographic variables were positively related to performance. Age was correlated with in-role performance and overall employee performance (r = .47 and r = .42, p < .05, respectively) and experience was correlated with extra-role performance and overall employee performance (r = .45 and r = .44, p < .05, respectively). These results were not surprising given age and experience are typically linked (i.e., older employees tend to have more experience). Next, three PM attributes were related to supervisors' ratings of extra-role performance and overall employee performance: sufficiency of originality (r = .51 and r = .45, p < .05, respectively), organization (r = .48 and r = .45, p < .05, respectively), and planning (r = .44 and r = .47, p < .05, respectively). Objective measures of performance were not related to PM performance with one notable exception. There was a negative correlation between job ambiguity tolerance and cost performance (r = -.54, p < .05). It should be noted that low scores on job ambiguity were indicative of higher tolerance levels; thus, the negative relationship indicated a higher tolerance for job ambiguity was related to a higher cost index (e.g., the PM copes well and was, on average, over budget). Surprisingly, project management performance and the indices of cost and schedule

Table 6. Means, Standard Deviations, Reliabilities, and Correlations Among Study Variables

			Correlations										
Dimension	*M*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Demographic Variables													
1. Age	45.33	8.62	-										
2. Sex	0.78	0.42	.36	-									
3. Tenure	5.20	4.45	.45*	.06	-								
4. Education Level	0.39	0.50	-.03	-.23	.04	-							
5. Experience	13.67	6.55	.47*	.08	.30	.11	-						
6. Project Workload	27.65	24.53	.21	-.08	.10	.54**	.29	-					
Project Manager Attribute Variables													
7. Leadership Ambition	4.06	0.44	-.09	-.31	.00	-.02	-.11	.38	(.90)				
8. Citizenship Behavior	3.71	0.38	-.25	-.41	-.22	.21	-.11	.00	.33	(.78)			
9. Coordination	4.06	0.45	.19	.05	.13	-.12	.13	.36	.59*	.42*	(.81)		
10. Expression	4.71	0.49	.17	-.10	.16	.30	-.06	.35	.39	-.08	.23	(.79)	
11. Rule Governance	3.72	0.29	-.33	.07	-.06	.11	.11	.10	.12	.02	.08	.28	(.59)
12. Sufficiency of Originality	3.83	0.48	.02	-.34	-.06	.09	.05	.48*	.70**	.37	.39	-.03	-.03
13. Decision Making Efficiency	3.70	0.48	.35	.00	.25	.23	.22	.22	.46*	.13	.30	.20	-.04
14. Organization	4.31	0.38	.19	-.25	.26	.23	.08	.47	.67**	.34	.63**	.25	.13
15. Planning	3.83	0.39	.05	-.11	.04	.53**	.19	.52*	.41*	.06	.30	.44*	.48*
16. Job Ambiguity Tolerance	2.86	0.69	-.24	.01	.09	.28	-.14	.03	-.10	.27	.06	.02	.11
17. Philosophy on Ambiguity Tolerance	3.87	0.54	-.08	-.41	.21	-.01	-.23	-.16	.34	.49*	.34	.10	-.13
18. Analytical	3.99	0.39	-.16	-.07	.03	.21	-.02	.19	.60**	.15	.19	.17	.26
19. Sense of Competence	3.79	0.40	.20	-.28	.31	.51*	.20	.35	.18	.42*	.45*	.25	-.17
20. Problem Solving	4.00	0.37	-.12	-.37	.28	.17	.11	.16	.57**	.53**	.44*	-.01	.04
Supervisor Observations													
21. Leadership	4.30	0.62	.23	-.03	.06	.31	.40	.29	.07	.24	.20	-.18	-.05
22. Decision Making	4.38	0.51	.19	-.01	-.07	.30	.00	.32	.26	.03	.09	.22	.15
23. Administrative	4.43	0.45	.32	-.21	-.15	.37	.12	.28	.14	.22	.04	.19	-.02
24. Coping	1.61	0.67	-.39	-.32	.01	-.06	.09	-.13	.06	.05	-.17	.08	.00
25. Analytical	4.48	0.41	.21	-.18	.17	.42*	-.03	.37	.32	.26	.24	.17	.12
Performance Measures													
26. In-Role Performance	4.65	0.39	.47*	.01	.12	.28	.28	.32	-.11	.10	.14	.19	-.05
27. Extra-Role Performance	4.31	0.46	.29	-.34	.07	.37	.45*	.31	.10	.28	.04	-.04	-.06
28. Overall Employee Performance	4.47	0.37	.42*	-.23	.10	.39	.44*	.36	.02	.24	.09	.06	-.06
29. Project Management Performance	6.26	0.64	.34	-.16	-.18	.32	-.07	.23	.11	.26	.02	.15	-.35
30. Cost Performance (n = 20)	1.37	0.37	.44	.19	.10	-.13	.26	-.16	.06	-.06	-.16	-.14	.12
31. Schedule Performance (n = 20)	1.68	0.09	-.04	.18	-.09	-.03	.22	-.18	-.10	.12	-.05	-.42	.19

Table 6 (Continued). Means, Standard Deviations, Reliabilities, and Correlations Among Study Variables

	Correlations												
Dimension	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
12. Sufficiency of Originality	(.76)												
13. Decision Making Efficiency	.40	(.63)											
14. Organization	.62**	.61**	(.84)										
15. Planning	.41	.48*	.62**	(.79)									
16. Job Ambiguity Tolerance	-.26	-.10	.24	-.03	(.65)								
17. Philosophy on Ambiguity Tolerance	.11	.09	.43*	.06	.47*	(.68)							
18. Analytical	.51*	.38	.50*	.52*	.09	.27	(.84)						
19. Sense of Competence	.06	.19	.44*	.21	.33	.38	.04	(.73)					
20. Problem Solving	.42*	.33	.60**	.36	.19	.46*	.32	.46*	(.72)				
Supervisor Observations													
21. Leadership	.45*	.34	.42*	.39	.04	.00	.08	.15	.36	(.79)			
22. Decision Making	.46*	.64**	.48*	.52*	-.10	-.07	.27	-.02	-.09	.51*	(.82)		
23. Administrative	.43*	.53**	.39	.39	-.09	.09	.17	.07	-.15	.52*	.86**	(.72)	
24. Coping	-.18	-.31	-.37	-.34*	.03	.03	.06	.12	.02	-.60**	-.57**	-.50*	(.83)
25. Analytical	.54**	.56**	.68**	.64**	.10	.30	.25	.23	.33	.62**	.79**	.71**	-.63**
Performance Measures													
26. In-Role Performance	.21	.19	.26	.37	-.19	-.11	-.21	.07	-.02	.58**	.44*	.52*	-.50*
27. Extra-Role Performance	.51*	.36	.48*	.44*	.00	.13	.28	.27	.27	.66**	.44*	.62**	-.30
28. Overall Employee Performance	.45*	.34	.45*	.47*	-.09	.04	.10	.22	.18	.72**	.51*	.67**	-.44*
29. Project Management Performance	.36	.41	.32	.27	-.09	.13	.06	.03	.03	.51**	.64**	.81**	-.58**
30. Cost Performance (n = 20)	.16	.28	.00	.14	-.54*	-.15	.18	-.15	.10	.08	.17	.18	-.31
31. Schedule Performance (n = 20)	-.10	.00	-.08	-.06	-.16	-.04	-.07	.05	.10	.22	.03	.01	-.25

Note. Unless otherwise stated, n = 23. Reliabilities are shown in parenthesis along the diagonal.
* p < .05 ** p < .01

Table 6 (Continued). Means, Standard Deviations, Reliabilities, and Correlations Among Study Variables

	Correlations						
Dimension	*25*	*26*	*27*	*28*	*29*	*30*	*31*
25. Analytical	(.67)						
Performance Measures							
26. In-Role Performance	.53**	(.89)					
27. Extra-Role Performance	.58**	.49*	(.85)				
28. Overall Employee Performance	.64**	.80**	.92**	(.89)			
29. Project Management Performance	.60**	.65**	.52*	.66**	(.96)		
30. Cost Performance (n = 20)	.18	.00	.39	.25	.09	-	
31. Schedule Performance (n = 20)	.05	-.16	.16	.03	-.13	.63**	-

performance by in large had no statistically significant correlations between any other variables (except for cost performance which is related to only job ambiguity tolerance, stated above). Also counter to expectations, the project management performance measure exhibits near zero, non-statistically significant correlations with the cost and schedule performance indices (r = .09 and r = -.13, p > .05, respectively).

In analyzing the correlations among the non-performance variables, several interesting relationships were revealed. Education level exhibited positive correlations with project workload (r = .54, p < .01), planning (r = .53, p < .01), sense of competence (r = .51, p < .05), and the supervisor's observations of the PM's analytical ability (r = .42, p < .05). Project workload was correlated with attributes of sufficiency of originality (r = .48, p < .05) and planning ability (r = .52, p < .05). There were also statistically significant correlations between a cluster of four PM attributes and all five supervisor observations. At the p < .05 level, sufficiency of originality was correlated with supervisor observations of leadership, decision making, and administrative ability (r = .45, r = .46, r = .43, respectively); organization was correlated with observations of leadership and decision making (r = .42, r = .48, respectively); and planning was correlated with the observations of decision making and coping (r = .52, r = -.34, respectively). At the p < .01 level, sufficiency of originality, organization, and planning were correlated with the supervisor observation of analytical ability (r = .54, r = .68, r = .64, respectively); and PMs' decision making efficiency was correlated with the supervisor observations of decision making, administrative ability, and analytical ability (r = .64, r = .53, r = .56, respectively). The PMs' sufficiency of originality, decision making efficiency, organization, and planning represented two of the seven facets of PM

attributes that were being studied, namely decision making skill and administrative ability. This implies that supervisors are attributing their observations of PM traits to just the two traits of decision making skill and administrative ability.

Regression Analysis

Regression analysis was used to build models which attempt to illustrate the extent to which relevant variables contributed to PM performance. Six models, corresponding to the six response variables of in-role performance, extra-role performance, overall employee performance, project management performance, cost performance, and schedule performance, were developed in a two step process. Best subsets regression was first conducted to reduce the number of predictor variables. Next, multiple linear regression was conducted in order to build models from the resulting subsets of predictor variables (i.e., PM attributes and demographics). The supervisors' observations of the PMs' attributes were omitted for two reasons. First, these variables were not considered to be the best measures of the PMs' attributes. Second, the high correlations among these measures and the performance measures would likely have lead to multicollinearity problems. Additionally, the PMs' sex was omitted due to the small number of females participating in the study.

Best Subsets Regression.

Through best subsets regression, nineteen variables were reduced to an average of nine variables for each of the six models: in-role performance (9), extra-role performance (9), overall employee performance (12), project management performance (10), cost performance (9), and schedule performance (6). Because the sample size was small (n = 20) for the cost and schedule performance models, one predictor variable was omitted

because of limitations inherent in the statistical software package that was used (MINITAB Release 14.20). Principal component analysis was used to determine which variable to remove. Because the final component accounts for the least amount of variance in the data, the single variable with the most substantial factor loading on this component was removed. Table 3 provides this principal component analysis where leadership ambition had the highest coefficient (.73) and was removed for the regressions on cost and schedule performance.

Adjusted R^2 was the criterion used for selecting the best subset of variables for further analysis with multiple linear regression. In three out of six best subset regressions, a single model that clearly contained the highest adjusted R^2 was retained. For the remaining three best subsets regressions, proposed models with adjusted R^2 values within 0.5 percentage points of the highest adjusted R^2 were further evaluated. These subsets were each regressed and the model with the smallest prediction sum of squares (PRESS) value, indicating the model with the best predictive ability, was retained.

Multiple Linear Regression.

Six multiple regression models were developed from the results of the best subsets regression. Table 5 displays the results of the multiple linear regressions with standardized betas (β) and t-statistics (t) which are both indicative of the relative importance of each variable contained in the models. Multicollinearity was assessed through examining the variance inflation factors (VIFs) of each variable. The VIFs ranged from a low of 1.3 to a high of 4.5. As no VIFs approached the value of 10.0, multicollinearty was determined not to be an issue.

Table 7. Results of Best Subsets and Multiple Linear Regression

	Response Variables (Performance)											
	In-Role		Extra-Role		Overall Employee		Project Management		Cost Index		Schedule Index	
Predictor Variables (Attributes)	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Leadership												
Leadership Ambition	-1.35	-5.14**			-.83	-3.57**						
Citizenship Behavior	.55	3.00**	.64	3.79**	.52	3.15**	.75	4.60**			-.34	-1.26
Communication												
Coordination			-.75	-4.16**	-.29	-1.64	-.39	-2.29*				
Expression	.63	3.31**			.42	2.61*	.20	1.37	-.42	-2.80*	-.93	-3.74**
Decision Making												
Rule Governance	-.28	-1.75	-.44	-2.92*	-.39	-2.30*	-.67	-4.17**	1.01	4.98**	.87	3.09**
Sufficiency of Originality					.32	1.26						
Decision Making Efficiency			-.25	-1.51	-.22	-1.28			.36	1.77		
Administrative Ability												
Organization	.86	3.77**	.77	3.41**	.88	2.97*	.47	2.10	-.65	-2.78*		
Planning			.64	2.69*	.28	1.40	.62	3.11**				
Coping												
Job Ambiguity Tolerance	-.53	-3.24**			-.23	-1.38			-.23	-1.50		
Philosophy on Ambiguity Tolerance												
Analytical												
Analytical (variable)							-.21	-1.33				
Technical Competence												
Sense of Competence	-.61	-2.77*			-.32	-1.78	-.46	-2.83*			.74	2.38*
Problem Solving	.29	1.27	-.34	-2.04			-.42	-2.34*	.46	2.43*		
Demographics												
Age							.23	1.49	1.13	4.51**	.64	2.29*
Tenure									-.25	-1.49	-.35	-1.48
Education Level			-.27	-1.58								
Experience			.61	4.73**	.45	3.27*			-.34	-2.14		
Project Workload	.42	2.40*										
R^2	75.3		82.2		88.0		82.9		83.6		55.2	
Adjusted R^2	58.2		69.9		73.7		68.6		68.8		34.5	
p	.01		.01		.01		.01		.01		.07	

Note. *β* = Standardized Regression Coefficient, *t* = t-Statistic

* p < .05 ** p < .01

All six models developed were, in large part, statistically significant ($p < .01$) and had adjusted R^2 values ranging from a low of 34.5 (schedule performance index) to a high of 69.9 (overall employee performance). Only the model for schedule index exceeded the traditional cutoff of statistical significance ($p < .05$), but was very close ($p < .07$). Assessing the predictor variables across all six models allowed for individual variables to be placed in one of five different categories: primary importance, secondary importance, negative effect, no effect, and demographics.

