

## Thesis Approval Page

Project Management Capability Assessment: A Case Study of Higher Education IT

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## Abstract

Higher education is becoming an ultra-competitive market that is continually re-shaped by technology, students, diversity, demographics, politics and the economy. To compete in this market for a reduced pool of student and while adapting to a decade's long trend in public reduction in funding many public Higher education institutes (HEIs) find themselves struggling to change their antiquated models that have worked for decades. Decision makers and leaders in public HEIs find themselves in the unenviable position of attempting to balance the increasing and changing demands of employers, taxpayers, and students in a global knowledge-based economy while under increasing pressure to prove their relevance in society. HEIs are turning to project management (PM) to deliver change and innovation but are struggling to capitalize on the performance and effectiveness that many other industries expect from PM practices. Many industries have used PM capability maturity models in the last three decades with success to help assess, build and identify gaps in their organization's PM practices. If HEIs are going to mature into a project-based organization that takes advantage of the efficiency's and reliability to operational practices offered by using PM; organizational culture change is needed. This study is committed to helping HEI practitioners and leaders develop a more in-depth understanding of current organizational PM capability. This survey utilized a mixed method approach to collect qualitative and quantitative information that generates insight and enriches the understanding of HEI complex organizations. Survey, interviews and document artifact analysis tools will be used to investigate how culture, leadership, resource management, and PM skills influence PM capability. This study investigates factors within the context of HEI Information Technology (IT) organizations to assess and identify the current variables that have substantial relationships in determining project outcomes and performance. The results have shown culture, leadership, resource management, and PM skills have a significant relationship in determining an organization's project capability in the HEI context, and IT leaders are optimistic about project management's ability to help campus IT projects perform. Leaders and practitioners in HEI using the capability maturity model can consider the uniqueness of their organization in their strategic plans to effectively build organizational PM capability to reduce the risk and increase project performance which in turn increases the likelihood of project success. The researcher thinks that this work has added to the context of project maturity, capability, and performance in public HEI context.

## **Dedication**

I dedicate this thesis to Dr. Ginger Levin who passed about halfway through the writing of this paper. Dr. Levin was my advisor, mentor and friend and a great inspiration to me in the formulation of the idea for this paper. Ginger was well known and regarded in the Project Management community and was very proud to be the second person in the world to have passed the PgMP exam. She inspired and helped many succeed in obtaining their certifications.

I will always remember one piece of advice she gave me about writing, and that was to have courage in whatever you wrote. I will also remember and miss talking baseball and ribbing Ginger for being a Yankees fan. Her stories and experiences inspired me to continue moving forward in education. I am proud to say I knew and learned a lot from Dr. Ginger Levin both as a teacher and a person. She will be missed by many.

## **Acknowledgments**

Most of all I would first like to thank my wife, Tammy, who endured this long journey with me and never gave up hope on me finishing even in my darkest hours. Her total belief in me gave me the courage to continue.

I would then like to thank my thesis advisor Dr. George Watson for stepping out of retirement to help me complete this journey. Dr. Watson consistently challenged me to be a better writer and researcher. I am very appreciative to George as he was always there to answer my questions in a quick and kind demeanor. I would to thanks my thesis committee comprised of Dr. Michael O'Connor and Shawn Belling for taking time out of their busy lives to help me accomplish my educational goals.

I am grateful to all that participated in survey and interviews for this study that I cannot name. I learned more from this experience and you than could be captured in these pages. Thank you for your time and sharing of your thoughts and experiences on project management in Higher Education.

Finally, I would like to acknowledge and thank the community that it took to write this thesis. I am inspired by the selflessness of those that helped me complete my thesis. I am greatly appreciative to all those that helped with the paper, had words of encouragement, or just listened to my ramblings. There are way too many to list but here are a few that stood out: Sue Traxler, Susan Greene, Bonni Faulkner, and Vicki Weber.

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## List of Abbreviations

AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
CBPP	Center on Budget and Policy Priorities
CIO	Chief Information Officer
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
CPM	Corporate Performance Management
DOD	Department of Defense
EFQM	European Foundation for Quality Management
HEI	Higher Education Institutes
IRB	Institutional Review Board
ITIL	Information Technology Infrastructure Library
ITSM	Information Technology Service Management
P-CMM	People – Capability Maturity Model
PM	Project Management
PMBOK	Project management Body of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
OPM3	Organizational Project Management Maturity Model
PERT	Program Evaluation and Review Technique
ROI	Return on Investment
TQM	Total Quality Management

## Chapter I. Introduction

This study will investigate how culture, leadership, resource management, and PM skills influences project capability in Higher Education Institutes (HEIs). This study investigates factors within the context of HEI Information Technology (IT) organizations to discover the variables that have significant relationships with project management capability. This study will focus on organizational factors that influence the Project Management (PM) capability of the institution relating to performance. Dr. Harold Kerzner states, “Project management is no longer regarded as a part-time occupation or even a career path position. It is now viewed as a strategic competency needed for the survival of the firm. Superior project management capability can make the difference between winning and losing” (p. 3, 2017). The Project Management Institutes (PMI) annual *Pulse of the Profession* report estimates that “9.9% of every dollar is wasted due to poor project performance, \$99 million for every \$1 billion invested” (PMI, 2018, p. 2). An organization’s ability to accurately judge its current PM capabilities could be the deciding factor in how organizations will perform in future markets (Heneman, 2007).

Researchers found in previous studies that using context-specific PM maturity model assessment tools can measure the relationship between PM capability and relay that the approach increases an organization’s likelihood of increasing project performance (Crawford & Group, 2015; Hillson, 2003; Rolstadås et al., 2014; Paulk & Curtis, n.d. Zubrow, 2003). “If your organization is not good at project management, you are putting too much at risk in terms of delivering on strategy” (PMI, 2018, p. 2). Literature does support the idea that increased PM capabilities increases the likelihood of competitive advantages from the iron triangle perspective (scope, cost and time) but can also increase the likelihood of project effectiveness, and customer satisfaction.

The purpose of this study is to identify factors that influence PM capability of an organization by examining culture, leadership, resource management PM skills domains that influence project performance by using defined maturity levels of the four domains. Domains are collections of key process areas. A maturity level defines the major characteristics of key

business processes of an organization based on best practices or standards (Paulk et al., 1993). Project Management capability assessments identify gaps and patterns in how HEI organizations conduct PM work against best PM practices standards collected from the literature review and other industries. The capability assessment examines the domains (independent variables) of culture, leadership, resource management, and PM skills research literature supports importance in determining PM capability (Bryde & Leighton, 2009; Hillson, 2003; Synder; 2017). Understanding the correlation of independent variables on PM capability from a public IT worker's perspective will provide a deeper understanding of the current state of the public HEI IT organization's PM capabilities. Studies like this are relevant because relationships are identified and measured between context variables of public HEIs and PM capability that may not be present in corporate environments. This survey can help HEI leaders and practitioners set realistic PM expectations based on their organization's PM capability.

## **Background**

The environment in public HEIs is changing rapidly in the United States. Many argue that disruptive innovation is already modifying the Higher Educational landscape and that the Great Recession of 2008 accelerated disruption in the field (Christensen, 2011). Whether in agreement with that statement or not, education is becoming an ultra-competitive market that is being re-shaped continuously by technology, students, diversity, demographics, government and the economy. Public HEIs leaders find themselves in the awkward situation of attempting to balance varying needs of corporations, politicians, taxpayers, and students while upholding function in furthering human knowledge, economic systems, and social concerns.

Decreasing public investments in HEIS have further complicated the task since the recession of 2008. Public funding for higher education has typically rebounded after recessions, but as of 2017 public spending for two- and four-year institutions are still nearly \$9 billion below the 2008 level when considering inflation (Mitchell, Leachman & Masterson, 2017, p. 1). With decreasing state and federal funding HEIs find themselves, "forced to evolve and be managed efficiently and effectively" or not and close (Costa, Maccari, Martins & Kniess, 2014, p. 1). In order to combat lower public funding from both federal and state, HEIs are attempting to reduce the risk of failure or waste by increasing an organizational project capability (Austin et al.; Kuo, 2019; Scott, 2011).

In order to increase project capability, many HEIs are exploring and investing in more formalized mature project management practices. HEIs like many other late adopting industries with immature PM practices are noticing the benefits of PM are not quite what they were expecting (Bryde & Leighton, 2009). Many researchers have acknowledged the role of organizational culture in project management performance and success (Yazici, 2017). Culture can be defined as “an organization’s personality that is comprised of assumptions, beliefs, values, norms, and artifacts of organizational members and their behaviors” (Lawrence, 2007, para. 3).

To build on the body of research, this researcher selected the following research question and hypothesis shown in Table 1.1. The culture was the domain or variable chosen for the hypothesis because of its overall influence on the other organization behaviors measured in this study. “These measurements all characterize an existing organizational culture” (Yazici, 2011, p. 22).

**Table 1.1 Research Questions and Hypothesis**

<b>Research Question and Hypothesis</b>	
<b>Research Question</b>	Is project capability significantly influenced by the relationship among culture, leadership, resource management, and PM skills?
<b>Hypothesis</b>	Culture significantly influences PM capability in HEIs.

### **Brief Overview of Methodology**

This study will use a non-experimental mixed method approach to collect data, with the intent of generalizing the sample to the population of four HEI IT departments participating in the study. The instruments chosen for the study included an online survey, interviews, and document artifact analysis. A pilot case study will be conducted to examine the feasibility of data aggregation and analysis methods discussed in chapters three and four. The data from the pilot and main study will be gathered, studied and organized into case studies to reduce inconsistencies in data before combining for further analysis. A pilot assessment of one HEI IT department site conducted followed by the assessment of three other volunteering HEI IT department test sites for the main study. The capability assessment will last 30 days at each site, and all data collected during that period. Correlation and regression analysis will be employed to investigate the strength and direction of the relationships of the independent variables and PM capability.

## **Assumptions**

This study assumes public HEIs are all unique organizations based on the community and stakeholder's ideologies, values and perceptions. Public HEIs provide intangibility of service, meaning that measuring value cannot be used because the perceived value is different for each stakeholder and community (Thomas & Mullally, 2008). HEIs mission or roles in society, economy, and community are defined through many different lenses which complicate goals and strategies. The significance of this assumption is that there is no one size fits all solution, step-by-step playbook or silver bullet for implementing and executing project management practices successfully in an organization (Jugdev & Thomas, 2002b). Discovering the solution that works best for an organization improving PM capabilities requires an honest appraisal of the current organization's current PM capabilities. "Maturity Models can be applied to an organization, a business unit or a team to provide a road map for performance improvement" (Demir & Kocaba, 2011, p. 1644). A Capability Maturity Model (CMM) has been selected by the researcher as the framework and methodology for a PM capability assessment in public HEIs.

## **Research Limitations**

The main focal point of this work is to understand how culture, leadership and resource management, and PM skills influence PM capability in public HEIs. There is a limited number of case studies, research and capability maturity models specifically designed and focused on PM practices in public HEIs. This research is limited by the lack of an agreement of standard for capability maturity models and a uniform way for developing project management in different organizations and industries (Gorog, 2016; Supic, 2005). This deficiency of standard or HEI context-specific model can threaten the validity of the research results. The model used in this study is a combination of multiple capability maturity models derived from the literature review.

Due to diverse individual and organizational PM expertise and research time constraints, a limitation is that interpretations of survey questions would vary. To help reduce response variability, random sampling was not used in this study as it was thought it would create an even wider variation in responses. The participants' pool for interviews and an online survey was intentionally limited by the researcher to one public state school system comprised of 13 universities to create a common language. By limiting the pool to the one school system, the researcher thought a common language could be established using the common IT projects that each site was charged to complete from the school system administration. A common language

was thought to help combat the wide variation of PM expertise and interpretations. Allowing the researcher to compare and contrast results from multiple HEI sites within the system without examining specific individual projects or further limiting response pool to only Project Managers. Due to these research limitations, the participants' pool was significantly reduced to help improve the participant's interpretation of survey questions and fundamental concepts of the study.

Another limitation of this study will be the ability to control the bias of the respondents and the researcher. Acquiescent response bias is the tendency of many respondents to give positive, agreeable, or optimistic answers to most survey questions, regardless of whether or not they agree with the item in reality (Paulhus 1991). Participants respond to the items mindlessly, without weighing up the options (Alzahrani, 2015). This research is also limited by a self-selection or non-response bias as well. Self-selection or non-response bias is one of the most common forms of bias with surveys that rely on voluntary participation (Save the children, 2014). People with strong views about PM may be the only ones that volunteer to participate in the study potentially creating a variance in the data results because they may not reflect the opinions of the whole population are creating a bias that is hard to distinguish and manage (Paulhus, 1991). Lastly, the researcher's personal world view and individual biases are contributing elements that may influence the study. It is necessary to be cognizant of these factors and safeguard against interjecting bias within the study.

### **Significance of the Study**

Research into public HEIs PM capability is foundational as HEIs integrate PM into operational practices to reduce risk and costs. Moving forward public HEIs will be dealing with increased competition for a reduced student population, lower public funding, and a social outcry for keeping education affordable. HEI leadership will be interested in the study because it provides insight into the domain relationships and how they influence PM capability. The knowledge that can be used to make impactful strategic decisions to move PM practices for forward.

Due to the late adoption of PM practices, many HEIs find themselves in an immature state, unable to solve or identify organizational factors affecting their PM practices because they have yet to internally and formally define the PM processes for their unique institute (Bryde & Leighton, 2009; Gorog, 2016; Nesensohn et al., 2014; Pasion, 2011; Synder, 2017; Torres,

2014). This study is significant because it will help fill the gap in the literature about HEI and PM practices. Research conducted in 2017, concluded that “26 out of 895 peer-reviewed articles published since 1990” were related to HEI maturity, capability and performance (Snyder, 2017, p. V). This study is an attempt to fill in the gap of literature, and further, the discussion as HEIs grow and integrate PM practices into their organizations using benchmarking.

## **Summary**

Many public HEIs find themselves in a state of change, struggling with antiquated models that have worked for decades trying to adapt to the current environment. Changes in financial support, student needs and increased competition for a smaller student population are challenging many institutes to improve the outcomes and performance of their project. A Capability Maturity Model (CMM) will be used to assess how culture, leadership, resource management, and PM skills influence public HEIs project management capability. Capability Maturity Models have been used in other industries to successfully to create a more in-depth understanding of the organizational behaviors that impact organizational PM capability. Understanding these influences can help organizations strategically improve organizational PM capabilities, thus, in turn, increases the likelihood of success of organizational projects and performance (Bryde & Leighton, 2009; Hillson, 2003; Paulk, 1993). The study will assess public HEI IT organizational behaviors and relationships and the impact on PM capabilities by conducting a non-experimental mixed methods study that uses interviews, online surveys and document artifact analysis collect data. The analysis of the finding can be useful in identifying gaps in project management practices and the creation of benchmark scores that can be used to plan and measure organizational PM capability improvements in public HEI IT departments. Lastly, this study will fill gaps in the HEIs and PM practice in literature, advancing the discussion on the topic.