Four variables fell under the primary importance category: citizenship behavior, expression, rule governance, and organization. Variables within the primary importance category demonstrated considerable effect across most performance measures. That is, these variables were in the subsets of five of the six models, were significant in at least four models ($p < .05$), and generally possessed comparatively high standardized regression coefficients. For example, citizenship behavior was a significant variable for in-role performance ($\beta = .55$, $p < .01$), extra-role performance ($\beta = .64$, $p < .01$), overall employee performance ($\beta = .52$, $p < .05$), and project management performance ($\beta = .75$, $p < .01$). Citizenship behavior also played a role in the schedule performance index model, but it was not statistically significant ($\beta = -.31$, $p > .05$). Similar patterns were repeated for the remaining three variables within this category.

Two variables fell under the category of secondary importance: planning and job ambiguity tolerance. These two variables were in subsets of only three regression models, were statistically significant ($p < .05$) at least once, and had standardized betas that vary in magnitude. For example, planning was a statistically significant component of the project management performance model ($\beta = .62$, $p < .01$) and the extra-role

performance model (β = .64, p < .05), but not statistically significant for the overall employee performance model (β = .28, p > .05).. A similar pattern is repeated for the remaining variable of job ambiguity tolerance. Although job ambiguity tolerance had negative beta coefficients, it was categorized here because its negative coefficient actually indicates higher levels of tolerance. Due to the inconsistency of the size and statistical significance of the standardized regression coefficients, it was unclear as to the extent these two variables play in predicting performance.

Four variables were categorized under negative effect: coordination, leadership ambition, and sense of competence and problem solving. These variables were in subsets of at least two regression models, showed consistent negative contributions towards performance, and were statistically significant ($p < .05$) in at least two of the models. For example, leadership ambition was consistent in negatively influencing in-role performance (β = -1.35, p < .01) and overall employee performance (β = -.83, p < .01). Coordination, sense of competence, and problem solving followed this same pattern.

Under the category of no effect (or negative effect) were those variables that did not have a statistically significant contribution to any model. These variables were sufficiency of originality, decision making efficiency, philosophy on ambiguity tolerance, and analytical. These variables were either not statistically significant in any model (i.e., sufficiency of originality, decision making efficiency, and analytical) or are not selected at all (philosophy on ambiguity tolerance).

The final category of demographic variables requires a different approach than the previous three categories. Each of the five demographic variables were assessed individually, in order to provide a better interpretation of their effects on PM

performance. For example, project workload is a significant, positive contributor to in-role performance (β = .42, p < .05) while experience contributes positively to the extra-role and overall employee performance models (β = .61 and β = .45, p < .01, respectively). This indicates that more experienced PMs with a greater workload are rated higher in performance by their supervisors. Age and tenure are both components of the cost and schedule performance index models. Age is statistically significant for both cost and schedule (β = 1.13, p < .01 and β = .64, p < .05, respectively) while tenure is not (β = -.25 and β = -.35, p > .05, respectively). This might indicate that older PMs are, on average, over-budget and over-schedule, but a high tenure may be able to offset that effect slightly. Education level may affect extra-role performance (β = -.27, p > .05) and cost performance (β = -.34, p > .05); but the interpretation that bachelor degree holders were rated higher on extra-role performance and were more likely to be over-budget is not definitive due to education level's lack of statistical significance.

It should be noted that the cost index and schedule index models consisted of variables whose coefficients were reversed when compared to the other models of in-role, extra-role, overall employee, and project management performance. For example, the cost index model uses the expression variable with a negative coefficient (β = -.42, p < .05), but in the overall employee performance model this variable has a positive coefficient (β = .41, p < .05). The coefficients within the cost and schedule models rarely contradict the general conclusion about the variable in question, the signs are simply opposite. Simply stated, poor performance within the cost and schedule models are indicated with positive coefficients and good performance is indicated with negative coefficients.

IV. Discussion

The purpose of this research was to identify personal attributes which contribute to a PM's success. The findings will help facilitate better PM selection by organizations so they can maximize their opportunities for project success. Many authors have compiled attribute lists (cf. Table 1), but the literature is short of rigorous work which directly tests the relationship of personal attributes to project management success. In an initial step to redress this concern, these lists were aggregated to develop seven broad PM attributes to study: leadership ability, communication skill, decision making skill, administrative ability, coping ability, analytical thinking, and technical competence. The extent to which a group of practicing PMs actually had these attributes was measured. These self assessments were compared to measures of the PMs job performance that were garnered from their supervisors and project records.

Of the seven attributes evaluated, findings indicated that a PM's administrative ability was the most important to performance. This was demonstrated in both bivariate (i.e., correlation) and multi-variate (i.e., regression) analyses. Within the broad category of administrative ability, planning and organizing were both related to measures of performance and supervisors' assessment of PM qualities, namely leadership, decision making, and coping. The relationship between the supervisors' assessment of PM qualities do suggest that PM supervisors may interpret some PM qualities that might be perceived to be relatively mundane like administrative ability as a more desirable attribute like leadership. In addition, the importance of one's administrative ability was reinforced through the regression analysis (i.e., a significant variable in five of six models). This result seems to align with the thoughts of Anderson and Tucker (1994),

Hauschildt et al. (2000), and Hyavri (2006) who put forth that administrative ability is not only important, but the most important attribute for a PM to possess.

Second, two facets of leadership were evaluated – leadership ambition and organizational citizenship behavior – and both were expected to contribute towards performance (Crawford, 2000; Odusami, 2002; Thamhain, 2004). Of the two traits measured, only citizenship behavior, which is indicative of an individual who exercises teamwork and encourages others to participate within groups (Van Dyne, Graham, and Dienesch, 1994), contributed positively toward performance. The other aspect of leadership ambition measured the degree to which an individual was self-confident, energetic, competitive and leader-like (Hogan & Hogan, 2002) and proved to negatively contribute towards performance. Although this result was surprising, it is completely plausible given that the leadership scales were measuring two different qualities – organizational citizenship behavior focusing on social interactions and leadership ambition measuring personality characteristics. This result seems to indicate that a single, broad characteristic of leadership is not an accurate predictor of performance. Leadership is a complex, multi-faceted attribute (Northouse, 2004) and specific aspects of leadership will contribute differently toward a PM's performance. This study reveals that PMs who demonstrate leadership through encouraging teamwork and display behaviors of organizational citizenship are higher performing, and therefore more successful, than PMs who do not.

Third, three aspects of decision making skill were evaluated. These included: rule governance, sufficiency of originality, and decision making efficiency. Of these, only rule governance contributed to the performance models with the coefficients

implying higher rule governance leads to lower supervisor ratings and a propensity to be over budget and over schedule (i.e., poor cost and schedule performance). Rule governance represents the extent to which an individual is either (a) adaptive, and restricts his or her behaviors and decisions to socially acceptable customs or (b) innovative, and defies conventional norms, choosing to ignore the rules or even creating their own (Bagozzi & Foxall, 1995). Considering this along with the context of this study, all of the PMs participating may have had a propensity to be only adaptive decision makers, which was a little unanticipated, but not improbable given the PMs' chosen line of work where they are constrained by rules, regulations, and other standards. The first conclusion reached is that PMs that are extremely adaptive with respect to rule governance (i.e., those that have a predisposition to strictly follow the rules) tend to have lower levels of performance than those who are more moderate in their rule governance. While innovativeness in decision making may still be an important factor, the extent to which it contributes towards a PM's performance could not be determined because no innovators were sampled in the study. Additionally, decision making skill appeared to be the second trait which was most detectable by supervisors (administrative ability being the other trait). The two other components of decision making skill (sufficiency of originality and decision making efficiency) were positively correlated to three supervisor observations, namely leadership, analytical, and administrative abilities. With respect to sufficiency of originality, a high adaptive style indicates an individual who tends to present a limited number of implementable solutions to a problem; and high adaptive styles with respect to decision making efficiency indicates an individual who prefers to address details and advance incrementally towards a goal (Bagozzi & Foxall, 1995). The

high correlations between these two facets of decision making skill and supervisor observations indicate that supervisors may be associating adaptive decision making with other PM traits. With decision making skill, two conclusions were reached: first, moderate levels of adaptive decision making are related to higher performance; and second, supervisors may be ascribing traits such as leadership, analytical ability, and administrative ability to this skill.

When considering the facets of communication skill, an interesting pattern of results were observed. The results showed that expressive style of communication contributed positively toward performance while a coordinating style contributed negatively. Expressive communications were more personal in nature while coordinating communications were more task-oriented. Unlike the scales used in the measurement of leadership which assessed two very different constructs, these measures were designed to measure the same construct – communication patterns between a PM and his or her project team – and should have resulted in a consistent pattern of relationships with performance. One explanation for this inconsistency is that coordinating communications may not be an essential skill to possess and that other communication abilities are more desired in project management such as technical communications, directive communications, and interpersonal communications, as the positive result for expression seems to suggest. Unfortunately, a second explanation may be more plausible, tracing this back to the measurement scales that were used. To measure coordination, a series of items focused on consensus seeking behaviors was used and this behavior may impact the effectiveness of that PM's ability to manage projects. High scores, therefore, on the coordination scale may actually be indicative of high consensus seeking behavior

and not necessarily skill in communication. For expressiveness, items were worded in such a way that almost all PMs answered identically and, thus, little variance was achieved from the measures. This lead to the high coefficients and high frequencies of use within the regression models. Because of these measurement issues, no conclusive statements about the effect of communication skill on PM success should be drawn.

The next attribute to be discussed is that of technical competence. Technical competence was determined to be negatively related to performance when it was significant. PMs largely reported that they had above average levels of competence and no PM considered himself to have a low level of technical competence. The findings indicated that those PMs that viewed themselves to be extremely competent were, in fact, rated lower by their supervisors and were typically over-budget and over-schedule on the projects they managed. Given that some view overly high technical competence as a possible liability to effective project management (Goodwin, 1993), this finding is not entirely surprising. Still, the findings should not be interpreted to mean that low levels of technical competence (i.e, little to no competency) would benefit the organization.

Conclusive statements on the final two attributes of coping and analytical thinking cannot be made. Although these two factors were identified in previous research as important to success, this research did not find any conclusive evidence of such a relationship.

Regarding demographic variables, results revealed that only age and experience related to performance. Interestingly, the older PMs tended to have higher cost and schedule indices (greater cost and schedule growth) indicating poor performance. Still, more experience appeared to be valued by supervisors where those with greater

experience were rated more favorably by their supervisors. Given that age and experience are usually interrelated, these findings seem to be incongruous with each other. However, the sample contained PMs with high age and low experience and other PMs with comparatively low age and high experience. This combination of the two demographic variables likely led to the above result.

The results of this research provide practicing PMs, selection personal, and researchers in the field of project management a model of attributes which relates to PM success. Administrative ability was found to be by far the most important attribute to possess. Leadership was important to the extent that it facilitated teamwork and citizenship behavior. It was found that PMs are generally adaptive in their decision making (i.e., exhibit rule following behavior) and possess above average technical competence, but extremely high adaptiveness and overly high technical competence can be a detriment to PM performance. With the exception of an adaptive decision making style, analytical ability, leadership through teamwork, and average to above average technical competence are attributes that can be developed and improved to maximize success in project management. Practicing PMs who choose to embark on self improvement may want to focus their efforts on these traits. Selection personnel may be able to use this model as a screening tool for PM applicants or launch PM development courses within their organizations. And researchers of project management are provided evidence to corroborate the importance of certain attributes through a method which directly tested individual levels of these attributes against the success of a PM.

There were limitations of this study to note. The greatest limitation was the small sample size of 23 PMs available. A small sample leads to a reduced power of statistical

tests performed which leads to the possibility that some statistically significant results might have been due to chance. Given that each correlation and regression equation computed is a statistical test, and the high number of these tests within the study, some statistically significant results due to chance, and therefore false conclusions about PM traits, are a strong possibility.

Second, the method used to ascertain PM success was quite limited because the study was designed to capture performance information from only two sources: supervisors and project data. Other sources of information such as project team members, project clients, and other groups of people the PM deal with were not pursued. Surveying these groups have provided unique and valid insights into the performance of PMs. Additionally, the extent to which the objective measures of cost and schedule indices captured performance characteristics of the PM may have been flawed for several reasons. First, the data concerning cost and schedule were not vetted to determine what cost and schedule growths were necessary and not a reflection of poor PM performance. Growth due to scope changes, unpreventable delays, and other justifiable factors were not taken into account. Moreover, this particular firm did not view project growth in the same light as a typical project management firm might. Most firms would want to achieve zero cost and schedule growth as a measure of its efficiency, yet, based on conversations with personnel within the firm, the organization is quite tolerant of such growth to the point that it may be interpreted that project increases are encouraged. Given this, the possibility exists that cost and schedule increases may actually be indicative of a successful PM.

Third, the communication measure and its applications in the study may have affected the results of the statistical analysis. The communication scales were adapted from a study assessing communication congruence which was outlined by Hatfield and Huseman (1982). Employing the measure as it was originally intended may have resulted in a better measure of communication ability as opposed to the adaptations used in this study. Mentioned earlier, one of the subscales of communication may have been measuring a construct other than communication due to the wording of each item. Because of this, nothing conclusive was determined with respect to communication ability.

Fourth, because the study used established instruments found from various sources, the study may be limited in measuring the constructs of PM attributes because the instruments themselves may only be capturing a portion of those construct. A question of construct validity arises. For example, the coping attribute is defined as " adapts and responds well to change" and "manages pressure effectively and copes well with setbacks" (Batram, 2005). The instrument used to measure this construct was the Measure for Ambiguity Tolerannce developed by Norton (1975), an established instrument focusing on the ability to cope with ambiguity. The measure is an adequate proxy for assessing a PM's ability to deal with change, but may be inadequate in assessing a PM's ability to manage pressures or setbacks. All of the measurement instruments used in the study follow this same model of using established instruments that could be found to measure defined constructs. The method chosen for developing the survey instruments used in the study inevitably leads to the question of construct validity. This question, however, should not be viewed as invalidating the current study,

it is simply a limitation to the extent that the chosen instruments actually measure the defined construct.

The fifth and final limitation to the study is the extent to which the findings can be generalized. The study takes a unique perspective when compared to other project management studies because of its analysis of Air Force PMs. These PMs seem to fill a different role when compared to their industry counterparts because they were positioned such that they served as the interface between an Air Force customer and the PM contractor. This PM contractor, in turn, more than likely managed a number of sub-contractors for execution of the project. Therefore, the Air Force PM may have only served as a project "facilitator" as opposed to serving as a project "manager." This may explain why the results of the study emphasized administrative ability and teamwork behavior as important traits. Because of the unique role the PMs filled, the generaliziblity of the results is somewhat limited.

Given these limitations, however, there are several opportunities for follow-up and additional research. Three opportunities for follow-up are offered. First and foremost, more data can be gathered from other project firms in order to increase the sample size and increase the statistical power. Second, a return trip can be made to the firm in order to survey and assess additional sources of PM success data such as project team members, clients, vendors, PM co-workers, and the like. This data would supplement the existing data providing a more reliable measure of PM success. Third, re-evaluation of the communication scale is warranted given the current doubt surrounding its construct validity. Employing the scale to measure communication congruenc,e or

utilizing a different communication scale altogether, may result in better insight this factor plays towards success.

Regarding additional research opportunities, two suggestions are offered. First, because the instruments used in measuring PM attributes may not be capturing the entire construct as defined, there is a clear need for the development of measurement instruments specific to project management. By doing so, the question of construct validity when measuring PM skills and attributes defined in the literature would be minimized. Second, the field of I/O psychology offers many other constructs that suggest a relationship with workplace performance. Examples include general cognitive ability and the Big Five personality traits. Analyzing constructs such as these in studies specific to project managers may help the project management field advance its understanding of other significant PM attributes.

This research determined what individual PM attributes and the extent to which each of these attributes affected an individual's level of success as a PM. Individuals can use the findings of this study as a model for increasing his or her effectiveness in management of projects, thereby increasing chances of project success. Organizational leaders can use these findings to systematically select personnel for the role of PM, thereby maximizing the firm's chances of success. All seven attributes studied were not significant contributors to success. The conclusions of this study extend the current literature concerning project management attributes by corroborating the findings of some studies while disputing the findings of others.

Appendix A – AFCEE Director's Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS CITY-BASE TEXAS

7 October 2006

MEMORANDUM FOR AFCEE PROJECT MANAGERS AND SUPERVISORS

FROM: AFCEE/CC

SUBJECT: AFIT Thesis Research Project on Project Manager Success

1. In several weeks, all AFCEE project managers and supervisors will receive surveys from researchers at the Air Force Institute of Technology (AFIT). The purpose of this survey is to collect research data on all AFCEE's project managers to answer the question, "What makes a good PM?" Although completely voluntary, those who volunteer to participate should provide frank and honest feedback. It is this frank honesty that will help AFCEE improve.

2. I have been assured by the researchers that your complete confidentiality will be maintained regarding your responses to the surveys. Your responses and information will only be seen by those researchers.

3. Thank you for your dedication and support in making AFCEE a better organization. Should you have any questions regarding the study, my POC is Mr. Eugene DeRamus, 4-5199.

PAUL A. PARKER
Director

Appendix B – PM Survey Packet

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY (AETC)

27 Nov 06

Captain Vhance Valencia
Department of Systems & Engineering Management
2950 Hobson Way, Bldg 640
Wright-Patterson AFB, OH 45433

AFCEE Project Manager
3300 Sidney Brooks
Brooks City-Base, TX 78235

Dear Project Manager,

Greetings! Hopefully you've received word on the current research effort studying project managers. As you may have read, the academic literature provides little in the way of scientific studies on what factors contribute to successful project managers. People have offered several *opinions* on what makes a successful project manager –few have offered *scientific evidence*. We would like to invite you to participate in this scientific study that attempts to address that issue scientifically.

To participate, you simply need to complete the attached questionnaire and Informed Consent Document and return the forms to the AFIT researcher. You will see that we measure a wide variety of things about your abilities as a PM as well as some basic demographic data. As you are completing these forms, your supervisor will also be completing a questionnaire asking him or her to provide an assessment of your knowledge, skills, abilities, and performance as a PM. Additionally, a member of the research team will review a sample of your project files in order to further gauge your PM performance.

As former project managers, we are aware of the demands on your time. Therefore, the questionnaire we have developed will be brief, taking approximately 30 minutes of your time. The questionnaire for your supervisor will be approximately the same. Please be assured that the information you or your supervisor provides will be kept confidential and be used for research purposes only. In order to maintain this confidentiality, we ask that you return your survey directly back to the researchers. We ask for your name in order to be able to match your survey to your supervisor's survey.

Thank you in advance for your support. With your help, we hope to provide some scientific evidence to the question of "What makes a successful project manager?" If you have any questions regarding this project, please contact Capt Vhance Valencia, e-mail: vhance.valencia@afit.edu; or Lt Col Daniel Holt, e-mail: daniel.holt@afit.edu.

Sincerely,

VHANCE VALENCIA, Capt, USAF
Student, Air Force Institute of Technology

2 Attachments: Project Manager Personal Attributes Questionnaire and Informed Consent Document

Global Power for America

INFORMATION PROTECTED BY THE PRIVACY ACT OF 1974

Informed Consent Document
For Project Managers Participating in
Project Manager (PM) Personal Attributes as Predictors of Success

Air Force Institute of Technology, Wright Patterson AFB, OH

Principal Investigator: Lt Col Daniel T. Holt, DSN 785-3636 ext. 7396, AFIT/ENV
daniel.holt@afit.edu

Associate Investigators: Capt Vhance Valencia, DSN 785-3636 ext. 7396, AFIT/ENV
vhance.valencia@afit.edu

1. **Nature and purpose:** You have been asked to participate in a study designed to determine what personal attributes PMs possess which lead to project success. Numerous studies have been conducted on general workplace competency traits, but relatively few have addressed the field of project management. This study investigates you, the project manager. Your participation will occur at your normal work center. Results of the study will extend the current project management literature regarding PM selection and development.

   The time required of you during the study is anticipated to be approximately one half hour to complete an in-depth questionnaire. You must be a current project manager actively managing one or more projects. We estimate 40-50 of your peers to participate.

2. **Experimental procedures:** Should you decide to participate, you will complete a survey which measures certain pre-identified attributes related to project management. A researcher from AFIT will visit the Center and review your project files to assess the extent to which you manage projects which meet two criteria, cost and schedule constraints. Additionally, your supervisor, should they decide to participate, will be asked to complete a similar survey on you and other PMs he/she manages. All the data collected will be analyzed statistically to determine which, if any, of the attributes are significant predictors of success. You will not have access to the research data, to include the survey your supervisor produces.

3. **Discomfort and risks:** We do not foresee any unusual discomforts or potential medical risks in the administration of this research. Please complete the questionnaire at your own leisure and return it to the researchers as indicated on the survey cover letter. Because survey matching is required between the PM survey and supervisor survey, your name will be required on the survey. There are risks to your privacy, identity, and reputation by taking part in this project, but once survey matching and project file data collection is complete, all identifying information will be removed.

   In the interim, before identifying information is removed, all survey information will be secured in a limited access, locked office or on a secure, password protected database.

4. **Benefits:** You are not expected to benefit directly from participation in this research study. Study results will be available to all participants. If you are interested in a copy of these, please feel free to contact the researchers using the contact information provided on the cover page.

5. **Compensation:** You will receive your normal salary.

6. **Alternatives:** Choosing not to participate is an alternative to volunteering for this study.

7. **Entitlements and confidentiality:**
   a. Records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 5 U.S.C. 552a, and its implementing regulations. Your personal information will be

stored in a locked cabinet in an office that is locked when not occupied. Electronic files containing your personal information will be password protected and stored only on a DoD server. It is intended that the only people having access to your information will be the researchers named above and the AFRL Wright Site IRB or any other IRB involved in the review and approval of this protocol. Your data will be used for research purposes only, and when no longer needed for research your data will be destroyed in a secure manner (e.g., shredding).

b. You understand your entitlements to medical and dental care and/or compensation in the event of injury are governed by federal laws and regulations, and that if you desire further information you may contact the base legal office (88 ABW/JA, 257-6142 for Wright-Patterson AFB).

c. The decision to participate in this research is completely voluntary on your part. No one may coerce or intimidate you into participating in this study. You are participating because you want to. Lt Col Holt, or an associate, has adequately answered any and all questions you have about this study, your participation, and the procedures involved. Lt Col Holt can be reached at (937) 255-3636 ext. 7396. You understand that Lt Col Holt, or an associate will be available to answer any questions concerning procedures throughout this study. You understand that if significant new findings develop during the course of this research, which may relate to your decision to continue participation, you will be informed. You further understand that you may withdraw this consent at any time and discontinue further participation in this study without prejudice to your entitlements. You also understand that the investigator of this study may terminate your participation in this study if she or he feels this to be in your best interest. If you have any questions or concerns about your participation in this study or your rights as a research subject, please contact Major Jeff Bidinger at (937) 255-4563 or jeffrey.bidinger@wpafb.af.mil.

d. You consent to the use of data collection and understand that any release of records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 55 U.S.C. 552a, and its implementing regulations. This means personal information will not be released to unauthorized sources without your permission.

YOU FULLY UNDERSTAND THAT YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Participant Signature_____ **Date**_____

Advising Investigator Signature _____ **Date** _____

Witness Signature _____ **Date** _____

Privacy Act Statement

Authority: We are requesting disclosure of personal information. Researchers are authorized to collect personal information (including social security numbers) on research subjects under The Privacy Act-5 USC 552a, 10 USC 55, 10 USC 8013, 32 CFR 219, 45 CFR Part 46, and EO 9397, November 1943.
Purpose: It is possible that latent risks or injuries inherent in this experiment will not be discovered until some time in the future. The purpose of collecting this information is to aid researchers in locating you at a future date if further disclosures are appropriate.
Routine Uses: Information (including name and SSN) may be furnished to Federal, State and local agencies for any uses published by the Air Force in the Federal Register, 52 FR 16431, to include, furtherance of the research involved with this study and to provide medical care.
Disclosure: Disclosure of the requested information is voluntary. No adverse action whatsoever will be taken against you, and no privilege will be denied you based on the fact you do not disclose this information. However, your participation in this study may be impacted by a refusal to provide this information.

Survey Number: _____

Project Manager (PM) Attributes Survey

Purpose: To conduct research on specific personal attributes possessed by project managers and determine which attributes contribute to project success. Because project managers play a critical role to the success of a project, it becomes extremely important for an organization to systematically select a PM to maximize opportunities for success. This survey will help determine to what extent you possess certain attributes.

Participation: We greatly appreciate your participation in our data collection effort. Your participation is COMPLETELY VOLUNTARY. Your decision to participate, not participate, or to withdraw from participation will not affect your relationship with the Air Force Institute of Technology or the Air Force Center for Environmental Excellence.

Last Name (Print) First Name Office Symbol

Confidentiality: We ask for identifying information (your name) in order to match PM surveys to supervisor surveys. Demographic information is also asked in order to interpret results more accurately. All answers will be kept completely CONFIDENTIAL. No one other than the research team will see your completed questionnaire. All findings will be reported as an aggregated group. Reports summarizing trends in large groups may be published.

Contact information: If you have any questions or comments about the survey please contact Capt Vhance Valencia at the telephone numbers, fax, mailing addresses, or e-mail addresses listed below.

Capt Vhance Valencia
2950 Hobson Way
Wright-Patterson AFB OH 45433-7765
email: vhance.valencia@afit.edu

Advisor: Lt Col Daniel Holt
email: daniel.holt@afit.edu

Phone: DSN 785-3636 ext. 7396, commercial (937) 255-3636 ext 7396
Fax: DSN 986-4699, commercial (937) 656-4699

INSTRUCTIONS

- Answer questions based on your own feelings and experiences
- Read directions carefully and mark only one answer for each question
- Please write clearly making dark marks (feel free to use an ink pen)
- Avoid stray marks and if you make corrections erase or white-out marks completely

MARKING EXAMPLES

Right ● Wrong ⊗ ⊘ ⊙

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Survey Number: _____

Part I. For each statement, please fill in the circle with the number that indicates the extent to which you agree with each statement. Use the scale below for your responses.

① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree	⑤ Strongly Agree

1.	Considering the time spent on the job, I feel thoroughly familiar with the practices and methods associated with project management.	①	②	③	④	⑤
2.	I explain to my project team my way of doing work.	①	②	③	④	⑤
3.	I am someone who uses my brain.	①	②	③	④	⑤
4.	I frequently make creative suggestions to coworkers.	①	②	③	④	⑤
5.	I see myself as someone who proliferates ideas.	①	②	③	④	⑤
6.	I set high standards for myself and others.	①	②	③	④	⑤
7.	I inform members of my project team when they have done a good job.	①	②	③	④	⑤
8.	I don't pay attention.	①	②	③	④	⑤
9.	I meet my own personal expectations for expertise in doing project work.	①	②	③	④	⑤
10.	I explain project problems to my project team.	①	②	③	④	⑤
11.	Project management offers me a chance to test myself and my abilities.	①	②	③	④	⑤
12.	Usually, the more clearly defined rules a society has, the better off it is.	①	②	③	④	⑤
13.	People describe me as someone who pays attention to details.	①	②	③	④	⑤
14.	My talents, or where I can concentrate my attention best, are found in areas not related to project management.	①	②	③	④	⑤
15.	I feel I make insightful remarks.	①	②	③	④	⑤
16.	While reading, I skip difficult words.	①	②	③	④	⑤
17.	I ridicule or make fun of some members of my project team.	①	②	③	④	⑤
18.	I am methodical and systematic.	①	②	③	④	⑤
19.	I am easily intimidated.	①	②	③	④	⑤
20.	I have a low opinion of myself.	①	②	③	④	⑤
21.	Often, I make last-minute plans.	①	②	③	④	⑤
22.	People say I have an eye for detail.	①	②	③	④	⑤

	① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree	⑤ Strongly Agree
23.	I see myself as someone how weighs the pros against the cons.	①	②	③	④	⑤
24.	Members of my project team question my instructions when they think the instructions are wrong.	①	②	③	④	⑤
25.	I prefer the certainty of always being in control of myself.	①	②	③	④	⑤
26.	Project work offers subjective rewards; the job is valuable to me for no other reason than I like to do it.	①	②	③	④	⑤
27.	I honestly believe I have all the skills necessary to perform the various aspects of project management well.	①	②	③	④	⑤
28.	I use my professional judgment to assess right/wrong for the organization.	①	②	③	④	⑤
29.	I make well-considered decisions.	①	②	③	④	⑤
30.	I reflect on things before acting.	①	②	③	④	⑤
31.	I follow-through on my commitments.	①	②	③	④	⑤
32.	I get confused easily.	①	②	③	④	⑤
33.	I encourage management to keep their knowledge/skills current.	①	②	③	④	⑤
34.	I see myself as someone who seldom notices details.	①	②	③	④	⑤
35.	If anyone here can find the answer to a project management problem, I'm the one.	①	②	③	④	⑤
36.	I can cope with several new ideas and problems at the same time.	①	②	③	④	⑤
37.	I pay attention to details.	①	②	③	④	⑤
38.	If I were a doctor, I would prefer the uncertainties of a psychiatrist to the clear and definite work of someone like a surgeon or X-ray specialist.	①	②	③	④	⑤
39.	I keep well-informed where opinion might benefit the organization.	①	②	③	④	⑤
40.	I express sympathy to members of my project team when something unfortunate happens in their personal life.	①	②	③	④	⑤
41.	People describe me as a person who learns quickly.	①	②	③	④	⑤
42.	I have original ideas.	①	②	③	④	⑤
43.	I find it difficult to approach others.	①	②	③	④	⑤
44.	I am someone who enjoys detailed work.	①	②	③	④	⑤
45.	I know the answers to many questions.	①	②	③	④	⑤
46.	I do not push my superiors to perform to higher standards.	①	②	③	④	⑤
47.	I inform my project team about project rules and regulations.	①	②	③	④	⑤

	① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree			⑤ Strongly Agree	
48.	Members of my project team question my instructions when they don't understand them.			①	②	③	④	⑤
49.	If I am uncertain about the responsibilities of a job, I get very anxious.			①	②	③	④	⑤
50.	I have a poor vocabulary.			①	②	③	④	⑤
51.	I can get so wrapped up in my work that I forget what time it is and even where I am.			①	②	③	④	⑤
52.	I see myself as someone who is easily discouraged.			①	②	③	④	⑤
53.	In a situation in which other people evaluate me, I feel a great need for clear and explicit evaluations.			①	②	③	④	⑤
54.	I feel I fit readily into "the system."			①	②	③	④	⑤
55.	People describe me as someone who takes charge.			①	②	③	④	⑤
56.	I think highly of myself.			①	②	③	④	⑤
57.	I take the initiative.			①	②	③	④	⑤
58.	Mastering the tools and methods of project management has meant a lot to me.			①	②	③	④	⑤
59.	Nothing gets accomplished in this world unless you stick to some basic rules.			①	②	③	④	⑤
60.	I wait for others to lead the way.			①	②	③	④	⑤
61.	I put little time and effort into my work.			①	②	③	④	⑤
62.	I tend to make a mess of things.			①	②	③	④	⑤
63.	I see myself as someone who does things by the book.			①	②	③	④	⑤
64.	I counter others' arguments.			①	②	③	④	⑤
65.	I make plans and stick to them.			①	②	③	④	⑤
66.	I would make a fine model for an apprentice to emulate in order to learn the project management skills he would need to succeed.			①	②	③	④	⑤
67.	No one knows the tools and practices of project management better than I do.			①	②	③	④	⑤
68.	I demand quality.			①	②	③	④	⑤
69.	Doing project work well is a reward in itself.			①	②	③	④	⑤
70.	I do *not* believe that in the final analysis there is a distinct difference between right and wrong.			①	②	③	④	⑤
71.	I see myself as someone who tries to lead others.			①	②	③	④	⑤
72.	I am someone who masters all details painstakingly.			①	②	③	④	⑤

	① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree	⑤ Strongly Agree
73.	I like to fool around with new ideas, even if they are a total waste of time.	①	②	③	④	⑤
74.	I tell my project team why changes are made in project work assignments.	①	②	③	④	⑤
75.	I never act without proper authority.	①	②	③	④	⑤
76.	If the work were only more interesting, I would be motivated to perform better.	①	②	③	④	⑤
77.	I express myself easily.	①	②	③	④	⑤
78.	I inform my project team about project plans for the future.	①	②	③	④	⑤
79.	People describe me as thorough.	①	②	③	④	⑤
80.	I am exacting in my work.	①	②	③	④	⑤
81.	I am someone who detects mistakes.	①	②	③	④	⑤
82.	I am someone who likes to plan ahead.	①	②	③	④	⑤
83.	I ask my project team for suggestions about how work should be done.	①	②	③	④	⑤
84.	I am someone who completes tasks successfully.	①	②	③	④	⑤
85.	I see myself as someone who thinks ahead.	①	②	③	④	⑤
86.	I consider myself an average person.	①	②	③	④	⑤
87.	I help coworkers think for themselves.	①	②	③	④	⑤
88.	Personally, I tend to think that there is a right and wrong way to do almost everything.	①	②	③	④	⑤
89.	I am someone who tends to analyze things.	①	②	③	④	⑤
90.	I encourage others to speak up at meetings.	①	②	③	④	⑤
91.	I like to act on a whim.	①	②	③	④	⑤
92.	I am someone who makes rash decisions.	①	②	③	④	⑤
93.	Project problems here are easy to solve once you understand the various consequences of your actions, a skill I have acquired.	①	②	③	④	⑤
94.	I have fresh perspectives on old problems.	①	②	③	④	⑤
95.	I see myself as someone who is stimulating.	①	②	③	④	⑤
96.	I am someone who jumps into things without thinking.	①	②	③	④	⑤
97.	I criticize the work of members of my project team in front of others.	①	②	③	④	⑤
98.	I know that I am not a special person.	①	②	③	④	⑤

① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree	⑤ Strongly Agree
99. I do not know as much as my predecessor did concerning this job.	①	②	③	④	⑤
100. If I were a scientist, I might become frustrated because my work would *never* be completed (science always make new discoveries).	①	②	③	④	⑤
101. Almost every problem has a solution.	①	②	③	④	⑤
102. I tell my supervisor when I think things are being done wrong.	①	②	③	④	⑤
103. I see myself as someone who conforms.	①	②	③	④	⑤
104. I function very poorly whenever there is a serious lack of communication in a job situation.	①	②	③	④	⑤
105. I inform members of my project team when they have not done a good job.	①	②	③	④	⑤
106. I am prudent when dealing with authority or general opinion.	①	②	③	④	⑤
107. Even though the project work here could be rewarding, I am frustrated and find my motivation to continue only because of my paycheck.	①	②	③	④	⑤
108. This job is manageable and many project problems tend to be optimally solved.	①	②	③	④	⑤

Part II. This section contains several items regarding general demographic information. These items are important for statistical analysis. Please respond to each item by WRITING the information requested or FILLING in the corresponding circles that describe you.

109. What is your age? _____

110. What is your gender?

- ○ **Male**
- ○ **Female**

111. In years, how long have you held your current position? _____

112. Please indicate your highest level of education.

- ○ **High School**
- ○ **Some College**
- ○ **Associates Degree**
- ○ **Bachelor Degree**
- ○ **Graduate Degree**
- ○ **Doctorate**
- ○ **Post Doctorate**

113. For each degree obtained, please specify the discipline or specialty for that degree.

1) _____
2) _____
3) _____

114. How many years have you worked as a project manager? _____

115. Please estimate how many projects in your career you have managed.
_____

116. Of those projects in Question 115, how have you managed from start to end?
_____

117. Currently, how many projects are you managing? _____

Reassurance of Confidentiality

No one other than the research team will see your completed questionnaire. We asked for identifying information (your name) in order to match your survey to your supervisor's survey. Demographic information was also asked in order to interpret results more accurately.

All answers will be kept completely CONFIDENTIAL. No one other than the research team will see your completed questionnaire. Findings of this study will be reported as an aggregated group. Reports summarizing trends within large groups may be published.

Questions/Concerns

If you have any questions or concerns please feel free to contact the research team members listed on the cover page of this questionnaire. We appreciate your participation and are happy to address any questions you might have regarding this survey or our research in general.

Feedback

If you are interested in receiving feedback on our research results, please feel free to contact the researchers using the contact information provided on the cover letter.

Appendix C – Supervisor Survey Packet

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY (AETC)

27 Nov 06

Captain Vhance Valencia
Department of Systems & Engineering Management
2950 Hobson Way, Bldg 640
Wright-Patterson AFB, OH 45433

AFCEE Project Manager Supervisor
3300 Sidney Brooks
Brooks City-Base, TX 78235

Dear PM Supervisor,

We are conducting a study titled "Project Manager Personal Attributes as Predictors of Success". In order to complete the study, we need for you to complete the attached questionnaires on the corresponding project managers. Your responses are important because we feel that you can provide an accurate assessment of your PM's knowledge, skills, abilities and job performance as a project manager. Please understand this is a volunteer opportunity for this research project.

Should you wish to take part, please complete the questionnaires and return the document to the AFIT researchers on site. You will see that we measure a wide variety of things about your PM as well as collect basic demographic data on you. We ask that you complete a survey for each of your PMs in order to protect their privacy. Also, a member of the research team will be reviewing your PM's project files in order to collect schedule and cost data as part of the study.

As former supervisors, we are aware of the demands on your time. Therefore, the questionnaire we have developed is brief, taking approximately 30 minutes for each survey. Please be assured that the information you provide will be kept confidential and used for research purposes only. In order to maintain this confidentiality, we ask that you return your surveys directly back to the researchers immediately upon completion.

Thank you in advance for your volunteer support. With your help, we hope to provide some scientific evidence to the question of "What makes a successful project manager?" If you have any questions regarding this project, please contact Capt Vhance Valencia, e-mail: vhance.valencia@afit.edu; or Lt Col Daniel Holt, e-mail: daniel.holt@afit.edu.

Sincerely,

VHANCE VALENCIA, Capt, USAF
Student, Air Force Institute of Technology

2 Attachments: Supervisor Rating Survey and Informed Consent Document

Global Power for America

INFORMATION PROTECTED BY THE PRIVACY ACT OF 1974

Informed Consent Document
For Supervisors Participating in
Project Manager (PM) Personal Attributes as Predictors of Success

AFIT/ENV, Air Force Institute of Technology, Wright Patterson AFB, OH

Principal Investigator: Lt Col Daniel T. Holt, DSN 785-3636 ext. 7396, AFIT/ENV
daniel.holt@afit.edu

Associate Investigators: Capt Vhance Valencia, DSN 785-3636 ext. 7396, AFIT/ENV
vhance.valencia@afit.edu

1. **Nature and purpose:** You have been asked to participate in a study designed to determine what personal attributes PMs possess which lead them to project management success. Numerous studies have been conducted on general workplace competency traits, but relatively few have addressed the field of project management. This study investigates the project manager. Your participation will occur at your normal work center or at home, if you wish. Results of the study will extend the current project management literature regarding PM selection and development.

   The time required of you during the study is anticipated to be approximately one half hour for each PM you supervise to complete in-depth questionnaires. You must be a current project manager's supervisor to participate. We estimate 40-50 project managers to participate and each of their supervisors.