This study is organized into six chapters. The first chapter provides the background and rationale for studying HEI factors that influence project capability or performance. Chapter Two highlights seven categories that explore project management, performance, PM capability, and the four domains of culture, leadership, resources, PM knowledge, and skills. Chapter Three will discuss the research methods and design used to assess the capability in HEIs test sites. Chapter Four will describe the routines utilized to amass data and the findings of the pilot assessment.

Chapter Five will analyze the data accumulated and present the study's findings. Chapter Six will conclude by summing up findings with recommendations for further inquiry.

## Chapter II. Literature Review

This chapter will review the literature used to support a mixed methods research study investigating the current capability of PM practices of four public HEI IT departments in one school system. The study will focus on measuring and understanding organizational factors that influence PM capabilities and project performance. This study will explore how domains of culture, leadership, resource management, and PM skills and knowledge in public HEI IT departments influence PM capability. Diving into a deeper understanding of what PM capability and maturity are and how they work together to create benchmark scores for an organization's project performance. The literature will also explore how Capability Maturity Models (CMMs) were developed to measure organizational PM practice maturity to determine the capability of an organization. Exploring the CMM history, components, variation of models and benefits of using a CMM model to determine HEIs PM capability. Reviews of literature on existing capability maturity models will contribute to the identification of assessment criteria. According to Demir and Kocaba (2011), improving PM practices, not only helps the individual HEI organization but “the whole of our society will benefit from more effective Project Management” (p. 1644).

Project management is not a new subject. Archeologists claim that the first project managers oversaw the completion of the Great Pyramids. The first signs of project management in the modern era was the advent and use of the Program Evaluation and Review Technique (PERT) and Corporate Performance Management (CPM) tools in construction, engineering, defense, and aerospace industries (Kerzner, 2013). According to the Project Management Institute (PMI), a professional group created in the 1960s, to standardize and share PM knowledge, project management, “is the application of knowledge, skills, tools, and techniques to meet project requirements” (PMBOK, 2017, p. 542). Project management evolved to be far more than a just a planning tool to accomplish simple tasks, and HEIs are hoping PM can help them maximize limited resources, control costs and increase the likelihood of project success. In this study, project success is not only defined by the traditional iron triangle (scope, cost, time) but whether the project delivered the value it promised when a project was accepted to move forward in an organization. If a project does not deliver the promised value to the organization, it can be considered a failure.

In this study, project management practices are either considered formal or informal. Often this designation has different meanings to different users, so it's important when reviewing project management maturity and capability that the formality of PM practices in an organization be defined. The culture of an organization can have a direct impact on deciding organizational PM formality (Kerzner, 2018).

### **Project Management Formality**

The formal project has different definitions and implied meanings for individuals and organizations. Formal project management, according to David Hillson, “typically consist of traditional planning activities.” “The value of a formal and structured approach to project management is becoming increasingly recognized as the discipline develops and more organizations begin to reap the benefits of proactive project-based management” (2003, p. 299). Formal project management typically consists of having a project manager on staff, and an organization typically uses a PM methodology such as agile or waterfall. Formal project management does not necessarily imply strict adherence to procedures and documentation. Formal for the scope of this study will assume organizations are investing time and effort to make sure plans are in place to ensure project performance.

Informal project management assumes that an organization does not use strict standards and rules for managing a project. An informal approach does not have any preferred methodology, scope, roles, control, or responsibilities defined to conduct the project (Wierchem & Johnston, 2005). In this study, an organization is considered informally practicing PM if project processes are ad-hoc and hard to repeat with any consistency. There is no investment in planning at the beginning of a project to ensure it performs as expected. This is not to say that informal project practices can be successful (Kerzner, 2018). “Strong cultures endure and are a means by which organizations can strengthen their performance, adapt to change and changing environments while increasing their chances of survival and maintaining their competitive performance” (Suda, 2007).

### **Organizational Maturity**

This study is based on the concept of organizational maturity and its ability to predict project performance. It is fundamentally important to understand mature and immature organizations in the context of project management and the link to capability and performance. According to the Oxford English Dictionary maturity is defined as the state of “being mature

about physical development, and its associated characteristics” (2019). It is important to note in the definition that characteristics describe maturity. Characteristics will play a pivotal role in users' self-assessing the maturity of their project practices. The identifiable benefits of the mature process are the ability to know how well the process will perform based common characteristics. “Project Management Maturity is, therefore, a level to which an organization has applied project management techniques and is using them in a proper, mature, way” (Supic, 2005, p. 647).

According to the Oxford English Dictionary maturity is defined as the state “of a person, animal, plant, cell, etc.: having not yet attained adulthood or a fully functional stage; not fully developed or grown” (2019). Projects that are not well defined or use ad-hoc processes and practices and consider unpredictable and immature (Pasian et al., 2012). Organizations that are considered immature often characterized as being reactionary and seem to be expending the efforts and resources putting out fires (Paulk et al., 1993). A typical characteristic of an immature organization are projects that go over schedule and budget (Lindberg, 2009). Organizations may have defined PM practices and processes but are still considered immature because they are not enforced rigorously (Paulk & Konrad, 1994).

“In general, a disciplined process is consistently followed because all the participants understand the value of doing so, and infrastructure exists to support the process” (Paulk et al., 1993, p. 2). Studies have linked that mature organizations' projects perform consistently better (Pasian, 2012; Bryde & Leighton, 2009). Mark Mullaly, who has studied the value of PM maturity extensively states, “If a better process does, in fact, lead to improvements in performance, as fundamental principles of project management maturity assume, than there should be an evidenced link between improvements in maturity and attainment of value” (2014, p. 177). Organizations that strive to improve maturity gain improved schedule and budget predictability increased productivity, improved quality, customer satisfaction, employee morale, increased return on investment and decreased the cost of quality (Albrecht & Spang, 2014; Demir & Kocaba, 2011, Goldenson et al., 1998). Project management maturity should be considered an asset to an organization because it can be used to improve processes and project performances to create savings and competitive advantages (Kwak & Ibbs, 2002).

## **Project Management Capability**

Project Management capability is a specific ability to perform, resulting in measurable outcomes or delivery of project requirements. A capability defined in the Oxford English Dictionary as the power or ability to do something or the extent of someone's or something's ability ("Capability," 2018). Capabilities define the qualitative attributes that are utilized to classify a project management competence objectively into clearly defined domain areas (Demir & Kocaba, 2011). Capability in a project-oriented organization is the perceived capability to acquire knowledge and experience and to store it in a 'collective mind (Senge, 1994). Capabilities and experiences of an organization "collective mind" determine how well projects perform. Project management capability is the set of abilities that comprise how an organization collectively plans and makes decisions based on the culture and structure of the environment.

There is more to project management success than meeting scheduled deadlines, staying within budget and scope. PM capability is an organization able to plan and predictably deliver projects that perform consistently (Pinto & Slevin, 1987). As PM practices mature and integrate practices into organizations culture, leaders and executives are finding that PM and capable vehicle to deliver organizational change and strategy. "There is ample evidence that when an organization invests in improving its project management capability in a disciplined and realistic way, it will reap significant returns on its investment" (Demir & Kocaba, 2011, p. 1644). In order to capitalize on this advantage and other PM performance benefits, organizations are finding that they require the right people, with the right set of skills. Understanding the organization's current PM capabilities or skill sets and committing to an investment in PM improvement is an essential factor in growing and increasing project performance output. PM capability as a practice is considered an organizational strategy for building the skills and people resources necessary to meet the organizations strategic and business goals (Dangmei, 2017).

Higher Education Institute IT organizations plan to invest in people, processes and PM tools in hopes of capitalizing on the benefits of the PM to increase project performance. With sizeable investments, organizations often produce underperforming projects which can be confounding to executives paying large amounts of capital with little to no return. "Grant and Pennypacker state, "Modern enterprise cannot afford to improve recklessly or randomly. The modern enterprise must approach improvement purposefully" (2006, p. 59). Consistent plans and strategies are necessary to deliver projects that perform as expected.

Moving from the current state of PM skills and knowledge to a desired future state requires an assessment (Backlund et al., 2015). The first step in developing any organizational capability is to do an honest organizational assessment of the current state PM skills and knowledge. Without this step, an organization is guessing at what PM skills and knowledge are needed to increase an organization's project performance. Organizations need to recognize where they are before they can properly produce a precise improvement plan with steps built into it to build organizational PM capability. Project Management capability management as a science or practice was created by PM professionals to help organizations systematically create, plan and measure the growth of PM capability to help projects perform predictably as required.

**Benefits.** As organizations invest in PM, the goal is to maximize the benefits of PM while minimizing costs to increase competitive advantage and ensure return on investment (ROI). Capability Maturity Models were developed to measure and ensure ROI, as well as help identify gaps in practices to improve output or performance. It is essential to this study that the concept of organizational PM capability and maturity be clearly understood as it is the means or framework of the assessment. "‘Capability’ is distinguished from ‘maturity’ in the sense that as a process develops through stages of maturity, its capability becomes first defined, and then improved" (Cooke-Davies, 2005). As an organization grows using PM practices, it learns how to improve PM practices by defining, repeating, and integrating PM into the organization's core knowledge and capabilities to ultimately create innovation or gain a competitive advantage. Project Management capability as an organizational approach to project management typically creates three outputs or opportunities that can bring value to an organization (Hobbs & Aubry, 2011). Project performance, gap analysis and benchmarking will be covered in more detail below and throughout the literature review as they are vital components of the capability management approach.

**Project performance.** Project performance is the ability of an organization to consistently deliver projects on time and budget that meet stakeholders' expectations. The primary criteria for determining project performance is the triple constraints of time, cost and scope (Barrata, 2006). That definition expanded over the last decade as organizations use PM strategies aligning to increase business value and organizational project performance (Jugdev & Muller, 2005). Performance is measuring the organizational inputs to produce a consistent project output.

Project management maturity is an organizational asset, that is constructed to improve PM practices and effectiveness to increase project performance (Torres, 2014; Ibbs & Kwak, 2002). Higher maturity levels in PM processes lead to higher PM capabilities which equate to increased overall predictability of organizational project performance. Studies have shown that increases in PM maturity, which connects organizational capability has a positive correlation relationship with project performance, whether measuring with schedule or cost indicators (Pennypacker, 2006; Ohara & Levin, 2000).

**Gap analysis.** Capability models evaluate and measure current PM processes, tools, policies, systems identifying and analyzing the gaps between the PM industry or model defined best practice standards. Identified gaps can help create benchmark scores that can be used to compare PM practices against other organizations. These gaps can help identify methods to improve the organizational PM capability or to identify that gap between competitors. Gap analysis is also helpful to leaders and project managers in creating improvement roadmaps for organizations. Leader and project managers can develop systematic plans to build and improve PM practices using the model's maturity levels as ideal goals and for measurement. The model's assessment can be rerun to determine if the changes improved the organization's project performance, rather than guessing or assuming the change solved the impediment to PM performance. Benchmarking and improvement roadmaps will be covered in further details in the CMM section.

**History.** In the 1990s, as the interest in the use of PM grew stronger, the concept of PM capability formed. As corporations began to embrace project management practices and benefits throughout the organization, the focus shifted from the individual project manager's knowledge of PM practices to the organizations or group's PM knowledge. The group's PM knowledge or capability identified as a crucial predictor in project success and through performance (Crawford, 2006). PM capability U.K. origins are traced back to the PRINCE2 PM methodology which was concerned with benefits management and governance. In the late 1990s, in the US, PMI started development of the Organizational Project Management Maturity Model (OPM3) which promoted the advanced discussion and concept of organizational PM capability.

### **Organizational Factors**

There are numerous PM capability studies in multiple industries that have investigated organizational factors that influence PM capability with no consensus (Jugdev & Muller, 2005).

Factors are typically identified and investigated to determine their impact on PM capability typically fall within one of three categories which are economic, social and cultural (Snyder, 2017). Many factors that influence PM capability and the “more coherent the relationship within and between these factors, the better positioned the organization is to achieve its goals and vision” (Tidd, 2001).

Organizational issues or factors are commonly related to structure and organizational functions. “The net result of these factors may be to inhibit the development of a healthy organizational climate, which in turn may impact the coalition’s performance of the operation” (Easter, 1996). This study will organize factors into four domains that will be used to measure PM capability. The four domains chosen for this study are culture, leadership, resource management, and PM skills.

**Culture.** To fully understand PM capability in an organization, the overall organizational culture the PM practices are integrated into must be investigated to determine their influence. “Culture is a complex phenomenon ranging from underlying beliefs and assumptions to visible structures and practices” (Denison et al., 2004, p. 99). An understanding of how an organization thinks and behaves toward PM determines how projects will perform. “Organizational culture is the set of values, beliefs, and behavioral norms that guide how members of the organization get work done” (Yazici, 2009, para. 10). Organizational culture’s shared beliefs and values influence decision making, motivation, communication, risk, and other individual and organizational behaviors (Schein, 2004). Culture comprises everything in an organization, and it shapes how the behaviors, decisions, and actions of all members and how project work gets conducted (Suda, 2007). “Organizational culture is a strategic-level variable that has been shown to influence overall organizational performance” (Lindbergh, 2009, p. 11). Understanding culture is becoming increasingly important in predicting how well a project performs (Yazici, 2011). The cultural conditions such as organizational structure, bureaucracy, shared administration, communication, stakeholders, risk management and motivation in public HEIs IT departments are integral in understanding how well a project performs in those types of environments.

Project managers perceive that organizational culture has a direct relationship with project performance and companies that focus on understanding cultural factors will outperform others (Doolan, 2003; Schein, 2012; Yazici, 2009). Not being aware of an organization’s culture

and values can cause unnecessary conflict in project work and performance (Suda, 2007). Studies have shown that organizations are more likely to meet project time and cost performance goals by promoting a culture of sharing, collaboration, and empowerment (Yazici, 2009). Organizations that do not recognize cultural influence are often more likely to cause failure due to intangible non-measurable factors, while the organization that embraces cultural factors will find their organization's projects perform more effectively long-term (Doolan, 2009; Yazici, 2009). Organizational projects that are more aligned with organizational culture tend to have higher success rates than projects that are not aware of the culture (Suda, 2017).

Organizational culture can also assess how an organization communicates the transfer of knowledge and works as a team. Studies show a positive linear relationship when organizational culture supports communication and cooperation between teams (Doolan, Hacker & Van Aken, 2003, p. 285). Another critical consideration in organizational PM capability is awareness of how culture influences decisions and strategies made when conducting and improving PM practices as a lack of awareness may cost more time and money than necessary (Rosenbloom & Markus, 2010).

In a cultural, literary review of project management conducted in 2005, it was found that there was a 14% increase in the articles and books for ten years ending 2003 (Henrie & Sousa-Poza, 2005). Research regarding culture in public HEIs in the context of project management is limited because each university has discretely different norms that are interpreted differently (Pasian et al., 2011). This uniqueness causes issues in generalizing the organizational phenomenon that influences PM capability in public HEIs.

Failure in public HEIs IT departments are often blamed on ineffective project management, organizational structures, shared governance, unrealistic schedules, communication, scope creep, lack of change control, poor resource management, ineffective documentation, lack of training and mishandling of stakeholders (Kubilus, 2016). This literature review will further review organizational structure, governance, stakeholder management, communications, and HEIs resource management cultures influence on PM capability and performance. It is argued by many that the culture of public HEIs is often in direct conflict with PM and hinders the maturity of PM progression (Snyder, 2017). Introducing a perceived "corporate practices" is often contradictory to the ethos of HEIs (Bryde & Leighton, 2009).

**Organizational structure.** Organizational structure in HEIs plays a crucial role in determining project performance. The organizational structure includes the people, process, and systems within an organization that decide and influence how resources are utilized to accomplish work. The Project Management Book of Knowledge (PMBOK) from PMI classifies organizations as projectized, matrix or a functional organization (2013). Projectized organizations typically coordinate strategy through projects using a Project Management Office (PMO). Project managers in these types of organizations control most aspects of a project, including human resources and budget. The idea of a centralized PMO can be particularly challenging in the HEIs culture where less bureaucratic and shared governance types of decentralized management are preferred (Snyder, 2017).

A matrix organization is where the PM and management in the organization share the responsibility for execution of project strategy. Matrix organizations are not typical in HEI environments due to the complexity of organization structure. Public HEIs are predominately functional organization due to the complexity of the organizational structure and decentralized administration. In functional organizations, project managers have little to no authority on human resources or project budget, which is not ideal in creating project efficiency (PMBOK, 2013). This centralizing of authority often creates inefficient bottlenecks that force organizational department had to go through certain people and be controlled by them (Almatrodi, 2016).

**Governance.** “Governance is the structure of relationships that bring about organizational coherence, authorized policies, plans and decisions, and account for their probity, responsiveness, and cost-effectiveness” (Gallagher, 2001, p. 1). Governance in public HEIs is shared between academics, administrators and other governing bodies such as a board of trustees or regents. Historically, there is a shifting balance of power between administrators with academics having the primary power or voice over all things academic. With decreased funding from state and federal governments, public administrators have been tasked to create efficiencies and run more like a corporate business. This transformation of power is seen by faculty as loss control, erosion of academic employment stability and the beginning of a much larger societal problem, the privatization of knowledge which may be damaging to the public good (Locke et al., 2011).

Discussion about project management and its lack of performance in public HEIs usually focuses on culture, leadership, resources, PM knowledge, and accountability (Pounder, 2002). “The academics resistance, coupled with the diversity of services and departments, independent motivations and goals, make these structures very decentralized which hinders the formulation and adoption of comprehensive strategies that may increase the inertia of this type of organization” (Duarte & Martins, n.d., p. 27). The relationship between administrative and academic is complicated and can be rife with animosity due in part to the decentralized governance. Project managers will need to use soft skills if there is to be any chance at implementing efficient project practices in at HEIs.

**Communication.** According to a study by Ibbs and Kwak, who assessed 38 companies in 4 different industries for project management maturity, communication was the second highest scoring skill among the most mature organizations (2000). “In the 1990s, there was a shift away from project management, technical skills to risk management, knowledge management, human resources, communication and quality” (Snyder, 2017, p. 24). Project management communication as one of the top five categories researched and investigated in the last five years, according to the meta-analysis conducted by Diane Synder (2017). It is apparent that the literature supports the idea that communication has a direct relationship with project capability and in an analysis of fifteen CMMs, eleven included communication as a factor that influences capability (Albrecht & Sprang, 2016). Leaders and practitioners need to understand how communication relationship plays a role in project management performance. It may be argued that this is more significant in HEIs environments with numerous stakeholders’ motivations, complex organizational structures, and shared governance. Studies confirmed the linked communication to project performance (Pinto, Slevin & Dennis, 1987; Zulch, 2014).

**Stakeholders.** Organizations realize improper management of stakeholders result in negative consequences not only to the individual project but to the organizations' long-term ability to deliver projects. Stakeholders in HEIs environment can be interpreted both as opportunities and as threats depending on whether they have been accurately identified and managed correctly (Gomes, Liddle & Gomes, 2009). Stakeholder management has been a core focus by project management professionals as they align and manage different objectives, interests, and expectations of stakeholders that directly contributes to project performance in an organization (Jepsen & Eskerod, 2009). Active involvement with stakeholders is a vital factor in

determining project capability and execution in an establishment. Project performance is directly related to its stakeholders' perceptions of the value created by the project and the relationship IT project team. Studies linked successful management of the relationships between projects and its stakeholder's assessment of project performance (Bourne, Kennerley &, Franco-Santos, 2005). As IT departments are increasingly asked by administrators to work and function as a business, "identifying and understanding the stakeholders of relevance to an organization, and their influence or interest is therefore of key importance to project managers and policy-makers" (Chapeleo & Simms, 2010, p. 1).

Stakeholder management is vital because complicated IT projects that finish on time and budget, may yet be considered failures because they neglected to satisfy stakeholder requirements expectations. Project management performance can also be affected by stakeholders' 'hidden agendas'; these 'hidden agendas' must be recognized early and resolved. Other common reasons projects performance is lowered, is that stakeholders are not managed or identified and communicated the goals and value of the project in terms that matter to them. Establishing a common language that is clear and concise is imperative to project performance in complex organizations (Grant & Pennypacker, 2006). Managing and defining organizational stakeholders' requirements and communications are a good sign of a maturing PM process that is becoming the norm. Project managers must walk a tight rope and use soft skills to navigate the complexity of the HEIs culture and internal and external stakeholders' motivations.

***bureaucracy.*** The Oxford English Dictionary defines bureaucracy as "Usually depreciative. Behavior or practice regarded as typical of this government system, especially when characterized by such features as an excessive concern with formal processes and a tendency for administrative power to increase and become more centralized, and hence by inefficiency and impersonality; officialism, red tape" (2019). Given the negative connotation of bureaucracy today, it is hard to believe at one time in history bureaucracy was considered an organizational innovation. Bureaucracy premise was to "organize the division of labor and make management and decision making a profession, and by providing order and a set of rules that allowed many different kinds of specialists to work toward one common end, bureaucracy greatly extended the breadth and depth of intelligence that organization could achieve" (Pinchot, G., 1994; Pinchot, E., 1994, p. 39). Today, the bureaucracy and its implied control in HEIs is

considered an impediment or an affront to many, while necessary to others for accountability which creates a divide (Whitchurch, 2010).

In many organizations, bureaucracy is viewed as negative, something that divides and often creates two separate groups of disagreement. HEIs bureaucratic culture tends to be thought of negatively as an obstruction to the growth of PM maturity. Shared governance and decentralize management often create a direct conflict with the traditional value of professional autonomy (Milliken & Colohan, 2004). There are two distinct positions in the debate concerning managerialism, performativity and accountability in HEIs (Murphy, 2009). This paper will avoid this debate but needs to acknowledge that bureaucracy needs to be considered when investigating the PM capability of an organization. If bureaucracy is considered part of the organizational culture, then it is implied that holds to the same ideal that culture is the belief structure of an organization, it is how an organization thinks and makes decisions. Culture does not recognize the importance of project management and is resistant to change and therefore is considered in determining PM capability (Torres, 2014).

**Leadership.** Project management studies have shifted from a focus from cost and schedule controls to more studies on people, teamwork, and leadership and how leadership practices, organizational structure and culture influence PM maturity and decision making (Dvir et al., 2003; Kloppenborg & Opfer, 2002; Lindberg, 2009). “Emerging PM research centers around the social aspect, such as leadership, organizational values, human resource management, communication, collaboration, and cooperation, which are culturally specific to the organization” (Synder, 2016, p. 25). Leadership is undoubtedly an important factor in considering PM capability in an organization because it can directly influence individual motivation, trust, and commitment of its participants. Many organizational assessment tools have recognized leadership as a domain of measurement. For example, the European Foundation for Quality Management’s (EFQM) Excellence Model and the Malcolm Baldrige Quality Award use the leadership domain as criteria to measure continuous improvement in organizations (Hammer, 2007).

Leadership can influence multiple areas in an organization’s culture, both internally and externally such as stakeholder and communication. Studies have shown that supportive leadership has a strong relationship with project performance (Hillson, 2003; Kerzner, 2001; Kwak & Ibbs 2000). In Dr. Beverly Pasian studies of HEI PM capabilities, she has identified

leadership as an adaptable variant or an element of an organization's culture that can influence project management capability (2011). Dr. Pasion states, “leadership affects the team's perception of how projects are managed. A change can empower or discourage members” David Bryde who developed the first context-specific CMM for HEIs that was empirically validated shows higher levels of PM maturity increases project performance the likelihood of project success identified leadership as one of the six criteria to assess project management performance (2003).

HEIs decentralized structure draws on departmental leadership to be collaborative and is often key to organizational project performance. Understanding leadership relationship to PM capability gives leaders and project managers the ability to “tap into the power lines and more effectively work with and influence the culture and politics of a project environment and the stakeholders that affect it” (Pasion, 2011, p. 87). Leadership can play a crucial role in moving away from ineffective values such as mistrust to more effective values like trust. When leaders genuinely understand their HEI uniqueness, they can formulate the right roadmap to improve the organization values and create a culture that is copacetic to project management (Ibbs, Reginato, & Kwak, 2007).

**Resource management.** With lower public funding and increased competition from other schools, public HEIs find themselves with outdated recruitment models trying to compete with fewer resources. The Center on Budget and Budget Priorities (CBPP.org) in a report has stated, “A decade since the Great Recession hit, state spending on public colleges and universities remains well below historical levels, despite recent increases” (Mitchell, Leachman, Materson, 2017, p. 1). These numbers should raise flags for educators as they are signaling that the public is losing faith in the importance of spending more public dollars on education. HEIs need to do a better job of providing or showing the value of the service provided with evidence that shows a return on investment for students that are paying higher tuitions. Research indicates that organizations that improve project management maturity experience cost savings increased schedule predictability and improved quality. All of these contribute to an improved return on investment and customer satisfaction (Zubrow, 2003).

The ripple effect of the Great Recession and HEI lower spending can also be argued curbed or stymied the development and recruitment of younger talent. State institutions may be in a perilous state with talent, as baby boomers retire in mass, ten years of staff reductions and

the inability of some institutions to pay or attract talent from other industries. The fallout from budget issues may be evident as the institutions struggle to transform to meet global business and student needs.

Researchers will agree that the human resource function is an essential element in an organization's strategic project performance (Belout & Gauvreau, 2004). Implementing project management and changing how the organization conducts work requires not only financial capital but human capital (knowledge and skills). In HEIs IT departments there are two inputs, capital, and labor which produce the output project performance which often equals success. Resource management optimization from a people and capital perspective in HEIs has arguably changed or is changing the way these organization's strategies and conduct project work.

It is essential in organizations with limited resources to identify and allocate available resources early (Pinto & Slevin, 1987). Lack of either people skills or capital harms project performance. HEIs prioritizing and allocation of resources can shorten timelines and reduce costs if they can move past negative PM perceptions to understand the long-term value and benefits of project management (Bryde & Leighton, 2009). E. Anderson and S, Jessen define the mature or ideal PM practices in their CMM as an "organization has a clear picture of how to map resource requirements and risks in its projects" (Anderson & Jessen, 2007). Resources and the human factors are essential to project management capability and not accurately knowing or accounting for them introduces unnecessary that reduces the predictability of project performance (Pasian et al., 2012).

**Project management skills and knowledge.** PM skills and knowledge influence PM capability in an organization in numerous ways. PM skills and knowledge are based on the ten knowledge areas of the *PMBOK Guide* which is a book created by PMI with accepted standards and best practices for conducting projects from a business and organizational aspects (Salidas & Kerzner, 2009). The *PMBOK* provides organizations' methods and techniques that will assist an organization in meeting strategic objectives and performance through effective project management practices (PMI, 2017). The *PMBOK Guide* can help project managers and organizations choose methodologies, define success, develop performance measures and monitor and control change processes that manage risks and stakeholders in an organization (Salidas & Kerzner, 2009). PM skills and knowledge domain in this study are the culmination of the *PMBOK Guide's* ten knowledge areas, and best practices are used to assess an organizations PM

maturity level which in turn determines the PM capability or performance of an organization's projects.

The standards or best practices used in the *PMBOK Guide* are established by professional consensus and approved by a recognizing body called the PMI Standards Program and Member Advisory Group (PMI, 2017). The guide provides the rules, guidelines, and characteristics of activities to help organizations achieve the optimal degree of success in their industry (PMI, 2017). PMI standards provide guidelines for achieving performance and success (PMI, 2017). The *PMBOK* is an established professional group that provides the tools, standards, and knowledge to perform project management in an organization. The 10-knowledge area are project integration management, scope management, time management, cost management, quality management, human resource management, communication management, procurement management, and stakeholder management add in 2013 *PMBOK* version 5 (PMI, 2017).

The *PMBOK Guide* use is a set of standards and best practices that can be used to define an organizations PM maturity. The PMI uses the standards in the *PMBOK Guide* to measuring maturity in the Organizational Project Management Maturity Model (OPM3). The OPM3 measures an organization maturity PM processes to determine how well the organization has built organization strategies and goals. Simply, stated it OPM3 measures PM capability using *PMBOK Guide* which will be used as one of the independent variable or domains of this study for assessing organizational PM capability.

Knowledge management as an assessment domain is not always included in capability maturity model assessments. Seweryn Spalek (2014) states, "knowledge management is of high importance in general management nowadays, and in project management practice it should be distinguished as a distinct area of maturity assessment" (p. 165). A model such as the Project Management Maturity Model uses the *PMBOK Guide* as their foundation (Cooke-Davies, 2004; Jugdev & Thomas 2002a). Some of the benefits of using the *PMBOK Guide* in a CMM assessment to set standards for benchmarking and to create a guide for continuous improvement based on professional industry standards (Albrecht & Spang, 2014). "Maturity is measured along three dimensions. They are knowledge (capability to carry out different tasks), attitudes (willingness to carry them out), and actions (actually performing tasks) (Anderson & Jessen, 2007, para. 2). Whatever the rationale the *PMBOK Guide*'s ten knowledge areas provides a

good set of standards to measure PM maturity and in turn, determine PM capability of an organization.