2. **Experimental procedures:** Should you decide to participate, you will complete a survey which measures your thoughts regarding the PM's attributes. Once your survey is received by the researchers, the team will match your responses to those of the PM. Additionally, a researcher from AFIT will visit the Center and review the project files to assess the extent to which the projects meet two criteria cost and schedule constraints. All the data collected will be analyzed statistically to determine which, if any, of the pre-identified attributes are significant predictors of success.

3. **Discomfort and risks:** We do not foresee any unusual discomforts or potential medical risks in the administration of this research. Please complete the questionnaire at your own leisure and return it to the researchers as indicated. Because survey matching is required between the PM survey and your responses, the PM name will be required on the survey. However, once matching and project file data collection are complete, all identifying information will be removed.

   In the interim, before identifying information is removed, all survey information will be secured in a limited access, locked office or on a secure, password protected database.

4. **Benefits:** You are not expected to benefit directly from participation in this research study. Study results will be available to all participants. If you are interested in a copy of these, please feel free to contact the researchers using the contact information provided on the cover page.

5. **Compensation:** You will receive your normal salary.

6. **Alternatives:** Choosing not to participate is an alternative to volunteering for this study.

7. **Entitlements and confidentiality:**

   a. Records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 5 U.S.C. 552a, and its implementing regulations. Your personal information will be

stored in a locked cabinet in an office that is locked when not occupied. Electronic files containing your personal information will be password protected and stored only on a DoD server. It is intended that the only people having access to your information will be the researchers named above and the AFRL Wright Site IRB or any other IRB involved in the review and approval of this protocol. Your data will be used for research purposes only and when no longer needed for research your data will be destroyed in a secure manner (e.g., shredding).

b. You understand your entitlements to medical and dental care and/or compensation in the event of injury are governed by federal laws and regulations, and that if you desire further information you may contact the base legal office (88 ABW/JA, 257-6142 for Wright-Patterson AFB).

c. The decision to participate in this research is completely voluntary on your part. No one may coerce or intimidate you into participating in this study. You are participating because you want to. Lt Col Holt, or an associate, has adequately answered any and all questions you have about this study, your participation, and the procedures involved. Lt Col Holt can be reached at (937) 255-3636 ext. 7396. You understand that Lt Col Holt, or an associate will be available to answer any questions concerning procedures throughout this study. You understand that if significant new findings develop during the course of this research, which may relate to your decision to continue participation, you will be informed. You further understand that you may withdraw this consent at any time and discontinue further participation in this study without prejudice to your entitlements. You also understand that the investigator of this study may terminate your participation in this study if she or he feels this to be in your best interest. If you have any questions or concerns about your participation in this study or your rights as a research subject, please contact Major Jeff Bidinger at (937) 656-5449 or jeffrey.bidinger@wpafb.af.mil.

d. You consent to the use of data collection and understand that any release of records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 55 U.S.C. 552a, and its implementing regulations. This means personal information will not be released to unauthorized sources without your permission.

YOU FULLY UNDERSTAND THAT YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Participant Signature_____ **Date**_____

Advising Investigator Signature _____ **Date** _____

Witness Signature _____ **Date** _____

Privacy Act Statement

Authority: We are requesting disclosure of personal information. Researchers are authorized to collect personal information (including social security numbers) on research subjects under The Privacy Act-5 USC 552a, 10 USC 55, 10 USC 8013, 32 CFR 219, 45 CFR Part 46, and EO 9397, November 1943.
Purpose: It is possible that latent risks or injuries inherent in this experiment will not be discovered until some time in the future. The purpose of collecting this information is to aid researchers in locating you at a future date if further disclosures are appropriate.
Routine Uses: Information (including name and SSN) may be furnished to Federal, State and local agencies for any uses published by the Air Force in the Federal Register, 52 FR 16431, to include, furtherance of the research involved with this study and to provide medical care.
Disclosure: Disclosure of the requested information is voluntary. No adverse action whatsoever will be taken against you, and no privilege will be denied you based on the fact you do not disclose this information. However, your participation in this study may be impacted by a refusal to provide this information.

Survey Number: _____

Project Manager (PM) Supervisor Rating Survey

Purpose: To conduct research on specific personal attributes possessed by project managers and determine which attributes contribute to project success. Because project managers play a critical role to the success of a project, it becomes extremely important for an organization to systematically select a PM to maximize opportunities for success. This survey will help determine to what extent the PM you supervise possesses certain attributes.

Participation: We greatly appreciate your participation in our data collection effort. Your participation is voluntary. Your decision to participate, not participate, or to withdraw from participation will not affect your relationship with the Air Force Institute of Technology or the Air Force Center for Environmental Excellence.

Project Manager to be Rated		
Last Name	First Name	Office Symbol

Confidentiality: We ask for identifying information (PM name) in order to match PM surveys to supervisor surveys. Demographic information is also asked in order to interpret results more accurately. All answers will be kept completely CONFIDENTIAL. No one other than the research team will see your completed questionnaire. All findings will be reported as an aggregated group. Reports summarizing trends in large groups may be published.

Contact information: If you have any questions or comments about the survey please contact Capt Vhance Valencia at the telephone numbers, fax, mailing addresses, or e-mail addresses listed below.

Capt Vhance Valencia
2950 Hobson Way
Wright-Patterson AFB OH 45433-7765
email: vhance.valencia@afit.edu

Advisor: Lt Col Daniel Holt
email: daniel.holt@afit.edu

Phone: DSN 785-3636 ext. 7396, commercial (937) 255-3636 ext 7396
Fax: DSN 986-4699, commercial (937) 656-4699

INSTRUCTIONS

- Answer questions based on your own opinions and feelings about the PM you supervise
- Read directions carefully and mark only one answer for each question
- Please write clearly making dark marks (feel free to use an ink pen)
- Avoid stray marks and if you make corrections erase or white-out marks completely

MARKING EXAMPLES

Right ● Wrong ⊗ ⊘ ⊙

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Survey Number: _____

Part I. This section measures general job performance of the PM that you supervise. For each statement, fill in the circle with the number that indicates the extent to which you agree with each statement. Use the 5-point scale below for your responses.

	① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree	⑤ Strongly Agree
1.	This PM fulfills responsibilities specified in his/her job description.	①	②	③	④	⑤
2.	This PM encourages others to try new and more effective ways of doing their job.	①	②	③	④	⑤
3.	This PM performs the tasks that are expected of him/her.	①	②	③	④	⑤
4.	This PM goes out of his/her way to help new employees.	①	②	③	④	⑤
5.	This PM works cooperatively with his or her supervisor.	①	②	③	④	⑤
6.	This PM volunteers for things that are not required.	①	②	③	④	⑤
7.	This PM adequately completes assigned duties.	①	②	③	④	⑤
8.	This PM makes constructive suggestions to improve the overall functioning of his/her work group.	①	②	③	④	⑤
9.	This PM spends time in idle conversation.	①	②	③	④	⑤
10.	This PM takes action to protect the organization from potential problems.	①	②	③	④	⑤
11.	This PM keeps well-informed where opinion might benefit the organization.	①	②	③	④	⑤
12.	This PM meets formal performance requirements of the job.	①	②	③	④	⑤
13.	This PM continues to look for new ways to improve the effectiveness of his or her work.	①	②	③	④	⑤

Part II. This section measures project management-specific job performance of the PM that you supervise. For each statement, fill in the circle with the number that indicates the extent to which you agree with each statement. Use the 7-point scale below for your responses.

	① Strongly Disagree	② Disagree	③ Slightly Disagree	④ Neither Agree or Disagree	⑤ Slightly Agree	⑥ Agree	⑦ Strongly Agree
14.	Budget contingencies were well managed are well managed by this PM.	①	②	③	④	⑤	⑥	⑦
15.	Overall, this PM meets project schedule performance based on baseline goals, targets, or expectations.	①	②	③	④	⑤	⑥	⑦

① Strongly Disagree	② Disagree	③ Slightly Disagree	④ Neither Agree or Disagree	⑤ Slightly Agree	⑥ Agree	⑦ Strongly Agree

16.	This PM properly reflects the customer's true goals and expectations in contract performance incentives.	①	②	③	④	⑤	⑥	⑦
17.	This PM uses new technologies in order to improve project performance.	①	②	③	④	⑤	⑥	⑦
18.	This PM ensures that project performance data (metrics) updates are accurate as he/she manages particular projects.	①	②	③	④	⑤	⑥	⑦
19.	Overall, this PM meets project quality objectives based on baseline goals, targets or expectations.	①	②	③	④	⑤	⑥	⑦
20.	The training and experience gained on this project by the project team improves the marketplace qualifications of the organization.	①	②	③	④	⑤	⑥	⑦
21.	Regulator involvement (e.g., EPA, NRC, OSHA) is effectively managed by this PM so that delays, rework, or harmful publicity is minimized.	①	②	③	④	⑤	⑥	⑦
22.	Customer satisfaction in this PM's projects is evidenced by direct feedback.	①	②	③	④	⑤	⑥	⑦
23.	This PM manages rework and repair issues during his/her projects such that baseline targets/expectations are met.	①	②	③	④	⑤	⑥	⑦
24.	Overall, this PM meets cost performance for his projects based on baseline goals, targets, or expectations.	①	②	③	④	⑤	⑥	⑦
25.	Vendors and/or subcontractors working with this PM comply with project schedule requirements.	①	②	③	④	⑤	⑥	⑦
26.	Rework costs were well managed by this PM.	①	②	③	④	⑤	⑥	⑦
27.	Vendors and/or subcontractors working with this PM comply with project documentation requirements.	①	②	③	④	⑤	⑥	⑦
28.	Equipment availability is well managed by this PM.	①	②	③	④	⑤	⑥	⑦
29.	Management of schedule float (or schedule slack) is optimized by this PM.	①	②	③	④	⑤	⑥	⑦
30.	I believe that project personnel are aware of the performance measurements for this PM's projects.	①	②	③	④	⑤	⑥	⑦
31.	This PM manages labor availability well.	①	②	③	④	⑤	⑥	⑦
32.	This PM uses a formalized method for managing project performance data (metrics).	①	②	③	④	⑤	⑥	⑦
33.	Net profit targets (or cost savings targets, as applicable) are met for this PM's projects.	①	②	③	④	⑤	⑥	⑦
34.	Customer satisfaction in this PM's projects is evidenced by the opportunity for follow-on work.	①	②	③	④	⑤	⑥	⑦
35.	Material availability is well managed by this PM.	①	②	③	④	⑤	⑥	⑦

Part III. This section measures the extent to which you believe your project manager possesses specific personal attributes. For each statement, fill in the circle with the number that indicates the extent to which you agree with each statement. Use the 5-point scale below for your responses.

① Strongly Disagree	② Disagree	③ Neither Agree nor Disagree	④ Agree	⑤ Strongly Agree

36.	I see this PM as someone who tries to lead others.	①	②	③	④	⑤
37.	I think this PM gets confused easily.	①	②	③	④	⑤
38.	This PM never acts without proper authority.	①	②	③	④	⑤
39.	This PM has original ideas.	①	②	③	④	⑤
40.	This PM gets very anxious if uncertain about the responsibilities of the job.	①	②	③	④	⑤
41.	This PM expresses himself/herself easily.	①	②	③	④	⑤
42.	This PM makes insightful remarks.	①	②	③	④	⑤
43.	This PM makes plans and stick to them.	①	②	③	④	⑤
44.	I see this PM as someone who conforms.	①	②	③	④	⑤
45.	This PM can cope with several new ideas and problems at the same time.	①	②	③	④	⑤
46.	This PM is methodical and systematic.	①	②	③	④	⑤
47.	I think this PM fits readily into "the system."	①	②	③	④	⑤
48.	I see this PM as someone who does things by the book.	①	②	③	④	⑤
49.	This PM has fresh perspectives on old problems	①	②	③	④	⑤
50.	This PM functions very poorly whenever there is a serious lack of communication in a job situation.	①	②	③	④	⑤
51.	This PM is exacting in his/her work.	①	②	③	④	⑤
52.	This PM takes the initiative.	①	②	③	④	⑤
53.	I would describe this PM as someone who is easily discouraged.	①	②	③	④	⑤
54.	I would say this PM learns quickly.	①	②	③	④	⑤
55.	This PM waits for others to lead the way.	①	②	③	④	⑤
56.	This PM has a poor vocabulary.	①	②	③	④	⑤
57.	People describe this PM as someone who takes charge.	①	②	③	④	⑤
58.	This PM counters others' arguments.	①	②	③	④	⑤
59.	I would describe this PM as thorough.	①	②	③	④	⑤

Part IV. This section contains several items regarding general demographic information. These items are important for statistical analysis. Please respond to each item by WRITING the information requested or FILLING in the corresponding circles that describe you.

60. What is your age? _____

61. What is your gender?

    ○ **Male**
    ○ **Female**

62. In years, how long have you held your current position? _____

63. If you have ever been a project manager, how many years have you worked as a project manager?

    _____

64. If you have ever worked as a project manager, how many projects have you managed?

    _____

65. Of those projects in Question 64, how have you managed from start to end?

    _____

Reassurance of Confidentiality

No one other than the research team will see your completed questionnaire. We asked for identifying information (your name) in order to match your survey to your project manager's survey. Demographic information was also asked in order to interpret results more accurately.

All answers will be kept completely CONFIDENTIAL. No one other than the research team will see your completed questionnaire. Findings of this study will be reported as an aggregated group. Reports summarizing trends within large groups may be published.

Questions/Concerns

If you have any questions or concerns please feel free to contact the research team members listed on the cover page of this questionnaire. We appreciate your participation and are happy to address any questions you might have regarding this survey or our research in general.