### **Capability Maturity Models**

**Purpose.** CMMs provide a framework for assessment and selection of the development of project management capabilities to consistently and predictably deliver successful projects through improved performance (Demir & Kocaba, 2011). CMMs measure organizational capability or ability based on a set of characteristics, key indicators, attributes or patterns found in organizational operations and processes. CMMs can be used to determine the meaning and understanding of how an organization capability is embedded in the maturity or culture (institutionalized process) of the organization (Carlyle et al., 2012). According to Anthony Teague and Terry Cooke-Davis, “Decades of research have shown that, in order to be more successful in delivering strategy, change, and new products or services, organizations need to become more capable of managing their entire project workload” (2007, para. 1).

“‘Capability’ is distinguished from ‘maturity’ in the sense that as a process develops through stages of maturity, its capability becomes first defined, and then improved” (Bryde & Leighton, 2009, p. 708). To plan and measure a path to improved organizational PM performance maturity models typically uses four stages to institutionalize and assess project processes. The stages are 1) Standardize, 2) Measure, 3) Control, and 4) Continuously improve the process (Supic, 2005, p. 647). “It is often easier for organizations to attribute their project failures to a lack of project manager competence or problems with the project management system, rather than problems associated with the organization's applied project management capability” (Lindberg, 2009, p. 1).

The project management capability approach goes beyond these types of narrow perceptions to investigate what role the organizational environments undermined or influenced project effectiveness and efficiency. Hillson (2003) stated, “Organizations wishing to improve the effectiveness of their project management need to be able to measure current capability and define improvement targets” (p. 309). To plan and measure an improvement path forward organizational CMMs typically use four stages to institutionalize and assess project processes. The stages are 1) Standardize, 2) Measure, 3) Control, and 4) Continuously improve the process (Supic, 2005, p. 647). These stages are used to help leaders and participants simplify and objectively look at the current status of how work is conducted and strategize improvements of

PM capability. As organizations mature PM practices, they increase the capability and overall project performance. It is believed by some researchers that in order to become a more mature PM organization with increased PM capabilities requires a fundamental organizational change (Aaen et al., 2001; Truex, 1999). This change in culture can be argued has not occurred for some HEIs organizations.

Capabilities are a means to benchmark and compare practices, thereby leading to project performance improvement (Pennypacker & Grant, 2003). Scoring methods or benchmarking for the capability model are devised to provide a baseline and consistent standards for measuring valued characteristics or attributes in how project work is conducted in the organization and industry. “The essence of benchmarking is the process of identifying the highest standards of excellence for products, services, or processes, and then making the improvements necessary to reach those standards, commonly called best practices” (Elmuti & Kathawala, 1997, p. 229). One of the main goals of the CMM is to create the framework for continuous PM improvement to increase project capability and operational performance.

Bryde and Leighton (2009), creators of the only known maturity model built and validated to benchmark higher education states, “defining a systematic process for increasing PM maturity that aligns corporate practices in a manner that is appropriate to the ethos and culture of HEIs is clearly a priority for attention” (2009, p. 1). Understanding the change needed in HEIs and implementing project management in higher education will require practitioners to account for subtleties the environment in order to integrate change into the working practices to create effective project management processes (Bryde & Leighton, 2009). “The project management community has been motivated by the idea that tightly defined, repeatable and predictable processes directly contribute to the maturity of a project management capability. The design and use of CMMs “reflect this view naturally” (Pasian et al., 2012, p. 147).

**Capability and maturity.** To further understand CMMs, it is best first to understand the maturity and capability relationship and how that is used to create the framework to measure organizational performance. To do this maturity needs to be further understood as it often varies among leaders and practitioners in the field, but to an extent they all agree maturity is "change" or a path from one state to another (Demir & Kocaba, 2011; Ibbs, Reginato, & Kwak, 2007; Kerzner, 2004; Pasian et al., 2011; Snyder, 2017). Dr. Harold Kerzner, a well-regarded author of numerous academic books in the field, defines maturity in project management context as the

“development of systems and processes that are repetitive in nature and provide a high probability that each project will be a success” (Kerzner, 2004, p. 34). John Schlichter who was key in the development of the Organizational Project Management Maturity Model (OPM3) states, “Maturity implies a state of being fully developed. Maturity connotes an understanding or visibility as to why success occurs, and as to ways to prevent common problems.” (1999, para. 4). Lastly, “maturity implies evolutionary progress in the demonstration of a specific ability or the accomplishment of a target from an initial to a desired or normally occurring end stage” (Mettler, 2012, p. 3). In summation, it is how well project practices perform and adapts to organization variables that influence the outcome. The definitions imply maturity is the growth toward the achievement of new abilities or capabilities with an organization.

**History.** CMMs can be traced back to as early as 1951 when William Edward Deming a statistician was sent to Japan to help with census collection. Deming known as the “father” of quality control helped the Japanese develop and implement Total Quality Management approach (TQM) (Demir & Kocaba, 2011; Synder, 2017). TQM is an approach that focuses on the process used to improve the quality of an organization's outputs, through continual improvement of internal practices (Snyder, 2017). TQM and many of its principles are the fundamental building blocks of the CMM. The modern models have progressed from the singular focus on quality to a more comprehensive model that focuses on the performance of processes within the organization.

In the mid-'80s Carnegie Mellon University and the MITRE Corporation funded by the United States Air Force were tasked with evaluating software engineers to determine their capability and likelihood of project success (Paulk, 2009). The framework for the CMM took shape when Watts Humphrey joined SEI in 1987 and introduced the maturity levels based on best practices to evaluate the contractors for the Department of Defense (DOD). Humphrey based his framework on the Quality Management Maturity Grid, which was developed by Phillip B. Crosby (Caralli et al., 2012, p. 4). In 1991 SEI formalized and published the concept CMM for developing software (Paulk et al., 1993). The development of version 2 of the model in 2005 when the Office of Undersecretary of Defense chooses CMMI because it integrated both staged (maturity levels) and continuous representation (capability) to measure process improvement in an organization (Paulk, 2009).

From these initial CMM models, many capability maturity models have created and developed over the last 30 years. CMMs have grown and progressed into a vital business tool for organizations that practice project management (Bryde & Leighton, 2009). They are used to not only predict and measure success but to determine the ability or performance capabilities organization (Ibbs & Kwak, 2007). The model has progressed from managing the quality of a single project management process or project to a more organized-oriented project approach.

**Components.** There are a few fundamental components that build the framework for a CMM. There have been many different CMMs created in last 50 years, that all fundamentally conform to the same structural model framework that Watts Humphrey's adapted Phillip Crosby's maturity grid (Pasian et al., 2011). There are three main components of most CMMs, and they are maturity model levels and domains. The CMM components provide the "linkage between objectives, assessments, and best practices, and it facilitates relationships between current capabilities and improvement roadmaps by linking them to business goals, standards, and so forth" (Caralli et al., 2012, p. 8).

**Maturity models.** "The concept "maturity model" has its origin in the field of quality management, with a focus primarily on process maturity, including statistical process control and continuous process improvement" (Snyder, 2017). The model is intended to capture the progression of growth, focusing on process maturity, object maturity or person's capability (Mettler, 2012). In its most generic form, "a maturity model is a set of characteristics, attributes, indicators or patterns that represent progression and achievement in a particular domain or discipline. "Artifacts or characteristics that make up the model are typically agreed and are validated through the model's iterative recalibration" (Caralli, Knight, & Montgomery, 2012, p. 3). A maturity model provides an organization with the ability to audit and benchmark PM processes against organizational objectives and strategies. Maturity models provide a pragmatic way for organizations to approach and solve identified PM organizational problems. "Maturity models are seen as models that reflect certain aspects of reality, often called capabilities, and define qualitative attributes which are used to classify a competence object into one of several clearly defined areas. These classes are typically brought into a sequential order" (Demir & Kocaba, 2011, p. 1642). The maturity model intent is to help assess PM processes, people and organization's characteristics to help create an increased PM capability to deliver increased project performance that advances business and strategic goals of an organization.

**Maturity levels.** The maturity levels are probably the most identifiable characteristic of CMMs and often confused with capability levels. Maturity levels are the framework that domains are measured by, “each level acting as a foundation, or pre-requisite, to the next” (Torres, 2014, p. 33; Humphrey & Curtis, 1991). Maturity levels create the guiding principles for CMM (Paulk et al., 1991). PM capability is the output of more mature PM practices in an organization. Maturity levels identify and demonstrate an organization's current project capability. Maturity models and points are used to map the steps to organizational maturity or continuous improvement (Wiley et al., 2004). Continuous process improvement is based on the successive ascension of levels with many small steps rather than on trying to implement change all at once could be counterproductive in an organization. Maturity levels, according to Paulk and Curtis, “help an organization prioritize improvement efforts” (Paulk & Curtis, 2003, p. 20).

There are typically five maturity levels used in CMMs to show the progression or ascension through levels to acquire PM capabilities. Some models include a level 0, which is unaware. Generically defined attributes or characteristics have been listed below in table 2.1. It is not recommended to skip levels as the attributes build the foundation for the next level of capability (Duarte & Martin, n.d.). Maturity level definitions for the studies four domains can be in Appendices K-N.

**Table 2.1 Maturity Level Attributes**

<i>Level</i>	<b>Stage</b>	<b>Characteristics</b>
1	<b>Initial</b>	Ad-hoc and informal project management processes
2	<b>Repeatable</b>	Some project management practices are implemented that are developing a foundation to track and verifies project performance
3	<b>Defined</b>	Defined standard processes that are starting to find value from project management processes and be more consistent
4	<b>Managed</b>	Quantitatively controlled processes that are adjusting, integrating, controlling project management practices into processes to increase organizational efficiencies and value in projects
5	<b>Optimized</b>	Finding, transforming and optimizing opportunities for developing innovative processes

Note: Data from (Ibbs, Reginato, Kwak, 2007).

**Table 2.2 Maturity Levels of Reviewed Models**

Progression from Immature to Mature →					
<b>CMM</b>	Initial	Repeatable	Defined	Managed	Optimizing
<b>CMMI</b>	Initial	Managed	Defined	Quantitatively Managed	Optimizing
<b>P-CMM</b>	Initial	Managed	Defined	Predictable	Optimizing
<b>OPM3</b>	Birth	Growth	Maturity Phase	Continuous Growth	
<b>ProMMM</b>	Naïve	Novice	Normalized	Natural	

Note: Data for CMM, CMMI, OPM3, and ProMMM from (Synder, 2017), for P-CMM (Demir and Kocaba, 2011).

Attributes help provide leaders with simple and transparent ways to identify organizational PM levels. The model provides the framework for an in-depth understanding of factors and other elements that strengthen or weaken the organizations' capability. This knowledge can be applied to produce a competitive advantage (Bryde & Leighton, 2009). As an organization PM process matures, it builds a foundation that increases the predictability or likelihood of project effectiveness and performance that can decrease the varied results of organizational project impact on cost or scheduling (Hillson, 2003).

Leaders and organization that build more effective PM plans can execute the PM organizational change that ultimately increases predictability and decrease the time and costs of projects. Studies have shown empirical evidence that organizations that achieve higher PM maturity gain a more significant a benefit or value from PM work (Torres, 2014). Studies have tied cost, schedule performance, customer satisfaction, and other intangible organizational factors to the maturity of PM practices (Flowes & Thordahl, 1994; Herblseb et al., 1997; Ibbs & Kwak 2000; Mullaly & Thomas, 2009).

**Domains.** Domains researched in this study refer to the categories used to measure culture, process, experience and application of project management in an organization (Torres, 2014). Domains categorize like critical and organizational factors into a main process area or group because of their relationships and objectives. “Capability maturity models, the domains are often referred to as “process areas” because they are a collection of processes that make up a larger process or discipline” (Caralli et al., 2012, p. 11). The four main domains used for this study used PM organizational processes, objectives, factors and relationships to categorize process area for more straightforward analysis. The four domains will define the maturity range (levels) of the least ideal organizational PM practices characteristics (immature) to the ideal

project practices (mature). The domains maturity model levels define what it takes to increase the maturity of PM processes and provided evidence that is needed to determine if an organization has acquired that PM capability. Refer to the maturity levels' section below for more details on maturity levels.

Domains are referred to by different names; for example, in the People Capability Model (P-CMM) are referred to as Key Process Areas (KPAs). They mainly function the same way to determine the PM capability defined in levels of maturity. OPM3 takes a different approach to domains because it divides the organization's project management into three domains for analysis using project, program, and portfolio. OPM3 explicitly relates the management of projects to organizational strategy by building domains as the basic blocks of the OPM3 model's framework to identify performance characteristics in five process groups (initiating, planning, executing, controlling and closing process) for each of the three domains (Wiley, Projects, Morris, & Pinto, 2004). Each process group progresses through four stages (standardize, measured, controlled, continually improved) of best practices to build the framework or concept of the OPM3 model (Wiley et al., 2004; Supic, 2005).

Domains used in this study to measure public HEIs IT department's PM capability are culture, leadership, resource management, and project skills and knowledge. Domains will be the independent variables used in the study to determine the association or relationship with organizational PM capability. Project skills and knowledge domain are based on PM knowledge areas and performance standards found in the PMBOK (2017). Questions in the online survey and interviews are intended to measure the domains against defined PM maturity levels of the organization are conducting project work in HEIs IT environments. Domains and corresponding maturity level definitions are an integral part of the framework used to assign a PM capability score that determines the overall maturity or performance capability of public HEI IT department project management practices (Pasian et al., 2011).

**Benefits.** The concept of the CMM is a tool or framework built to systematically plan and capture the strengths and weaknesses of how projects are conducted in organizations to predict the likelihood of their success by determining organizational capability (Paulk, 1993). Dr. Hillson, a Fellow in the PMI, says, "models represent a practical an empirical approach to assessing current project management capability, based on a simple, pragmatic foundation"

(2003, p. 309). Using CMMs in HEIs could provide the framework for improving organizational project practices and performance (Austin et al., 2013; Bryde & Leighton, 2009; Pasian, 2011).

Literature supports that CMMs as easy to implement and administer, and the measurements based on current empirical evidence within the context of the organization (Hillson, 2003). CMMs have also been found useful in guiding strategic organizational decisions for continuous improvement. Models can assist leadership in planning and implementing change that increases the likeliness of project meeting budget and schedule deadlines (performance), but also increases competitive advantages (Hillson, 2003). CMMs give leaders and practitioners the ability to quantify organizational PM maturity to determine organizational PM capabilities which provide the ability to predict the likelihood of project performance. CMM can be an invaluable resource for leaders in a competitive market (Bryde & Leighton, 2009; Demir & Kocaba, 2010; Ibbs & Kwak, 2007; Jugdev & Thomas, 2002; Pasian, 2011; Synder, 2017; Torres, 2014).

The two primary outputs of using a CMM are benchmarking and roadmaps for continuous improvement (Hillson, 2003; Pasian, 2011). The two topics are explored in more detail in the following sections and throughout the literature review.

**benchmarking.** Benchmarking includes setting goals by using objective, external standards and learning from others (Boxwell, 1994). Benchmarking provides the external standards needed to set achievable goals that are both challenging and accepted by the organization. Benchmarking is more than setting goals; it can be used to learn from competitors to generate and find other ideas on how to improve current project practices. Benchmarking allows organizations to compare different aspects of the organizations' current PM practices against the practices of others to learn and improve project performance (Ibbs & Kwak, 2007). The intent of benchmarking is to help leader analyze current practices against other organizations finding best practices and insights to leading to increased project performance and quality internally, also to gain a competitive advantage in the market (Bryde & Leighton, 2009; Camp 1995).

The most often utilized approach to benchmark PM is maturity models as maturity models can be used to describe as an organization's relationship with capability in PM practices. Benchmarking assesses project performance by assigning a value to PM capability, a value that is derived from PM maturity levels embedded within the framework CMMs (Bryde & Leighton,

2009; Hillson, 2003; Pennypacker & Grant, 2003). Compatibility Maturity Models build the foundation for the measurement of project processes because key performance characteristics are identified and defined in maturity levels (Hillson, 2003). Benchmarking uses maturity levels to identify attributes and characteristic from surveys, participant results to capture and quantify the organizational PM capability (Hillson, 2003; Pennypacker and Grant, 2003). Benchmarking can be used by organizational leaders and practitioners to calculation both overall organization PM maturity scores and individual domain scores for specific PM process areas (Bryde & Leighton, 2009, Cooke-Davies & Arzymanow, 2003; Ibbs & Kwak, 2000; Pennypacker & Grant, 2003).

Benchmarking and research for project management in the educational field is limited. In 2003, one of the first studies for implementing project management practices in HEI came from the Consortium for Excellence in Higher Education in the United Kingdom. It adopted and studied the Excellence Model using the European Foundation for Quality Management's (EFQM) standard as the baseline. The model was developed to measure and understand how mature an organization was in adopting and executing project management practices. The Excellence Model is the first maturity model that used benchmarking to understand project management, a business tool for efficiency from the context of an HEI (Bryde & Leighton, 2009).

**roadmaps.** Capability Maturity Models are “evolutionary roadmaps” that assess project management practices and identify gaps that are central to the organization's project processes (Duarte & Martins, n.d., p. 3). The Meriam-Webster dictionary defines a roadmap as a “detailed plan to guide progress toward a goal” (2019). Roadmaps are long-term visions that help organizations develop ad-hoc and inconsistent practices to mature project practices and functions (Almotrodi, 2016). Roadmaps are important to project management success because it provides scope, as well as steps needed to implement change in an organization. The overall objective of CMMs and roadmaps are to outline the must have project management capabilities that HEI organizations need to acquire in order to achieve “growth and excellence” in project work and processes (Vergopia et al., 1988, p. 60).

Compatibility Maturity Models are keys to continuous improvement roadmaps. Models not only provides the framework to measure critical factors of organizational performance but also provide the definition or attributes for achieving the next level of maturity that increases project capability. Leaders can use the maturity level definitions as logical guides for

organizational PM improvement. Roadmaps provide a systematic, repeatable path to improve project management capabilities. A concept that can direct organizations with the lack of process maturity or discipline to an organization that has a stable and predictable project practice (Kerzner, 2004; Rad & Levin, 2006b; Varney & Heller, 2013; Vergopia et al., 1988). A roadmap can help late adopter leaders and practitioners set realistic expectations as they find out what is needed to increase organizational PM capability systematically.

Capability Maturity Models can be used as a roadmap that pushes an organization toward improvements and validation performance that “must come, implicitly and explicitly, from within” (Rad & Levin, 2006b, p. 1). A well-designed roadmap can provide all the activities needed to ease the improvement path, “reducing the cost, resource requirements, and timeframe for an improvement initiative” (Crawford, 2006, p. 14). Roadmaps can be utilized to quickly see if resources that leadership is investing (human and monetary) for change are increasing project performance and returning expected outcomes. The ability and flexibility to reallocate resources are critical to HEIs due to funding shortages (Bryde & Leighton, 2009; Kenny, 2004; Lindbergh, 2009). Before the coming of the maturity model, governments, organizations, corporations, and the military struggled to build strategies for achieving the detailed design for project capability improvement (Kerzner, 2011). Organizations often failed to achieve project management capability, because there was no detailed and strategic way of obtaining organizational project management capabilities (Andersen & Jessen 2003).

***Shortcomings.*** In the literature review of capability maturity, it was clear that the researchers, academics, and practitioners are mostly in agreement that potential benefits to be realized from an organization using a CMM approach far outweigh any shortcomings (Hillson, 2003). It was a challenge to find literature that supported authentic shortcomings of CMM concept. Issues or weaknesses found in specific CMMs are discussed in further depth in the model review section of the paper. Main criticisms found with using CMMs is that the maturity levels do not accurately evaluate the PM processes, model limits organizational growth to what the model has defined, and the model does not capture the intangibles affecting projects (Jugdev & Thomas, 2002).

## **Model Reviews**

**Capability maturity model.** The Capability Maturity Model (CMM) was produced in the late 1980s and publicly released in the early 1990s by SEI at Carnegie Mellon University.

The United States Air Force funded it because it required a way to assess software developers' ability or capability to deliver before awarding contracts (Paulk, 2009). The CMM is not technically the first capability maturity model, but its framework has influenced the development of many new models. The model uses a five-level upward progressing maturity model to measure an organizations PM capability. The steps or levels are assigned scores that can be used to create metrics or benchmarks useful in assessing maturity levels of PM processes. Maturity levels used in CMM methodology were developed by Watts Humphrey, who based them on Phillip Crosby previous work Crosby's Quality Management Maturity Grid, the first to define the stages in adopting a quality process (Paulk, 2009).

The main benefits of the CMM includes ease of use, collect data and interpretation because of the shared vision and common language. CMM is known to improve "productivity, quality, time to delivery, and accuracy of cost and schedule estimates" (Khan, 2010, para. 5). The main disadvantages of the CMM include the human element was excluded influencing the capability of project management. The next complaint of the model is the time for an organization to adjust to the new approach of process improvement and achievement of maturity levels. Management often takes an unfavorable short-term view of cost, and improvement processes that are spread out over the years and do not show immediate returns (Vergopia et al., (1988).

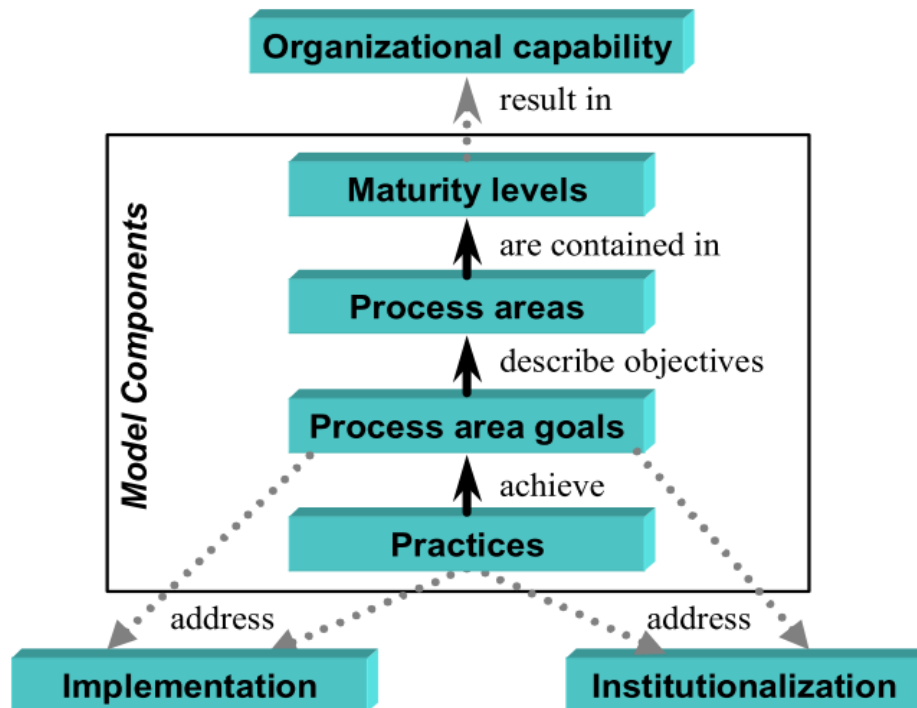
**Capability Maturity Model Integrations.** The Capability Maturity Model Integration (CMMI) is the successor of CMM, and the framework for improving organizational processes in the fields of development, acquisitions and service delivery. The goal of this model is to create a higher quality product at a lower cost which increases the predictability of success. The focus of the CMMI framework is process areas, which are groups of like processes used to deliver and develop products and or services to an organization. The CMMI model uses staged (Five maturity levels), and continuous (six maturity levels) approaches to compare processes against standards. The CMMI model intent is to predict or take the guesswork on whether a project will be successful, using the defined the measurements to help control processes ensuring more consistent predictable result.

A benefit of the model's framework is it provides a clear definition for practitioners of what must be done to improve further their PM processes, which leads to improved performance and the production of quality products at low cost (Aljedaibi & Alsulami, 2017). The criticism

of the CMMI model is that it does not consider the human, cultural or organizational factors in measuring the maturity levels (Albliwi, Antony, & Arched, 2014). The model is also known for being complicated, time-consuming, needing special training, non-scalable, and as well for being costly to implement (Koppensteiner & Swan 2005).

**People Capability Maturity Model.** The People Capability Maturity Model (P-CMM) was developed in the mid-'90s by SEI of the Carnegie Mellon University and was patterned on CMM to build and develop an organization's workforce. P-CMM, version 2 was issued in 2001 and has been employed by many global companies such as Boeing and Lockheed Martin (Curtis, Hefley, Miller, & 2009). The goal of P-CMM is to help organization's measure the maturity of their organizational practice and, help guides transformational change in the organization by building a solid foundation for managing and developing the workforce to establish a culture of excellence (Curtis, Hefley, & Miller, 2009). "The People CMM has proven popular because it allows organizations to characterize the maturity of their workforce practices against a benchmark being used by other organizations" (Uma & Surega, 2013, p. 55). Five maturity levels help guide organizations in more predictable process performance. P-CMM was designed to increase organizational performance by managing and improving the capability of the workforce by building competencies (Zhang, 2015). The maturity model's framework is founded along with the premise that organizational changes to processes do not endure unless the conduct of the organization changes to sustain the modification, which means that individuals are more likely to adapt and align their motivation and performance to organizational objectives if there is a solid foundation built that also promote their individual growth and learning (Curtis, Hefley, & Miller, 2009).

The P-CMM model uses several factors to help specify and build the maturity levels that guide the improvements in human performance and capability. Maturity levels, except level 1, use process areas to identify a group of work practices that are important to improving workforce capability. "Process areas identify the capabilities that must be institutionalized to achieve a maturity level" (Curtis, Hefley, Miller, 2009, p. 29). Twenty-two process areas comprise the five maturity levels in the P-CMM model. Once process areas goals are institutionalized the performance and capability organization will increase. To help better see or visualize how the model elements are used and work together the figure below describes the framework of the P-CMM model.



**Figure 2.1 - Structure of People CMM (Curtis, B., Hefley, B., & Miller, S. 2009, p. 44).**

The benefits of this model include the potential for increased organizational capability due to workforce competencies built to complement the objectives and strategies of the organization. Using this model can help communicate with outside entities that human resources processes are stable and the product or services received from the organization are likely to be consistent and stable. This model can help build a brand known for excellence and stability that can be intricate in the success of the business goals. “In a nutshell, it means helping workers help top managers steer project processes according to current and target capability levels and project directions, as well as provide a framework for optimizing employee competencies for greater measurable value” (“WHY IS PEOPLE CAPABILITY MATURITY MODEL NECESSARY?”, 2018, para. 3).

The shortcomings of the P-CMM model is that it only addresses organizational aspects of the environment and it does not factor in the technology components that easily and equally influence PM processes and practices in an organization (Acuna et al., 2005). Lastly, the P-CMM model could thwart creativity of exceptional employees which is the opposite of what is intended. P-CMM is building organizational processes that build the overall competencies of the organization, so heroes are not needed for projects to perform.

**Organizational Project Management Maturity.** The Organizational Project Management Maturity (OPM3) model was developed by the Project Management Institute (PMI) between 1998 and 2003 that used best practice standards defined in the PMBOK to assess and develop the capabilities of executing organizational strategy through projects. The OPM3 model helps organizations understand and measure project management maturity of the processes used to conduct projects based on the best practice standards defined in the PMBOK (Schlichter, 2003). “OPM3 combines three elements: knowledge (the contents of the standard, including maturity and best practices), assessment (a method for comparing a real organization to the standard), and improvement (how to change the organization, build capabilities and implement best practices” (Wagenstein, 2006, para. 30).

The OPM3 structure is comprised of three domains: portfolio, program, and project (PMI, 2013, p. 20). The domain standards are defined in detail by three PMI books: The Standard for Portfolio Management, The Standard for Program Management and A guide to the Project management Body of Knowledge (PMI, 2013, p. 20). “These standards provide the best practices for each domain” (PMI, 2013, p. 20). The OPM3 model examines the relationship between best practices or standards and of where organizational ability is or where they want to be known as capability. A unique feature of OPM3 is the identification of dependencies is existing between and among capabilities” (Fahrenkrog, Kruszewski, Baca, & Lewandowski, 2004, para. 11). Another element that distinguishes the OPM3 model from many other maturity models is the use of four maturity levels instead of the standard five (PMI, 2013).

There are many benefits of using the OPM3 model. It ties strategic planning and execution of reliable, predictable and consistent organization's project success. Organizational Project Management Maturity Model focuses on the organizational strategy and how project management integrates and promotes those strategies with metrics. The OPM3 model takes into consideration the mission and goals of an organization based on best practices and evaluates how the variants of people, culture and technology influence key processes in dictating or predicting project performance and outcomes. Lastly, the OPM3 model can be used as the framework or guide driving organizational changes and improvements in complex organizational structures.

One of the criticisms of the OPM3 model is that it is complicated to understand and expensive. The real criticism of the model is the controversy surrounding the capability statements component of the model. The capability statements were created by a volunteer

group of PM professionals led by John Schlichter to develop the standards (Friedrich, Schlichter, & Haeck, 2003). The group of PM professionals created and tested the capability statements used as the OPM3 best practices standards. Capability statement was available in the original online implementation of the model. Project Management Institute in the next three versions excluded them, and PMI began to sell the capability statements through a consulting company called HSI at a very steep cost. Many users took issue and complained that these standards should not be sold since it was volunteers that created them in the first place (Friedrich, Schlichter, & Haeck, 2003). Project Management Institute's latest response in 2017 to the public objections, announced they would no longer offer maturity assessment through HSI and that the fourth version of the model would be released with no clear indication if the capability

**Project Management Maturity Model.** The Project Management Maturity Model (ProMMM) is a maturity model developed by PM Professional Solutions Limited for an organization to self-assess PM processes against best practices for effectiveness and efficiency (Vergopia, Malone, Mollaghasemi, Reilly, & Tavakoly, 1998). The origins of the ProMMM model can be tracked like most maturity models back to CMM. "The basis for ProMMM is practical and pragmatic, based on the empirical experience of its developers in providing project management consultancy across a wide range of industries over many years" (Hillson, 2001, p. 1). The ProMMM model allows an organization to determine if project management processes adequate or efficient in their organization while benchmarking the scores against other competitors (Hillson, 2003).