Feedback

If you are interested in receiving feedback on our research results, please feel free to contact the researchers using the contact information provided on the cover letter.

Appendix D – Items and Sources for PM Survey

Conceptual Variable	Operational Variable	Item	Item No.
Project Manager Attributes			
Leadership Ability	Leadership *International Personality Item Pool (IPIP) representation of the Hogan Personality Inventory (HPI) Ambition Scale* International Personality Item Pool (2006); Hogan & Hogan (2002)	People describe me as someone who takes charge.	55
		I express myself easily.	77
		I see myself as someone who tries to lead others.	71
		I think highly of myself.	56
		I take the initiative.	57
		I wait for others to lead the way. (R)	60
		I am easily intimidated. (R)	19
		I have a low opinion of myself. (R)	20
		I see myself as someone who is easily discouraged. (R)	52
		I find it difficult to approach others. (R)	43
	Citizenship/Teamwork *Advocacy Participation Scale* Van Dyne et al. (1994)	I frequently make creative suggestions to coworkers.	4
		I use my professional judgment to assess right/wrong for the organization.	28
		I encourage management to keep their knowledge/skills current.	33
		I encourage others to speak up at meetings.	90
		I help coworkers think for themselves.	87
		I keep well-informed where opinion might benefit the organization.	39
		I do not push my superiors to perform to higher standards. (R)	46
Communication Skills *Hatfield and Huseman Communication Scale*	Coordination	I ask my project team for suggestions about how work should be done.	83
		I inform my project team about project rules and regulations.	47
		I inform my project team about project plans for the future.	78
		I inform members of my project team when they have done a good job.	7
		I inform members of my project team when they have not done a good job.	105
		I explain project problems to my project team.	10
		I tell my project team why changes are made in project work assignments.	74
		I explain to my project team my way of doing work.	2
	Participation	Members of my project team question my instructions when they don't understand them.	48
		Members of my project team question my instructions when they think the instructions are wrong.	24

Conceptual Variable	Operational Variable	Item	Item No.
Hatfield & Huseman (1982)		I tell my supervisor when I think things are being done wrong.	102
	Expression	I criticize the work of members of my project team in front of others. (R)	97
		I ridicule or make fun of some members of my project team. (R)	17
		I express sympathy to members of my project team when something unfortunate happens in their personal life.	40
Decision Skills	Rule Governance	I see myself as someone who conforms.	103
		I am prudent when dealing with authority or general opinion.	106
		I never act without proper authority	75
		I feel I fit readily into "the system."	54
Kirton Adaption-Innovation Inventory, 13-item version	Sufficiency of Originality	I have fresh perspectives on old problems.	94
		I see myself as someone who is stimulating.	95
		I have original ideas.	42
		I see myself as someone who proliferates ideas.	5
Foxall & Hackett (1992)		I can cope with several new ideas and problems at the same time.	36
	Efficiency	I am someone who enjoys detailed work.	44
		People describe me as thorough.	79
		I am someone who masters all details painstakingly.	72
		I am methodical and systematic.	18
Administrative Skills	Organization	I pay attention to details.	37
		I am someone who completes tasks successfully.	84
	IPIP representation of Abridged Big Five Dimensional Circumplex Model (AB5C) Organization Scale	People say I have an eye for detail.	22
		I demand quality.	68
		I set high standards for myself and others.	6
		I make well-considered decisions.	29
		I follow-through on my commitments.	31
		I am someone who detects mistakes.	81
		I see myself as someone who thinks ahead.	85
	International Personality Item Pool (2006); Hofstee et al. (1992)	I see myself as someone who seldom notices details. (R)	34
		I put little time and effort into my work. (R)	61
		I don't pay attention. (R)	8
	Planning	I am someone who likes to plan ahead.	82
		I see myself as someone who does things by the book.	63
	IPIP representation of the Multidimensional Personality Questionnaire (MPQ) Control Scale	I am exacting in my work.	80
		People describe me as someone who pays attention to details.	13
		I make plans and stick to them.	65
		I am someone who jumps into things without thinking. (R)	96
		I like to act on a whim. (R)	91

Conceptual Variable	Operational Variable	Item	Item No.
	International Personality Item Pool (2006); Tellegen (in press)	Often, I make last-minute plans. (R)	21
		I am someone who makes rash decisions. (R)	92
		I tend to make a mess of things. (R)	62
Coping Ability *Measure of Ambiguity Tolerance* Norton (1975)	Job-Related Ambiguity Tolerance	I function very poorly whenever there is a serious lack of communication in a job situation.	104
		In a situation in which other people evaluate me, I feel a great need for clear and explicit evaluations.	53
		If I am uncertain about the responsibilities of a job, I get very anxious.	49
		If I were a scientist, I might become frustrated because my work would *never* be completed (science always make new discoveries).	100
		If I were a doctor, I would prefer the uncertainties of a psychiatrist to the clear and definite work of someone like a surgeon or X-ray specialist. (R)	38
	Personal Philosophy on Ambiguity Tolerance	Almost every problem has a solution.	101
		I like to fool around with new ideas, even if they are a total waste of time. (R)	73
		Nothing gets accomplished in this world unless you stick to some basic rules.	59
		I do *not* believe that in the final analysis there is a distinct difference between right and wrong. (R)	70
		Usually, the more clearly defined rules a society has, the better off it is.	12
		Personally, I tend to think that there is a right and wrong way to do almost everything.	88
		I prefer the certainty of always being in control of myself.	25
Analytical Skills *IPIP representation of the Sixteen Personality Factor (16PF) Reasoning Ability Scale* International Personality Item Pool (2006); Conn & Rieke (1994)	Reasoning Ability	I feel I make insightful remarks.	15
		I know the answers to many questions.	45
		I am someone who tends to analyze things.	89
		I am someone who uses my brain.	3
		People describe me as a person who learns quickly.	41
		I counter others' arguments.	64
		I reflect on things before acting.	30
		I see myself as someone how weighs the pros against the cons.	23
		I consider myself an average person. (R)	86
		I get confused easily. (R)	32
		I know that I am not a special person. (R)	98
		I have a poor vocabulary. (R)	50
		While reading, I skip difficult words. (R)	16

Conceptual Variable	Operational Variable	Item	Item No.
Technical Competence *Wagner and Morse Sense of Competence Index* Wagnor & Morse (1975)	Overall Sense of Competence	Project management offers me a chance to test myself and my abilities.	11
		Doing project work well is a reward in itself.	69
		If the work were only more interesting, I would be motivated to perform better. (R)	76
		Mastering the tools and methods of project management has meant a lot to me.	58
		My talents, or where I can concentrate my attention best, are found in areas not related to project management. (R)	14
		Project work offers subjective rewards; the job is valuable to me for no other reason than I like to do it.	26
		I can get so wrapped up in my work that I forget what time it is and even where I am.	51
		Even though the project work here could be rewarding, I am frustrated and find my motivation to continue only because of my paycheck. (R)	107
	Task Knowledge / Problem Solving	Project problems here are easy to solve once you understand the various consequences of your actions, a skill I have acquired.	93
		Considering the time spent on the job, I feel thoroughly familiar with the practices and methods associated with project management.	1
		This job is manageable and many project problems tend to be optimally solved.	108
		I honestly believe I have all the skills necessary to perform the various aspects of project management well.	27
		I meet my own personal expectations for expertise in doing project work.	9
		I would make a fine model for an apprentice to emulate in order to learn the project management skills he would need to succeed.	66
	Confidence	No one knows the tools and practices of project management better than I do.	67
		If anyone here can find the answer to a project management problem, I'm the one.	35
		I do not know as much as my predecessor did concerning this job. (R)	99
Project Manager Demographics			
Demographics	General Demographics	What is your age?	109
		What is your gender?	110
		In years, how long have you held your current position?	111
	Education	Please indicate your highest level of education.	112

Conceptual Variable	Operational Variable	Item	Item No.
		For each degree obtained, please specify the discipline or specialty for that degree.	113
	Experience	How many years have you worked as a project manager?	114
		Please estimate how many projects in your career you have managed.	115
		How many projects have you managed from start to end?	116
		Currently, how many projects are you managing?	117

* (R) = Reverse scored

Appendix E –Items and Sources for Supervisory Survey

Conceptual Variable	Operational Variable	Item	Item No.
Project Manager Performance			
Employee Performance	In-Role Performance	This PM performs the tasks that are expected of him/her.	3
		This PM adequately completes assigned duties.	7
		This PM fulfills responsibilities specified in his/her job description.	1
Employee Performance Questionnaire		This PM works cooperatively with his or her supervisor.	5
		This PM spends time in idle conversation. (R)	9
		This PM meets formal performance requirements of the job.	12
	Extra-Role Performance	This PM makes constructive suggestions to improve the overall functioning of his/her work group.	8
Lynch et al. (1999)		This PM encourages others to try new and more effective ways of doing their job.	2
		This PM keeps well-informed where opinion might benefit the organization.	11
		This PM continues to look for new ways to improve the effectiveness of his or her work.	13
		This PM takes action to protect the organization from potential problems.	10
		This PM goes out of his/her way to help new employees.	4
		This PM volunteers for things that are not required.	6
Project Management Performance	Cost Management	Overall, this PM meets cost performance for his projects based on baseline goals, targets, or expectations.	24
		Rework costs were well managed by this PM.	26
		Budget contingencies were well managed are well managed by this PM.	14
		Net profit targets (or cost savings targets, as applicable) are met for this PM's projects.	33
Adaptation of Construction Project Success Survey	Schedule Management	Overall, this PM meets project schedule performance based on baseline goals, targets, or expectations.	15
		Material availability is well managed by this PM.	35
		Equipment availability is well managed by this PM.	28
		This PM manages labor availability well.	31
		Management of schedule float (or schedule slack) is optimized by this PM.	29

Conceptual Variable	Operational Variable	Item	Item No.
Hughes et al. (2004)	Quality Management	Overall, this PM meets project quality objectives based on baseline goals, targets or expectations.	19
		Customer satisfaction in this PM's projects is evidenced by direct feedback.	22
		Customer satisfaction in this PM's projects is evidenced by the opportunity for follow-on work.	34
		This PM properly reflects the customer's true goals and expectations in contract performance incentives.	16
	Performance Management	This PM uses a formalized method for managing project performance data (metrics).	32
		This PM ensures that project performance data (metrics) updates are accurate as he/she manages particular projects.	18
		I believe that project personnel are aware of the performance measurements for this PM's projects.	30
	Operating Environment	Vendors and/or subcontractors working with this PM comply with project schedule requirements.	25
		Vendors and/or subcontractors working with this PM comply with project documentation requirements.	27
		This PM uses new technologies in order to improve project performance.	17
		This PM manages rework and repair issues during his/her projects such that baseline targets/expectations are met.	23
		Regulator involvement (e.g., EPA, NRC, OSHA) is effectively managed by this PM so that delays, rework, or harmful publicity is minimized.	21
		The training and experience gained on this project by the project team improves the marketplace qualifications of the organization.	20
Project Manager Attributes			
Leadership Ability	Leadership *International Personality Item Pool (IPIP) representation of the Hogan Personality Inventory (HPI) Ambition Scale* International	People describe this PM as someone who takes charge.	57
		This PM expresses himself/herself easily.	41
		I see this PM as someone who tries to lead others.	36
		This PM takes the initiative.	52
		This PM waits for others to lead the way. (R)	55

Conceptual Variable	Operational Variable	Item	Item No.
	Personality Item Pool (2006); Hogan & Hogan (2002)	I would describe this PM as someone who is easily discouraged. (R)	53
Decision Skills *Kirton Adaption-Innovation Inventory, 13-item version* Foxall & Hackett (1992)	Rule Governance	I see this PM as someone who conforms.	44
		I think this PM fits readily into "the system."	47
		This PM never acts without proper authority.	38
	Sufficiency of Originality	This PM has fresh perspectives on old problems.	49
		This PM has original ideas.	39
		This PM can cope with several new ideas and problems at the same time.	45
	Efficiency	I would describe this PM as thorough.	59
		This PM is methodical and systematic.	46
Administrative Skills	Planning Ability *IPIP representation of the Multidimensional Personality Questionnaire (MPQ) Control Scale* International Personality Item Pool (2006); Tellegen (in press)	I see this PM as someone who does things by the book.	48
		This PM makes plans and stick to them.	43
		This PM is exacting in his/her work.	51
Coping Ability *Measure of Ambigutiy Tolerance* Norton (1975)	Job-Related Ambiguity Tolerance	This PM gets very anxious if uncertain about the responsibilities of the job.	40
		This PM functions very poorly whenever there is a serious lack of communication in a job situation.	50
Analytical Skills *IPIP representation of the Sixteen Personality Factor (16PF) Reasoning Ability Scale* International Personality Item Pool (2006); Conn & Rieke (1994)	Reasoning Ability Scale	This PM makes insightful remarks.	42
		I would say this PM learns quickly.	54
		This PM counters others' arguments.	58
		I think this PM gets confused easily. (R)	37
		This PM has a poor vocabulary. (R)	56
Supervisor Demographics			
Demographics	General Demographics	What is your age?	60
		What is your gender?	61
		How long have you held your current position?	62

Conceptual Variable	Operational Variable	Item	Item No.
	Experience	If you have ever been a project manager, how many years have you worked as a project manager?	63
		If you have ever worked as a project manager, how many projects have you managed?	64
		How many projects have you managed from start to end?	65

Appendix F – Single Project Assurance (SPA) Approval

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

NOV 1 5 2006

MEMORANDUM FOR Air Force Insitute of Technology (AFIT)
ATTN: Heidi Ries, Dean for Research,
Graduate School of Engineering and Management

FROM: HQ USAF/SGRC
5201 Leesburg Pike, Suite 1401
Falls Church, VA 22041

SUBJECT: Approval of Single Project Assurance (SPA)

References: (a) 32 CFR 219, Protection of Human Subjects
(b) 10 USC 980, Limitation on Use of Humans as Experimental Subjects
(c) AFI 40-402, Protection of Human Subjects in Research
(d) DoDD 3216.2, Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research

On behalf of the AF Surgeon General, I have approved your SPA application and assigned a SPA number to your institution for the protocol listed below.