The model is useful for organizations trying to promote improvements in project management practices and processes. The ProMMM has four staged levels and explores the culture and the human experience domains and their influence on project management capability (Hillson, 2003). This model's assessment framework helps an organization identify cultural characteristics that impede or improve PM capability or performance. Another key benefit according to Bryde and Leighton (2009) of the ProMMM model is that it "enables the collection of both overall scores and individual domain scores" (p. 709). A mechanism or framework to measure improvements is fundamental to ensure the organization's investment in improvement is working. This model's ability to create a framework to score domains can be invaluable to the organization get a deeper understanding of how culture and human experience correlates to PM performance. According to Hillson (2003), "the structure of ProMMM is simple without being

simplistic, allowing strengths and weaknesses to be highlighted for further attention” (p. 300). One of the few drawbacks of using this model is that the primary instrument used to collect data is surveys and survey question can be or interpreted differently than intended and unintentional skew findings.

In Chapter Three, the research design, participant sampling, research instruments, research procedures, and data collection analysis methods and the rationale why the methods were chosen for study will be discussed.

## Chapter III. Methodology

### Research Design

The researcher started with a comprehensive theory or explanation on why HEI's culture struggled with project management which helped develop the path to capture and interpret the data used in this study. The intent of the study is to understand how PM capability is influenced by culture, leadership, resource management, and PM skills. To expand and further understand the relationships, a pragmatic worldview was used to guide the selection of mixed methodology and approaches because it gave the researcher the freedom to explore. "A pragmatic perspective draws on employing "what works," using diverse approaches, giving primacy to the importance of the research problem and question, and valuing both objective and subjective knowledge" (Dowding, 2013, p. 4).

This study is not limited to one philosophical underpinning or approach to investigate the research question. Multiple approaches will be needed to understand the variable relationships entirely, and that is why the pragmatic philosophical worldview is the dominant underpinning of this mixed methods research study. Use of multiple approaches to data collection and analysis will build a broader deeper base of knowledge about the PM capability in public HEI IT departments. Another important component of choosing a pragmatic approach for this study is that it gives up the idea that the data collected for the study will pin down the "underlying causal" relationship (Cherryholmes et al., 2018, p. 15).

A pragmatic worldview can be used to guide the collection and analysis of the qualitative data collected. Interpretivist is an epistemology that allows researchers to ask general open-ended questions (Creswell, 2009). The interpretivist approach guided the creation of interview questions and a semi-structured approach to the interviews that promoted a discussion. This type of approach allows the researcher to ask "why" an organization that an organization's culture can influence project capability and performance in public HEIs. The use of interpretivist approach in this study is not meant to produce generalizations but assess project management behaviors and patterns in HEI social situations with similar organizational structures, limitations, and mandates. Grounded theory was used from the very beginning of this study as the "researcher's ontological and epistemological assumption was used to provide the best foundation on which to construct and defend a theoretical argument" (Partington, 2002, p.141).

**Mixed methods.** A mixed methods research design is chosen to guide this research due to the pragmatic worldview guiding the study. The method allows the researcher to collect data from multiple sources, types, and perspectives with equal weighting to create a more insightful understanding of all the factors that influence PM capability in public HEIs IT departments. This study hopes to identify the organizational factors and generate new theories about how the independent variables influence PM capability and project performance in public HEIs. The use of both quantitative and qualitative data will provide a more intricate understanding of an organization from the perception of the workers at multiple levels of the public HEI IT departments.

The qualitative data for the survey will be collected from interviews of IT leadership, researcher observations and document artifacts of PM practices at each test site. The qualitative data are weighted equally in this study and is essential to note, as it supports the pragmatic worldview underpinning this study. The data will be used primarily as a method to advance insights about public HEI PM capabilities and to validate quantitative data results in the study. The role of qualitative data will ensure that research does not focus solely on collecting quantifiable metrics that can skew and be misinterpreted (McKim, 2015; O’Cathain, Murphy, & Nicholl, 2010). Allowing for subjective participants' perceptions increases the detail of the human experience in data collected and studied. The downside of using qualitative data from a scientific research standpoint is that replicating the effects of a qualitative research study can be virtually impossible to replicate as results founded on a person’s reality for that day, which may not be the same the next week or even the following day (Creswell, 2009).

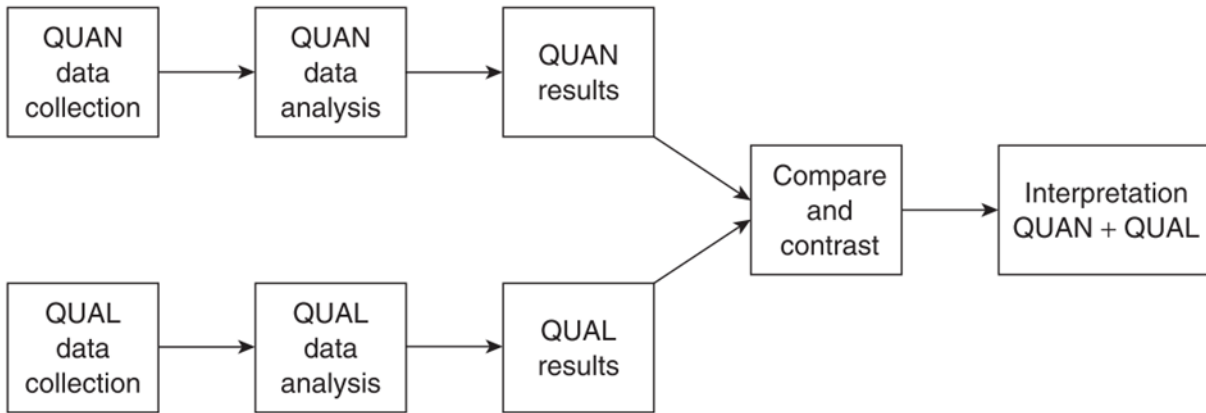
Quantitative data is collected using an online survey, which assesses and quantifies the current environment and PM practices from the perspectives of current public HEI IT workers. This survey instrument was chosen because of ease of use and its ability to quantify users’ perceptions of public HEI IT departments. The instrument’s bonus is the ability to create benchmark scores which promote competition and continuous improvement projects which implies increased project performance and functional efficiencies of PM practices in HEI IT departments. This study is non-experimental and will use correlation statistics to understand and measure the relationships between independent variables and the dependent variable of PM capability. Survey research using closed-ended questions provided a means to quantify a large

group of participants voices and perspectives about PM capability in public HEI IT departments (Creswell, 2009).

Public HEI organizations are complex systems with many different perspectives, values, and political orientations. Utilizing a mixed method approach ensures information used in this study will offer multiple data types from different sources, bearing out the pragmatic world view. Using multiple types of information will allow the researcher to overcome the failings of one method with the strength of another, which enables the researcher to potentially get more authentic and concise outcomes (Creswell, 2009). The researcher thinks that the benefits far outweigh the shortcomings and instruments and methodology approach will reduce data variability.

In conclusion, the research questions for this study is exploratory and focuses on how culture, leadership, resource management, and PM skills influence organizational PM capability. A mixed method is an ideal approach because it permits a more complete and interdependent utilization of data than separate quantitative and qualitative data collection and analysis. The role of mixed methods approach supports seeking multiple perspectives on the factors that influence PM capability which assist the researcher in systematically collecting data. By collecting both qualitative and quantitative data concurrently, the researcher can use the data to provide validation for each other, creating a solid foundation for drawing conclusions about the results of whether culture negatively impacts public HEI PM capability.

**Mixed methods model.** The mixed methods model chosen for this study is the triangulation convergence model because of the pragmatic world view used. Refer to figure 3.1 for a visual representation of the mixed methods model be used for this study. This model was primarily selected to give equal weight to each data type, and by collecting concurrently, the researcher was able to remove any bias or preference for data type or instrument. The triangulation approach “solicits data from multiple and different sources as a means of cross-checking and corroborating evidence and illuminating a theme or a theory” (Rudestam, 2015, p. 114). This model also allows the researcher to collect data that will allow for a broader interpretation of data, ensuring data collected is not askew when comparing. A convergence design to assure the researcher has a better understanding of the factors in each data type before the data’s final merge for comparison and interpretation.



**Figure 3.1 Triangulation Design: Convergence Model (Creswell, 2009, p. 63)**

**Case study.** Creswell, a well-known and influential researcher, define a case study as “A qualitative strategy in which the researcher explores an in-depth program, event, activity, process or one or more individuals. The case(s) bound by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period” (2009, p. 227). A case study approach aligned with the pragmatic world view and is necessary to collect perceptions and observations from each test site systematically. The systematic collection, analyzing and storing data procedures described in chapter four will create reliability of data (Pasian, 2011).

### **Instruments**

**Surveys.** The instrument selected to conduct the quantitative data collections of the study was an online survey hosted by Qualtrics. The Qualtrics system was used to distribute unique individual invitations emails links that were used to track progress, and prevent fraud, duplicate responses, and abuse of the survey at each public HEI site. The online survey or self-assessment of the organization’s PM practices contains 54 questions that use defined maturity levels in four domains or process areas to quantify responses from participants. Closed-ended questions capture, measure and quantify individual participant perceptions of PM practices from the four PM domains areas. The respondent’s answers are based on a Likert scale ranging from 1 to 5 that corresponds to an ascending maturity level (1-5) to determine the score. The maturity level scores correlate to the PM capability of the respondent’s HEI IT departments. Answers that score a one represents immature project management practices, whereas a score of five represents ideal or mature PM practices. Scores from each participant will be added together and averaged to find the domains average score and the sites overall PM capability. Scores from

each site will be used to examine, distinguish and explore generalities or relationships between the test sites.

Domains are used to organize and determine PM capability in process areas based on participant identification of the characteristics present in the current environment. Each domain area receives a score or a benchmark score that represents the domain's PM capability for the site and later the population when data is merged and each domain area receives a score or a benchmark score that represents the domain's PM capability for the site and later the population when data is merged. Benchmark scores are used to identify the theoretical characteristics of each level of organizational PM practices maturity. Maturity definitions have been created to identify the organizational characteristics in each domain area and maturity level; the maturity level definitions for each field is placed in Appendices K, L, M, and N.

An online survey was chosen because of its power to gather and generate data from a large, geographically separated areas quickly, confidentially and at no cost to the researcher. Surveys capture individual perceptions that can be measured to gain insight into each test sites situation. Surveys will be used to help to test the correlation and regression relationships between independent domain variables and the dependent variable of PM capability within the public HEI IT department organizations. Another consideration for choosing an online survey was the ease of use and the ability of a participant to participate in the study anonymously, which the researcher believed may increase participation because of the sensitive nature of some of the questions. Research has found that if survey questions have sensitive and or embarrassing information the response behavior is likely to change (Armacost et al., 1991).

Disadvantages of utilizing a survey are the ability to gather enough participants willing to fill out the study. Participants often avoid surveys or are skeptical because they take too much time, the purpose is not clear, and the information gathered is sensitive. One more disadvantage is using a survey in conjunction with a Likert scale can lead to more than one interpretation of the questions which can adversely affect and skew results (Hasson & Arnetz, 2005, p. 2). Social and acquiescent response bias is a disadvantage of self-report online surveys, to minimize this bias the researcher has switched or rearranged the positive and negative order of questions to promote reading the and participants mindlessly answering questions. Self-selection or non-response bias can skew results, and in order to minimize this bias, the researcher will pay careful attention to these shortcomings both in the design of the survey and recruitment of participants.

To increase participation, a clear, concise email invitation was sent offering an anonymous response as some information could be considered sensitive and a \$50 random giveaway was used to incentivize participation.

**Interviews.** The interview instrument was chosen for this study because it created a way to collect data that influenced PM capability at each site subjectively. It offered the ability to capture context and develop further insights from two IT department leaders at each site. The questions results would not merely be to comprehend the influence of organizational factors on PM capabilities but to also work as a validation tool for online study. The questions were semi-structured, open-ended style to encourage a discussion about perceived as project performance at their respective site. The flexible format allowed the researcher to develop a kinship with the interviewee that can reduce reluctance to share negative experiences or characteristics of their current PM environment which is necessary to explore the beliefs and perceptions about project management in a public HEI IT department. Interviews confirm key relationship indicators and complement quantitative data from online surveys. The primary deterrent to interviews is the time to conduct and analyze information. For this reason, interviews are limited to one hour and interviewees were given the choice of a telephone call, Skype video chat or in-person encounter.

**Document artifacts.** Artifacts are the “visible organizational structures and processes;” that defines a culture (Schein, 1991, p. 252). Archival evidence that is relative to project management practice at each site is collected. Document retrieval will focus on how well PM practices, techniques and processes are defined publicly that provides evidence of PM practice maturity. “The analytic procedure entails finding, selecting, appraising (making sense of), and synthesizing data contained on website and documents” (Bowen, 2017, p. 28). Document artifact analysis was chosen in this study to help triangulate the qualitative data in the study by building a “confluence of evidence that breeds credibility” (Eisner, 1991, p. 110).

The types of document artifacts analyzed and used in this study are documents that represent the PM processes, procedures and maturity of PM of the organization. Examples of these types of documents the study will seek are project requests forms, project charters, schedules, risk registers, project change requests, and communication plans. The research is not limited to the documents listed above. The document artifact analysis will capture qualitative data evidence that supports maturity level definitions of PM capability. The information collected can be used as evidence to support findings from other instruments, and major themes

and broaden the knowledge and relationships of PM capability in the case studies for each test site.

**Field notes.** Field note observations of the researcher are used to amass more data and insight about a site's capability, leaders and findings. It permits the researcher to acquire an in-depth knowledge of participants, events, variables, and relationships in public HEI test sites. Field notes also help as a retention aid. Field notes field will help in the triangulation approach used to analyze qualitative data for the study. The findings can be employed as a memory aid to assist the researcher in exploring relationships while also possibly helping to increase the credibility of qualitative data. Field notes were used to assist the researcher to develop coding themes in qualitative analysis.

### **Participant Selection**

Selection of test sites will be crucial to study. Thirteen universities from one public HEI school system in the Midwest were invited to participate in a capability maturity study. The researcher thought that the selection of one school system would create a common language for sites participating in the study. Also, the researcher had prior knowledge of the system chosen for the study that system projects were mandated to each site that required IT organizational change and project work. The school system chosen was influenced by the researcher's personal and professional network having worked in one of the thirteen schools in the school system for the past fifteen years in an IT role.