SPA Number	USAF Protocol Number and Title
50189	FWR20060071H, "Project Manager (PM) Personal Attributes as Predictors of Success"

Attached is the signed copy of your Assurance of Compliance with Title 32, Code of Federal Regulations Part 219 Federal Policy for the Protection of Human Subjects. Please maintain these documents with your research records.

We request that you provide this office with a copy of annual status reports and the final report when the project has been completed.

Thank you for your support in this matter. Please do not hesitate to contact me at 703-681-6103, telefax 703- 681-8050, or joe.narrigan@pentagon.af.mil.

JOSEPH J. NARRIGAN, Lt Col, USAF, BSC
Director, Research Oversight/Compliance Division
Office of the Surgeon General

Attachment:
SPA #50189

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY (AETC)

RECEIVED

DOD SINGLE PROJECT ASSURANCE

Print Form

AIR FORCE INSTITUTE OF TECHNOLOGY

ASSURANCE OF COMPLIANCE WITH DEPARTMENT OF DEFENSE REGULATIONS FOR PROTECTION OF HUMAN RESEARCH SUBJECTS

**Using this Template, supply where indicated information specific to the proposed research activity and your organization, including the required certification on the endorsement page.*

Assurance of compliance with Department of Defense, Title 32, Code of Federal Regulations, Part 219 (32 CFR 219), "Protection of Human Subjects" and "Protection of Human Subjects in DoD Supported Research," August 19, 1991.

PART 1

Air Force Institute of Technology
hereinafter known as the "facility," hereby gives assurance that it will comply with the Department of Defense Regulations for the Protection of Human Subjects (32 CFR 219); Title 10, United States Code, Section 980, Limitation on Use of Humans as Experimental Subjects (hereinafter referred to as 10 USC 980); Air Force Instruction AFI 40-402; DoD Directive DoDD 3216.2; and where applicable, 21 CFR 50, 21 CFR 56, and 45 CFR 46 (Subparts B, C, D) under the authority of the Department of Defense as specified below.

1. Statement of Principles and Policies

a. Ethical Principles

This facility is guided by the ethical principles regarding all research involving humans as subjects as set forth in the report of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research entitled, Ethical Principles and Guidelines for the Protection of Human Subjects of Research (the "Belmont Report"). In addition, the requirements set forth in Title 32 Part 219 of the Code of Federal Regulations (32 CFR 219) will be met for all DoD-supported research.

b. Facility Policy

(1) This facility acknowledges and accepts its responsibilities for protecting the rights and welfare of human subjects of research covered by this assurance.

(2) It is the policy of this facility that, except for research in which the only involvement of human subjects is in one or more of the categories exempted under 32 CFR 219.101(b)(1-6) or 219.101.e of the DoD regulations, this policy is applicable to all research involving human

subjects, and all other activities which are even in part such research, if either:

(a) The research is sponsored by this facility, or

(b) The research is conducted by or under the direction of any employee or agent of this facility in connection with his or her facility responsibilities, or

(c) The research is conducted by or under the direction of any employee or agent of this facility using any property or component of this facility, or

(d) The research involves the use of this facility's nonpublic information to identify or contact human research subjects or prospective subjects.

(3) It is the policy of this facility that, except for those categories specifically exempted by 32 CFR 219, no research investigator shall involve any human being as a subject in research unless the research investigator has obtained the legally effective informed consent of the subject, or for research intended to be beneficial to the subject, the subject's legally authorized representative. IRB waiver of informed consent, as defined at 32 CFR 219.116, is not permitted within DoD for research involving humans as experimental subjects (see Title 10, USC 980). Categories of exemption as defined above [32 CFR 219.101 paragraph (b)(1-6)] shall not be confused with minimal risk categories referenced in 32 CFR 219.110. Human subjects research defined as "minimal risk" is eligible for expedited review to the extent permitted by 32 CFR 219.110."

(4) This facility acknowledges and accepts its responsibilities for protecting the rights and welfare of human subjects of research covered by this policy.

(5) This facility assures that before human subjects are involved in research covered by this policy, proper consideration will be given to:

(a) The risks to the subjects,

(b) The anticipated benefits to the subjects and others,

(c) The importance of the knowledge that may reasonably be expected to results, and

(d) The informed consent process to be employed.

(6) This facility acknowledges that it bears full responsibility for the performance of all research involving human subjects, covered by this policy.

(7) This facility bears full responsibility for complying with federal, state, or local laws as they may relate to research covered by this policy.

(8) This facility encourages and promotes constructive communication among the research administrators, department heads, research investigators, clinical care staff, human subjects, and facility officials as a means of maintaining a high level of awareness regarding safeguarding of the rights and welfare of the subjects.

(9) This facility will exercise appropriate administrative overview carried out at least annually to insure that its practices and procedures designed for the protection of the rights and welfare of human subjects are being effectively applied.

(10) This facility will consider additional safeguards in research when that research involves pregnant women, children, other potentially vulnerable groups and human in vitro fertilization.

(11) This facility shall provide each individual at the facility conducting or reviewing human subject research (e.g., research investigators, department heads, research administrators, and research reviewers) with a copy of this statement of ethical principles and policy.

PART 2

Applicability of Assurance and Responsibilities:

In regard to the Protocol entitled:

"Project Manager (PM) Personal Attributes as Predictors for Success

Protocol Number _____, submitted on behalf of:

Daniel T. Holt, Lt Col, USAF

Principal Investigator, this facility has complied and will continue to comply with the requiments of 32 CFR 219 as specified below.

1. IRB Review

   a. The AFRL Wright-Site IRB has reviewd and approved the above Protocol .

   b. The IRB determined, in accordance with the criteria found at 32 CFR 219.111, and where applicable, 45 CFR 46 Subparts B, C, and D, that protections for human research subjects are adequate.

   c. The IRB has the authority to suspend or terminate approval of research activity in accordance with 32 CFR 219.113 because of (1) noncompliance with 32 CFR 219, this Assurance document, or the IRB's requirements; or (2) unexpected serious harm to subjects.

d. The IRB has determined that legally effective informed consent (copy of document must be attached) will be obtained in a manner and method which meets the requirements of 32 CFR 219.116 and 219.117, and in the case of research involving children, 32 CFR 219.408.

e. The IRB shall review, and have the authority to approve, require modification in, or disapprove changes proposed in this research activity.

f. The IRB shall conduct continuing reviews of all research at intervals appropriate to the degree of risk, but not less than once per year (32 CFR 219.109(e)). The Chairperson at the request of any IRB member or Facility Official to consider any matter concerned with the rights and welfare of any subject may call the IRB into an interim review session.

g. The IRB shall prepare and maintain adequate documentation of its activities in accordance with 32 CFR 219.115.

h. The IRB shall report promptly to the facility Dean and HQ USAF/SGRC:

(1) Any serious or continuing noncompliance by investigators with the requirements of the IRB, and

(2) Any suspension or termination of IRB approval.

i. The IRB shall report promptly to the facility Dean any information received concerning:

(1) Injuries to human subjects,

(2) Unanticipated problems involving risks to subjects or others, and

(3) Any changes in this research activity which are received and approved by the IRB.

2. Responsibilities of the Institution with the IRB

a. The Air Force Research Laboratories authorizes designation of its IRB for review of the project named in this Assurance.

b. Air Force Research Laboratories has provided and will continue to provide both meeting space for the IRB and sufficient staff to support the IRB's review and record keeping duties.

c. In accordance with the compositional requirements of section 219.107 of 32 CFR 219, Air Force Research Laboratories has established an IRB as listed in the attached roster. This IRB is responsible for the initial and continuing review of this activity and will observe the quorum requirements of 32 CFR 219.108.

3. Research Investigator Reporting Responsibilities

a. Research investigators shall report promptly to the IRB proposed changes in this research activity and the changes shall not be initiated without IRB review and approval except where necessary to eliminate apparent immediate hazards to the subjects.

b. Research investigators shall report promptly to the IRB any unanticipated problems involving risks to subjects and others.

4. Facility Responsibilities

a. This facility shall report promptly to HQ USAF/SGRC:

(1) Injuries to human subjects,

(2) Unanticipated problems involving risks to subjects or to other, and

(3) Any changes in this research activity which are reviewed and approved by the IRB and this facility.

b. In addition to the review and approval of the IRB, this facility reviewed and sponsors the project entitled:

"Project Manager (PM) Personal Attributes as Predictors for Success."

PART 3

Air Force Institute of Technology

Facility certification and endorsement and HQ USAF/SGRC approval regarding this Assurance and the Project entitled: "Project Manager (PM) Personal Attributes as Predictors for Success Study."

1. I certify that the above Project was reviewed and approved by the Wright Site IRB in accordance with the requirements of Part 219, Title 32 of the Code of Federal Regulations and this Assurance of Compliance on 23 Oct 2006

IRB Chairperson

Signature [signature] Date 23 Oct 2006

Jeffrey J. Bidinger, Maj, USAF, MC, FS
Chairperson, Wright Site IRB
AFRL/HEPG
2215 First Street, Bldg 33
Wright-Patterson AFB, OH 45433
937-255-4563 FAX 937-255-9687
jeffrey.bidinger@wpafb.af.mil

****

The Signatory Official must be a senior Facility Official who has the authority to commit the entire facility named in the Assurance application, as well as all of the Facility components to a legally binding agreement. Entities that the Signatory Official is not legally authorized to represent may not be covered under the Assurance. This individual must also have the authority to assure compliance of the Facility and all of its components to the terms of the Assurance. The IRB Chair and IRB members are not appropriate personnel to serve as the Signatory Official.

2. I certify that this facility endorses the above project and abides by the principles, policies, and procedures of Parts 1 and 2 of this Assurance of Compliance.

Authorized Facility Official

Signature [signature] Date 26 Jul 06

Dr. Heidi Ries
Dean for Research, Graduate School of Engineering and
2950 Hobson Way, Bldg 641/Rm 100
WPAFB OH 45433
Telephone 937-255-3633 Fax 937-656-9043
E-mail heidi.ries@afit.edu

3. Authorized Official of the Institution with the IRB
(Include only if different from the facility named in Part 3, paragraph 2 above)

I certify that this institution abides by the procedures of Part 2, paragraph 2, of this Assurance.

Signature: _____ Date: OCT 2 6 2006

Hendrick W. Ruck, PhD, SES
Director, Human Effectiveness Directorate
AFRL/HE
2610 Seventh Street
Wright-Patterson AFB, OH 45433-7008
Commercial: 937-255-0215 DSN: 785-0215
Hendrick.Ruck@wpafb.af.mil

4. Responsible Research Investigator at Facility

I certify that I will abide by this Assurance, including the procedures stated in Part 2, paragraph 3.

Signature: _____ Date: 21 July 06

Daniel T. Holt, Lt Col, USAF

Assistant Professor of Management

2950 Hobson Way, Bldg 640/Rm 104b
Wright Patterson AFB, OH 45433

Telephone 937-255-3636 x7396 Fax 937-656-4699

E-mail daniel.holt@afit.edu

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Print Form

THIS PART FOR HQ USAF/SGRC USE ONLY

3. All parts of this Assurance are in compliance with the requirements of Part 219, Title 32 of the Code of Federal Regulations; 10 USC 980; AFI 40-402; DODD 3216.2; and where applicable, 21 CFR 50, 21 CFR 56, and 45 CFR 46 (Subparts B, C, D) under the authority of the Department of Defense.

ASSURANCE NUMBER SPA # 50189

Project Title: FWR20060071H, "Project Manager (PM) Personal Attributes as Predictors of Success"

Signature: _____ Date: NOV 1 5 2006

Name: JOSEPH J. NARRIGAN, Lt Col, USAF, BSC

Address: HQ USAF/SGRC
Office of the Surgeon General
5201 Leesburg Pike, Suite 1401
Falls Church, VA 22041

Telephone: (703) 681-6103
FAX: (703) 681-8050
E-Mail Address: joe.narrigan@pentagon.af.mil

This assurance expires **three years** from the date of its approval. It must be updated regularly subject to a change in Signatory Official, the IRB Chair, the IRB membership, or of the policies and procedures to maintain this Single Project Assurance file current. A revised and dated IRB membership roster must be submitted if there is a change in the IRB membership. For its uninterrupted continuation, this Assurance must be renegotiated with HQ USAF/SGRC prior to its expiration.

Expiration Date: 14 Nov '09

Appendix G – Institutional Review Board (IRB) Approval

DEPARTMENT OF THE AIR FORCE
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

16 November 2006

MEMORANDUM FOR AFIT (Daniel T. Holt)

FROM: AFRL/Wright Site Institutional Review Board

SUBJECT: IRB approval for the use of human volunteers in research

1. Protocol title: Project Manager (PM) Personal Attributes as Predictors for Success

2. Protocol number: F-WR-2006-0071-H

3. Risk: Minimal

4. Approval date: 23 October 2006

5. Expiration date: 23 October 2007

6. Scheduled renewal date: 23 September 2007

7. Type of review: Initial

8. The above protocol has been reviewed and **approved** by the Wright Site IRB via **expedited** review procedures. This protocol meets the criteria for expedited review established by the U.S. Department of Health and Human Services per category (7): Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

9. This approval applies to human use research (as defined in 32 CFR 219 and AFI 40-402) portions of this project only. Attitude and opinion surveys associated with this research must be conducted IAW AFI 36-2601.