Invitations were sent to all thirteen school sites Chief Information Officer's (CIO's) of the IT department to procure consent that advised perspective sites of the ethical concerns of the study (Appendix B). All thirteen sites were considered for the study because they were either practicing PM or considering integrating PM practices into their IT organizations. Having various levels of PM experience could help identify relationships that influenced PM capability. Taking in a varying range of PM experience will create some challenges for instruments used in PM capability, but the pragmatic worldview underpinning this study encourages building a more extensive understanding of the subject. The comparison of sites at various PM maturity levels offers the opportunity for insight that would not be obtainable if site participants being restricted to only sites currently practicing PM.

**Researcher.** The researcher is an integral part of the study. It is significant to mention the researcher is currently employed and has been working IT technician at one of the test sites

for fifteen years. This could create bias, but the mixed methods approach used to compile and dissect the data for the study were believed to be enough to cut back any personal bias. To further combat personal bias and ensure objectivity the interviews and survey questions were examined for any positive or negative bias by Dr. Ginger Levin a well-regarded PM professional in maturity studies.

**Participants.** To take part in the study, participants will be required to be a current IT worker or management level employee in the prospective test sites IT department. Possessing two different views from different points of the organization will broaden the insight of the relationships of the independent variables to the dependent. Interviewing leaders and surveying workers will help validate findings and identify any outliers in data that can be made by disgruntled workers or leaders that may withhold negative details. Both groups will need to be volunteers and consent (Appendix C and D) to study to ensure an accurate and uninhibited account of factors that influence PM capability. The participant in both instruments will be anonymous in hopes of promoting an honest assessment. The interview will require two participants from each site; two individuals will provide multiple perspectives that can identify and reduce bias if present.

### **Purpose of the Study**

The purpose of this study is to investigate how culture, leadership, resource management, and PM skills and knowledge influence project capability in public HEI IT departments using capability maturity models. Understanding and measuring how the four domains influences on PM capability can provide insight to leaders and workers are practicing PM in HEIs. Providing knowledge to PM professionals, leaders, and practitioners that can be optimized to help improve project work in public HEIs IT departments by improving organizational PM capability and project performance.

### **Research Question and Hypothesis**

A pragmatic worldview, the assemblage of both quantitative and qualitative data should facilitate the researcher finding enough data to conclude which independent variables in the case studies for each site have the most influence on organizational project capability. The research question shown in table 3.1 guided the research and development of the study's hypothesis.

**Table 3.1 Research Questions and Hypothesis**

<b>Research Question and Hypothesis</b>	
<b>Research Question</b>	Is project capability significantly influenced by the relationship among culture, leadership, resource management, and PM skills?
<b>Hypothesis</b>	Culture significantly influences PM capability in HEIs.

**Variables**

The study uses four independent variables or domains (culture, leadership, resource management, and PM skills) utilized for evaluating the impact of the dependent variable of PM capability in public HEI IT departments. Variables chosen were extracted from existing PM maturity models and associated studies (Bryde & Leighton, 2009; Cooke-Davies, 2002; Curtis, Hefley, & Miller, 2009; Hillson, 2003; Ibbs, Reginato, & Kwak, 2007; Pasian, Sankaran, & Boydell, 2012; Paulk, 2009; Synder, 2017). The variable selection was influenced by fifteen years of empirical observations of the researcher working in the public HEI IT department. It is thought that variables and questions representing these variables would accurately capture the context of the public HEIs IT organizations to measure PM capability.

Factors from empirical observations and literature that are known to influence PM performance were combined and organized into the four variables or process areas to better categorize the data for the study. Each independent variable used to assess and set the PM capabilities is based on identifiable characteristics in each maturity level. Maturity levels create the baseline for comparison, in the assessment. The maturity level definitions for each independent variable are found in Appendices K, L, M, and N. Refer to Figure 3.2 HEI PM Capability Model for the visual representation of the approach used to investigate variables.

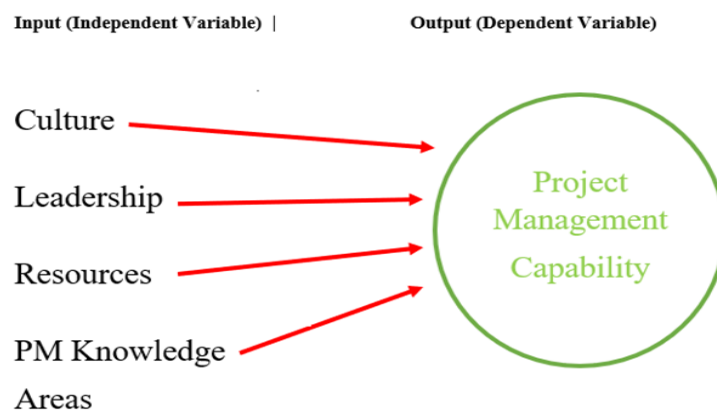


Figure 3.2 HEI PM Capability Model

## Data Analysis Plan

This study will use descriptive correlational and regressive statistics to examine the outcomes from the online study. This is a non-observational research study, meaning the researcher cannot manipulate the independent variables. This study will use both parametric and non-parametric tests to analyze data choosing and applying the most appropriate test based on sample size and the shape of the distribution.

The first step of the analysis will be to test the validity of the individual and domain factors to ensure a minimal effect size. Cronbach alpha or Cronbach f coefficient statistical measure is for smaller samples will be utilized to determine consistency or validity of the factors is affecting PM capability. Four questions were designed into a survey to review for internal consistency; participants are asked to rate; maturity levels of their department and the university is using supplied maturity definitions to compare against the results of the 36 ordinal questions based on same maturity level definitions. The overall outcomes from the ordinal questions should provide similar scores to ensure consistency.

The next objective or step two of the analysis is to measure the four areas (independent variables) for each site against defined maturity levels ranging from 1 to 5, one being least immature and 5 being a mature PM practice. The online survey consists of 52 questions which include 12 nominal demographic questions to group participant characteristics, four questions used for consistency tests, and 36 ordinal questions. The ordinal questions are grouped in the following areas to establish more relevant comparisons and simplify analysis. The domains and factors are as follows, culture (10), leadership (6), resources (4), and PM knowledge and skills (16). The factors or questions used to measure the organizational PM capability and the domains used were adapted from peer-reviewed publications in the PM research. Each ordinal question uses a Likert scale (1-5) that correlates to the maturity level scores (1-5). For each factor, the participants rate their level of agreement or evaluation of PM practice that determines the maturity levels based on a five-point scale

The data will be analyzed using Qualtrics built-in test and measurements. Univariate, bivariate and multiple regression tests will be used to test both individual and domain factors. Pearson, Spearman, and two tail T-tests will be used depending on sample size and distribution to test and measure the correlation and regression of the relationships between the independent

variables and PM capability. In this study, the maximum acceptable error level of 0.1 with a 90% confidence level was due to the expected small sample size.

The quantitative data results collected from an online survey will identify the linear association and strength between the independent variables on project capability by using correlation coefficients and positive or negative direction. The main disadvantages of using correlation are that it only examines whether a relationship exists. Correlation statistics cannot be used to determine whether one variable cause another to change.

The qualitative data from interviews, document artifacts, and field notes will be analyzed, coded for themes and frequency using NVivo 12 software. It will analyze the unorganized text in a matter that can help further the understanding of PM capability in public HEI IT departments. This data will be will used to add depth to the study, but also validate the findings from the quantitative data analysis.

The third objective of the analysis will be to compare, contrast quantitative and qualitative the findings first at the site level and then at group level when data are merged to find any generalities or other interesting relationships. The analytical data of both data types are organized into separate individual case studies and NVivo databases in preparation for convergence.

Once all test site's data has been a collection, and individual analysis has been completed the data will be merged. Correlation and regression analysis will be conducted on group data using the maximum acceptable error level of 0.1 with a 90% confidence level. Qualitative data will be combined into one database to and coded to find commonalities and frequency of themes in public HEI IT departments. Once both data type group analysis is completed a comparison of both data types will occur to both triangulate data findings and discover interesting relationships that support the hypothesis that culture negatively influences PM capability in HEIs IT departments.

### **Expected Findings**

The expected findings of this study are that the capability maturity model would capture the context of project management capability for public HEIs IT departments and determine that culture influences capability which affects project performance in HEIs. It was anticipated that the domains chosen and measured for this study would have a significant, direct relationship with an organizational PM capability. It is expected that the culture's relationship would be

significant and have a direct linear relationship with the organization PM capability. It is depicting that an organization's culture determines how projects perform in HEI IT departments. It is anticipated that the statistical finding would indicate that there is a negative relationship between public HEI culture and organizational PM capability.

### **Summary**

This study is non-experimental using correlation statistics to study the associations or strengths or weaknesses of the independent variables (culture, leadership, resources and PM skills and knowledge) on the dependent variable (PM capability). A mixed methods approach was chosen based on the “assumption that collecting diverse types of data best provides a complete understanding of a research problem that either quantitative or qualitative data alone” (Creswell, 2012, p. 19). The survey, interviews and document artifact collection will be carried on concurrently for each site using, and both data types will enhance the understanding and depth of the different variable relationships.

The goal of this chapter was to outline and present the research methodology and approaches used in this study to answer the research question. Chapter Four will outline and introduce the procedures utilized to compile and dissect information and deliver the outcomes of the pilot study used to appraise the reliability and robustness of the approaches and instruments.

## Chapter IV. Data Collection

The purpose of this study is to understand the variables that influence PM capability by converging and analyzing both quantitative and qualitative data for an in-depth investigation. Understanding the relationships can provide, leaders with data to guide investing in PM practices strategies within the organization. The data collected for this study will come from two data types. Quantitative data gathered from the online survey instrument, and the qualitative data is gathered from semi-structured interviews, document artifacts, and field notes instruments. The first half of this chapter will describe the procedures used in data collection and analysis while the second half of the chapter will present the results and feedback of the pilot study used to evaluate the reliability and validity of the approach.

### Quantitative Data

**Data Collection.** The quantitative data collected for this study collected through one instrument, an online survey hosted by the Qualtrics survey system. The online study is comprised of 52 questions, 36 questions based on ordinal questions using a Likert scale. The survey also contains 12 demographic questions will be used to group characterizations and four questions to test internal consistency and validity. The study is grouped into nine parts, four main domains, four subgroups, and 1 group for demographics. The four subgroups were used to further divide the PM skills and the knowledge domain into more discrete categories that were more representative of the ten knowledge areas found in PMI's PMBOK. The study did not cover all ten areas individually because several were groups were merged several and questions reduced lower the time needed to complete the survey.

The survey questions, consent, procedures, and recruitment materials were reviewed and cleared by the Institutional Review Board (IRB), Appendix A. Once IRB approval was received recruitment emails were sent to the IT department's CIOs for the thirteen universities in the schools. Consent from four CIOs was received from four universities to participate in the study. All sites were accepted, and a pilot study was scheduled for Site A in mid-December 2018 that concluded in 30 days.

A participant list of a current of non-management IT workers was scraped from public facing web pages, and CIO was asked to verify the list. An independent survey database was created for each site to manage site response data and distribution of survey invitations. Once CIO verified the list, an email was sent to potential participants asking them to be part of the

study. The recruitment email (Appendix B.) followed IRB standards, by ensuring informing potential participants about the purpose of a study, how do they participate, risks and any benefits they would receive from participating in the study. The survey participants were incentivized with a \$50 gift card raffle at three of the four schools for completion of the survey. One site did not allow workers to accept the gift for completing surveys. Potential participants were scheduled to receive three emails from the Qualtrics system inviting them and reminding them to participate. Emails were sent in the beginning, the halfway point and the last invite the one week before the survey closed. All emails included a link to unsubscribe to further emails about the survey.

The survey will be open for any email invited a participant to take in within the sites 30-day deadline. All the data gathered for each test site is collected during the 30-day timespan the survey is open. Any partial responses would be rejected from the data gathered to ensure consistency. The response data is cleaned and prepared for analysis, which required removing all identifying information, assuring there were no errors in the question fields or scoring for each query.

**Table 4.1 Survey Data Collection Procedures**

Survey Data Collection Procedures	
1.	IRB approval
2.	CIO site consent approval and assessment scheduled
3.	Validate participant list and schedule recruitment emails through Qualtrics
4.	Close survey and remove any partial completion from response data
5.	Clean and prep data for analysis

**Data analysis.** When data has been cleaned and prepared, it will be ready for analysis. The four domains (independent variables) will be tested to measure the strength and direction of the relationship to PM capability by using bivariate, regression, and multiple regression analysis tests. In this study, the maximum acceptable error level of 0.1 with a 90% confidence level is due to a small population sample. To test for consistency, the domains will be tested for Cronbach's alpha and then tested for bias. Correlation tests will then be used to reject or accept the hypothesis that culture has a significant relationship with PM capability.

**Correlation.** This study will use Pearson's  $r$ , Spearman rho and paired two-tail t-tests. The relationships between the dependent variables and independent variables for each site will be investigated using bivariate parametric Pearson's correlation coefficient will determine if the variables are significantly related ( $p < 0.01$ ). Correlation coefficients vary from - 1 to + 1, where 0 indicates no relationship, a positive relationship will increase, and a negative relationship will decrease a correlated variable (Pallant, 2010). Before conducting the analysis, the assumptions of linearity and homoscedasticity will be evaluated. Pearson's  $r$  will assume linearity that there is a straight-line relationship between variables in the analysis and homoscedasticity assumes that residual scores are normally distributed around the regression line (Stevens, 2009). The R-Squared measurement will also be used to determine the significance of the relationship to PM capability. Pearson's will identify the strength of the parametric linear correlation and determine a positive or negative relationship.

Spearman rho tests if variable relationships are not linear, outliers exist and if the sample size is too small for Pearson's. Spearman replaces values with ranking orders and then conducts a correlation test. The t-test will be with two independent variables when the sample size is lower than 15 and data are normally distributed.

**Regression.** To validate inferences made from correlation relationships simple and multiple linear regression tests will be conducted to validate relationships. To reduce multicollinearity which decreases the accuracy of relationships between independent variables will be tested against each other to determine the strength of the correlation. Independent variables that show a substantial relation is removed before regression testing. Qualtrics uses Johnson Relative Weight Analysis to balance and quantify the independent variables that are highly correlated by their importance in the regression results lessening the effects of multicollinearity. The regression analysis technique used for regression analysis of the independent variable is M-estimation which deals with outliers in variables more effectively.

Multiple regression and logistical regression are used when appropriate and if sample size allows. Model Fit or Akaike information criterion (AIC) will be used with residual plots to determine if the model will be approved. AIC is the metric that balances accuracy with complexity; a lower score implies a better model.