10. Any serious adverse event or issues resulting from this study should be reported immediately to the IRB. Amendments to protocols and/or revisions to informed consent documents must have IRB approval prior to implementation. Please retain both hard copy and electronic copy of the final approved protocol and informed consent document.

11. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator. Please ensure the timely submission of all required progress and final reports and use the templates provided on the Wright Site IRB web site https://www.he-internal.afrl.af.mil/org/IRB/index.htm.

12. For questions or concerns, please contact the IRB administrator, Helen Jennings at (937) 904-8094 or helen.jennings@wpafb.af.mil OR Lt. Douglas Grafel at douglas.grafel@wpafb.af.mil or (937) 656-5437.

JEFFREY BIDINGER, Maj, USAF, MC, FS
Chair, AFRL/Wright Site IRB

References

Abel, M. H., & Brown, L. K. (1998). Validity of the 16PF reasoning ability scale. *Psychological Reports, 83*(3), 904-906.

Ahmad, S., & Schroeder, R. G. (2002). The importance of recruitment and selection process for sustainability of total quality management. *The International Journal of Quality & Reliability Management, 19*(5), 540-550.

Anderson, S. D., & Tucker, R. L. (1994). Improving project management of design. *Journal of Management in Engineering, 10*(4), 35-44.

Bartram, D. (2005). The great eight competencies: A criterion-centric approach to validation. *The Journal of Applied Psychology, 90*(6), 1185-1203.

Bowenkamp, R. D., & Kleiner, B. H. (1987). How to be a successful project manager. *Industrial Management & Data Systems,* (Mar/Apr), 3-7.

Brugger, W. E., Gerrits, R. J., & Pruitt, L. L. (2000). Effective project management equals successful military engineering. *Cost Engineering, 42*(11), 33.-37

Carr, P. G., De La Garza, Jesus M., & Vorster, M. C. (2002). Relationship between personality traits and performance for engineering and architectural professionals providing design services. *Journal of Management in Engineering, 18*(4), 158-166.

Conn, S. R., & Rieke, M. L. (1994). *The 16PF fifth edition technical manual*. Champaign, Ill: Institute for Personality and Ability Testing.

Crawford, L. (2000). Profiling the competent project manager. *Project management research at the turn of the millennium: Proceedings of PMI research conference,* Paris, France. 3-15.

Crawford, L., Pollack, J., & England, D. (2006). Uncovering the trends in project management: Journal emphases over the last 10 years. *International Journal of Project Management, 24*(2), 175-184.

de Raad, B., & Perugini, M. (2002). *Big five assessment*. Seattle, WA: Hogrefe & Huber Publishers.

Dunteman, G. H. (1989). *Principal component analysis*. Newbury Park: Sage Publications.

Einsiedel, A. A.,Jr. (1987). Profile of effective project managers. *Project Management Journal, 18*(5), 51-56.

El-Saba, S. (2001). The skills and career path of an effective project manager. *International Journal of Project Management,* (19), 1-7.

Farrell, S., & Hakstian, A. R. (2001). Improving salesforce performance: A meta-analytic investigation of the effectiveness and utility of personnel selection procedures and training interventions. *Psychology & Marketing, 18*(3), 281-316.

Folkman, S., & Moskowitz, J. T. (2004). Coping: Pitfalls and promise. *Annual Review of Psychology, 55*, 745-774.

Foxall, G. R., & Hackett, Paul M. W. (1992). The factor structure and construct validity of the Kirton Adaption-Innovation inventory. *Personality and Individual Differences, 13*(9), 967-975.

Gatewood, R. D., & Feild, H. S. (2001). *Human resource selection* (5th ed.). Philadelphia: Harcourt College.

Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., & Cloninger, C. R., et al. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality, 40*(1), 84-96.

Goodwin, & Robert S.C. (1993). Skills required of effective project managers. *Journal of Management in Engineering, 9*(3), 217-226.

Grant, K. P., Baumgardner, C. R., & Shane, G. S. (1997). The perceived importance of technical competence to project managers in the defense acquisition community. *IEEE Transactions on Engineering Management, 44*(1), 12-19.

Gushgari, S. K., Francis, P. A., & Saklou, J. H. (1997). Skills critical to long-term profitability of engineering firms. *Journal of Management in Engineering, 13*(2), 46-57.

Hatfield, J. D., & Huseman, R. C. (1982). Perceptual congruence about communication as related to satisfaction: Moderating effects of individual characteristics. *Academy of Management Journal, 25*(2), 349-358.

Hauschildt, J., Keim, G., & Medcof, J. W. (2000). Realistic criteria for project manager selection and development. *Project Management Journal, 31*(3), 23-32.

Hughes, S. W., Tippett, D. D., & Thomas, W. K. (2004). Measuring project success in the construction industry. *Engineering Management Journal, 16*(3), 31-37.

Huselid, M. A. (1995). The impact of human resource management practices on turnover, productivity, and corporate financial performance. *Academy of Management Journal, 38*(3), 635-672.

Hyväri, I. (2006). Project management effectiveness in project-oriented business organizations. *International Journal of Project Management, 24*(3), 216-225.

Jolliffe, I. T. (1986). *Principal component analysis*. New York: Springer-Verlag.

Judge, T. A., Thoresen, C. J., Pucik, V., & Welbourne, T. M. (1999). Managerial coping with organizational change: A dispositional perspective. *The Journal of Applied Psychology, 84*(1), 107-122.

Jugdev, K., & Müller, R. (2005). A retrospective look at our evolving understanding of project success. *Project Management Journal, 36*(4), 19-31.

Jugdev, K., & Thomas, J. (2002). Project management maturity models: The silver bullets of competitive advantage? *Project Management Journal, 33*(4), 4-14.

Katz, R., & Tushman, M. (1979). Communication patterns, project performance, and task characteristics: An empirical evaluation and integration in an R&D setting. *Organizational behavior and human performance, 23*(2), 139-162.

Keane, J. F. (1996). A holistic view of project management. *AS/400 Systems Management, 24*(6), 58-61.

Kim, H., & Yukl, G. (1995). Relationships of managerial effectiveness and advancement to self-reported and subordinate-reported leadership behaviors from the multiple-linkage mode. *The Leadership Quarterly, 6*(3), 361-377.

Kirton, M. (1976). Adaptors and innovators - a description and measure. *The Journal of Applied Psychology, 61*(5), 622-629.

Kloppenborg, T. J., & Opfer, W. A. (2002). The current state of project management research: Trends, interpretations, and predictions. *Project Management Journal, 33*(2), 5-18.

Lake, D. G., Miles, M. B., & Earle, R. B. (1973). *Measuring human behavior; tools for the assessment of social functioning*. New York: Teachers College Press.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer Publishing.

Le Pine, Jeffrey A., Colquitt, J. A., & Erez, A. (2000). Adaptability to changing task contexts: Effects of general cognitive ability, conscientiousness, and openness to experience. *Personnel Psychology*, (53), 563-593.

Lynch, P. D., Eisenberger, R., & Armeli, S. (1999). Perceived organizational support: Inferior versus superior performance by wary employees. *The Journal of Applied Psychology*, *84*(4), 467-483.

McDonough III, E. F. (1990). Investigation of the relationship between project performance and characteristics of project leaders. *Journal of Engineering and Technology Management*, (6), 237-260.

Meredith, J. R., & Mantel, S. J. (2006). *Project management : A managerial approach* (6th ed.). New York ; Chichester: Wiley.

Morris, P. W. G. (1997, November). *Professionalism in project management*. Paper presented at the meeting at the meeting of the Institution of Electrical Engineers on Professionalism in Project Management, London, United Kingdom.

Morse, J. J., & Wagner, F. R. (1978). Measuring the process of managerial effectiveness. *Academy of Management Journal, 21*(1), 23-35.

Munns, A. K., & Bjeirmi, B. F. (1996). Role of project management in achieving project success. *International Journal of Project Management, 14*(2), 81-87.

Northouse, P. G. (2004). *Leadership: Theory and practice* (3rd ed.). Thousand Oaks: Sage Publications.

Odusami, K. T. (2002). Perceptions of construction professionals concerning important skills of effective project leaders. *Journal of Management in Engineering, 18*(2), 61-67.

Patrick, C., Curtin, J., & Tellegen, A. (2002). Development and validation of a brief form of the multidimensional personality questionnaire. *Psychological Assessment, 14*(2), 150-163.

Pettersen, N. (1991). Selecting project managers: An integrated list of predictors. *Project Management Journal, 22*(2), 21-25.

Pinto, J. K., & Kharbanda, O. P. (1995). Lessons for an accidental profession. *Business Horizons, 38*(2), 41-50.

Pitagorsky, G. (1998). The project manager/functional manager partnership. *Project Management Journal, 29*(4), 7-15.

Posner, B. Z. (1987). What it takes to be a good project manager. *Project Management Journal, 18*(1), 51-54.

Radecki, C. M., & Jaccard, J. (1996). Gender-role differences in decision-making orientations and decision-making skills. *Journal of Applied Social Psychology, 26*(1), 76-94.

Ree, M. J., & Earles, J. A. (1991). Predicting training success: Not much more than g. *Personnel Psychology, 44*(2), 321-332.

Robertson, I. T., & Smith, M. (2001). Personnel selection. *Journal of Occupational and Organizational Psychology*. (74), 441-470.

Salgado, J. F., Anderson, N., Moscoso, S., Bertua, C., de Fruyt, F., & Rolland, J. P. (2003). A meta-analytic study of general mental ability validity for different

occupations in the European community. *Journal of Applied Psychology, 88*(6), 1068-1081.

Samovar, L. A., & Mills, J. (1995). *Oral communication: Speaking across cultures* (9th ed.). Dubuque, Iowa: Brown & Benchmark.

Schmidt, F. L. (2002). The role of general cognitive ability and job performance: Why there cannot be a debate. *Human Perfomance, 15*(1/2), 187-210.

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological* Bulletin. *124*(2), 262-274.

Smith, N. J. (Ed.). (1995). *Engineering project management*. Cambridge, MA: Blackwell Science, Inc.

Snyder, R. A., & Morris, J. H. (1978). Reliability of the factor structure of the Wagner and Morse competence index. *Psychological Reports, 43*, 419-425.

Thamhain, H. J. (2004). Team leadership effectiveness in technology-based project environments. *Project Management Journal, 35*(4), 35-46.

Trumbo, D. A. (1961). Individual and group correlates of attitudes toward work-related change. *Journal of Applied Psychology*. *45*(5), 338-344.

Turner, J. R., & Müller, R. (2003). On the nature of the project as a temporary organization. *International Journal of Project Management, 21*(1), 1-8.

Turner, J. R., & Müller, R. (2005). The project manager's leadership style as a success factor on projects: A literature review. *Project Management Journal, 36*(2), 49-61.

Urli, B., & Urli, D. (2000). Project management in North America, stability of the concepts. *Project Management Journal, 31*(3), 33-43.

Van Dyne, L., Graham, J. W., & Dienesch, R. M. (1994). Organizational citizenship behavior: Construct redefinition, measurement, and validation. *Academy of Management Journal, 37*(4), 765-802.

Wagner, F. R., & Morse, J. J. (1975). A measure of individual sense of competence. *Psychological Reports, 36*, 451-459.

Zimmerer, T. W., & Yasin, M. M. (1998). A leadership profile of American project managers. *Project Management Journal, 29*(1), 31-38.

Vita

Captain Vhance Valencia grew up in a military home and was privileged to travel the world during his father's service in the United States Air Force. He graduated from Wylie High School in Abilene, TX in 1996 and attended San Diego State University in San Diego, CA from 1996 to 2001. There, he earned a Bachelor of Science degree in Mechanical Engineering and a commission in the United States Air Force through the university's Reserve Officer Training Corps unit, Detachment 075.

Captain Valencia' first assignment as an Air Force civil engineer was with the 1st Civil Engineer Squadron at Langley Air Force Base, VA. There he worked as a project programmer identifying, planning, and prioritizing repair and construction project requirements for base facilities. He played a significant role in Langley's Hurricane Isabel recovery efforts through the programming and identifying over $150 million dollars of facility repair projects. In 2004, he deployed to Al Udeid Air Base, Qatar as part of a civil engineer staff providing assistance and guidance to engineers within the Operation Enduring Freedom area of responsibility.

Captain Valencia entered the Air Force Institute of Technology at Wright-Patterson Air Force Base, OH in August 2005. Upon graduation, he will return to Al Udeid Air Base, Qatar for a one-year tour assigned as the Engineering Flight Commander with the 379th Expeditionary Civil Engineer Squadron.

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14. ABSTRACT

The purpose of this research was to determine what personal attributes project managers (PMs) possess which leads them to project management success. Numerous attributes are identified in the literature through a variety of methods, but very few studies relate specific qualities to success. The traits identified in the literature were compiled and condensed into seven distinct skills and attributes: leadership ability, communication skill, decision making skill, administrative skill, coping ability, analytical thinking, and technical competence. A survey method was developed which involved the PM, to measure levels of each attribute, and the PM's supervisor and project data, to provide a level of PM success. PMs and their supervisors from the Air Force Center for Environmental Excellence, a project management firm within the United States Air Force, were invited to participate in the study. Through correlation and regression analysis, a sample of 23 PMs suggest that administrative ability is the single most important trait to possess. Leadership ability emphasizing teamwork, decision making skill with moderate levels of an adaptive decision making style, and moderate levels of technical competence were found to also contribute towards PM success. No conclusions could be drawn on communication skill, analytical thinking, and coping ability.

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