## Qualitative Data

**Data collection.** The qualitative data collected for this study will be collected through multiple instruments. Interviews, document artifacts, and field notes which will be collected for each site and stored and organized in case study folders until data analysis.

**Interviews.** The purpose of the interviews is to collect perceptions from another level of the organization about project management capability when using defined maturity levels as the basis for analysis in public HEI IT departments. The interviews contain ten semi-structured queries that are meant to garner information around the culture, leadership, resource management practices and the PM skills and knowledge levels at each campus. Questions were created and analyzed for researcher bias by PM professional Dr. Ginger Levin. Once finalized, interview questions (Appendix E), recruitment email with consent (Appendix C) stating the purpose, risk, confidentiality, and benefits of the study were submitted to the IRB and approved.

Once site consent was obtained from CIO and dates agreed to for site capability assessment, a recruitment email was sent to the management team targeting two volunteers from each site that are involved in project work that is interested in participating in a recorded anonymous interview for the study. The interviewee could respond to the email or call the researcher with their consent to engage in the study. When consent has been received from the interviewee, the researcher contacted the interviewee to schedule and agree upon the interview method (phone, in-person, or video chat). Recorded interviews will be scheduled for 1 hour and conducted concurrently during survey timeframe. The interviewees were emailed the questions and directions which included the definitions of the maturity levels.

Interviews conducted with nine IT leaders, consisting of 10 semi-structured questions totaled six hours. An extra interview was allowed for the only site in the study that had a PMO as the researcher believed that there was value to from interviewing the leader of the PMO and two leaders outside the PMO. Immediately after the interview, interview recordings were uploaded to NVivo transcription service and transcribed. Transcriptions are reviewed, and mistakes in transcription fixed. Any individual and site identification will be removed from the transcript at this time. Once transcripts are ready for analysis, the researcher converts field notes into a formatted document useful NVivo to analyze. Completed transcriptions and field notes are imported into NVivo software site database for analysis after all data collection is completed for the site.

**Table 4.2 Interview Data Collection Procedures**

<b>Interview Data Collection Procedures</b>	
1.	IRB approval
2.	CIO site consent
3.	Recruit management interviewees and get consent
4.	Schedule an interview and send directions, questions and maturity level definitions
5.	Assign a code name to the interviewee
6.	Conduct recorded interview
7.	Transcribe interview within 24 hours
8.	Record researchers' observations
9.	Prep, clean, organize and store transcribed interviews and field notes in case study folder that only the interviewee has access to.
10.	Create an NVivo site database and import interview and field notes

**Document Artifacts.** The document artifact collection aims to find substantiating evidence of PM capability of the site. The information captured by this instrument should offer evidence or validation of existing project management operations at the site. Document analysis begins for each site by the researcher as soon as IRB and CIO approval has been obtained. This study utilizes a case study approach to organize all document and site artifacts collected. The intention is to find data that complements and supports the findings and data collected from the other instruments while providing a different view of how the site processes and conducts technical projects in an HEI environment.

Any document or public-facing website is captured for further analysis. Site participants in the interviews will be asked to provide documentation about PM practices on their site if available. The interviewees will be granted permission to a network case study folder hosted on OneDrive for their respective sites.

The document artifact analysis for each site will end with each site's survey deadline. Once the survey assessment has closed the researcher will re-verify all data in the case study folder to ensure the validity of the study. All documents cleaned to remove any individual or organizational identifying information before the document is ready for analysis.

**Table 4.3 Document Artifact Data Collection Procedures**

Document Artifact Data Collection Procedures	
1.	IRB approval
2.	CIO site approval
3.	Create site case study folder
4.	Start document artifact analysis as soon as site consent is given
5.	Grant permissions to CIO and interviewee to document artifact folder
6.	Gather documents; artifacts fill in the form
7.	Close collection of document and artifacts concurrently with site's survey assessment
8.	Clean, prep and store all documents and artifacts by removing any identifying information

**Field notes.** Field notes provides in-depth contextual knowledge of sites project management practices to aid in the assessment. Field notes from sites will be used to increase the credibility of qualitative data by using the triangulation approach. Once the site agrees to participate in the study, a journal created for each site, and the researcher will enter at least one entry per week in the about site findings and reflections. The researcher notes captured from interviews key takeaways from the conversation that add depth to the study.

**Table 4.4 Field Notes Data Collection Procedures**

Field Notes Data Procedures	
1.	IRB approval
2.	CIO site approval
3.	Create a researcher's journal for each test site
4.	Weekly, during survey assessment journal findings from data collection
5.	Journal reflections of the interview immediately afterward
6.	Clean, prep and store all journals in the case study folder

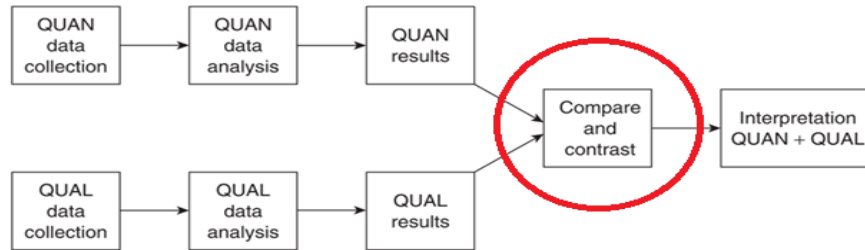
**Data analysis.** The qualitative data analysis will use the triangulation approach and NVivo software to coordinate and identify themes collected from each test site. The interviews will be transcribed verbatim and imported into individual site NVivo databases. NVivo software will be utilized to analyze qualitative data, organize and code data collected for each test site. NVivo will be used to analyze interviews, field notes, and document artifacts collected from each site to find and recognize word frequency, common patterns, and themes to create a meaningful picture of the data.

Once the interview data is transcribed; it was read to determine common words and themes. Two types of coding are used to analyze the qualitative data include broad brush coding and manual coding. Broad brush coding automatically codes the data sources based on the words or phrase frequency and is a good starting point (QSR International, 2019). Manual coding involves working within each source and selecting the content and then coding it. Manual coding is the predominant method used to categorize and find themes for each site.

Step one is to run a word frequency examination of all files for each site. Words and phrases are then assembled to help determine broader themes and to assist in the manual coding of nodes. Step two is to begin to organize the text from the files into logical groups or themes using nodes. In step three, nodes are created and gathered to create and discover themes within the data. Ten nodes are created initially to group the responses of the ten interview questions. More nodes are created as data is explored to help in the organization of newly discovered themes. In step four, nodes are then used to explore the data further and help assist in creating logical grouping or themes in the data.

### **Merging Data**

Once qualitative and quantitative data have been analyzed individually for each site, it will be merged at the site level. A comparison and contrast of the findings and data will be conducted to provide a broader understanding of PM capability at the site level. A summary of the findings can be found in the individual site case studies in Appendix G-J. Figure 4.1 represents the merge used for each site's case study results and for the main study when all the test sites are merged.



**Figure 4.1 Triangulation Design: Convergence Model (Creswell, 2009, p. 63)**

After the data is analyzed at the site level, it will then merged at the group level. The responses from all Qualtrics site surveys will be exported and imported into an empty identical survey database. Imported response data will be checked for any missing data and corrected. The four areas will be tested again, this time against the 66 responses that collected from all the sites. Bivariate correlation, regression, and multiple regression analysis tests will be conducted again on merged data. The qualitative information will be combined into one NVivo database and analyzed to determine common themes, using the same approaches that were used for individual sites.

When the qualitative and quantitative data analysis is complete at the group level comparison and contrast of the data will be conducted. Providing the researcher, a broader understanding of PM capability as a group of public HEIs IT departments within one Midwestern school system. The results and finding group data can be found in chapter five. The culmination of the mixed method study should provide the researcher with a plethora of rich data to explore and understand PM capability and the relationships that influence project performance in public HEI IT departments. The quantitative research describes the strength of variable relationships to PM capability, whereas qualitative data adds an in-depth understanding of the social, political and cultural context of PM capability in public HEI IT department. Utilizing a mixed method allows the research to triangulate findings from both data types, which strengthens the validity of results and instruments utilized. A mixed method research design provided a practical means of researching a complicated research question in a complex system.

### **Pilot Case Study**

A pilot was conducted to test the data collection process and procedure of the study's instruments and data analysis procedures. Site A was chosen to ensure the consistency, reliability, and construct of the model, methods, techniques, and instruments used in the study.

**Site characteristics.** The pilot test site is a regional public university situated in a rural Midwestern town with a population less than 20,000. Site A services approximately 6,110 full and part-time students in 70 undergrads and 12 graduate programs. Site A is comprised of 4 colleges with a small on-site IT department made up of 5 departmental units with less than 25 non-management workers. The researcher has identified the IT department practices as an organization that performs formal PM practices using a waterfall PM methodology. PM is an established practice that is integrated into the site's processes and service management systems using an ITIL approach. Site A has integrated PM practices into help desk system and uses many standard PM approaches to campus IT project work. The site has experienced a decade of budget and employee reductions. Along with the reduction of full-time employees from 42 to 26, multiple leaders have changed in IT organization within the last three years.

**PM capability assessment.** The HEI capability pilot assessment is scheduled after CIO verbal consent. The assessment was delivered over winter break 2018-19 and completed in 30 days. A list of active IT employees was verified, and a direct email invitation to an online survey, signaling the beginning of the site's capability assessment for seventeen non-management IT workers. Document artifacts, field notes and interviewee recruitment, consent, and recording of interviews began and completed before online survey assessment expired.

**Survey results.** Of the 17 eligible IT workers, eight consented and completed the survey that was incentivized with a chance to win a \$50 gift card giveaway. Three participants started and failed to complete 90% of the survey, and those responses were removed before data analysis started. Out of the 17 eligible IT workers, eight consented and completed the survey. The response rate for the site survey was 47% with an 80% completion rate for respondents that started the survey.

**Analysis.** Due to the small population that completed the survey truth of the confidence level of 90% with a 10% margin of error was not met. The small sample will increase the likelihood of Type II errors that can skew the results and reduce the strength of the analysis findings.

**Internal consistency review.** To test the reliability of data and flag potential response bias in the survey responses the researcher designed two survey questions (46, and 48). To help improve the reliability responses question scales were reversed in 11 of the 36 questions to minimize item-order effect of respondents mindlessly responding to the first answer and flag

possible response bias. The two questions represented the culmination of the all the questions that the respondents answered in the initial 36 survey questions about the department's capability and knowledge of project management using an underlying Likert scale based on defined maturity levels (Appendices K-N).

Site A's respondents scored the IT department's overall PM capability with maturity level definitions in question 48 a 2.67 compared to the benchmark score or 3.43 (Table 4.7) calculated from 36 questions, a decline of 0.76. When responding to questions 46, respondents scored IT department's PM skills and knowledge with definitions 2.44 compared to the benchmark score of 3.31 (Table 4.7), a decrease in PM knowledge and skills capability of 0.87. There is a reasonable likelihood of response bias which reduces the reliability of the data but is typical in self-reporting surveys and acknowledged and accepted in chapter three and four.

**Correlation.** The full correlation analysis and regression analysis for Site A can be found in Appendix G. The correlation results for the primary independent variables are in table 4.5. Two of the four independent variables show a statistically significant relation using a 90% confidence interval, with PM capability using Pearson and Spearman. Culture did show a linear or significant relationship with PM capability.

**Table 4.5 Site A Correlation Tests**

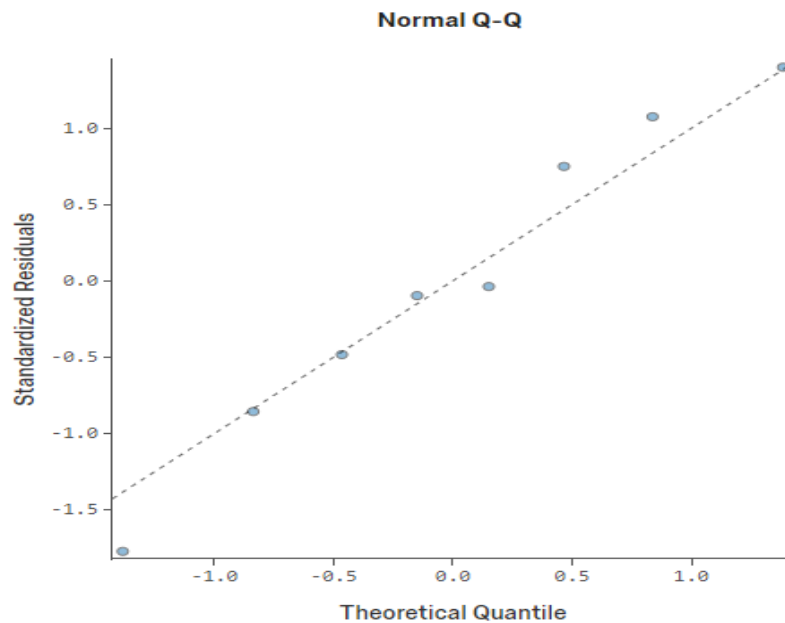
	Statistical Test	P-value	Effect Size	Confidence Interval	R-Squared	Significant Relationship
<b>Resource Management</b>	Pearson	0.00541	0.866	0.444	0.750	Yes
<b>PM Skills &amp; Knowledge</b>	Spearman	0.0283	0.761	0.683	0.477	Yes
<b>Leadership</b>	Pearson	0.322	0.403	1.121	0.162	No
<b>Culture</b>	Pearson	0.574	0.236	1.21	0.0555	No

**regression.** Simple linear regression is determined from the R-squared values in table 4.5. The closer the R-squared score is to -1 or +1 the more linear the relationship between the independent and dependent variables. Due to the small sample size, regression may not be consistent. Step one determines what independent variable have a significant relationship with PM capability. Step two compares two independent variables to each other to determine their relationship. Step three setup multivariate regression with resource management and PM Skills and Knowledge (PM Skills) domains. Regression test using M-estimation for analysis, which had a high R-squared value and low model fit score which is considered more accurate. Figure

4.2 represents is a visual check of data plausibly that assumes the dependent variable is normally distributed. Again, a small sample must be considered in determining the accuracy of results.

**Table 4.6 Site A Regression Model**

<b>Regression of PM Capability – (Resource Management and PM Skills)</b>					
<b>Sample Size</b>	<b>Method</b>	<b>R-Squared</b>	<b>Standard Error</b>	<b>Coefficient of Variation</b>	<b>Model Fit (AICR)</b>
<b>8 of 8</b>	M-estimation	0.855	0.0634	0.0185	8.45



**Figure 4.2 Site A Normal Q-Q Residual Plot**

**Interview results.** Two 45-minute semi-structured interviews comprised of ten questions were conducted and recorded via Skype in December 2018. The interviews were recorded and transcribed and themed and coded in NVivo. The common themes found in the analysis of the interview were that both leaders supported formal PM practices, culture affected the organization’s PM capability, but other factors such as resources (human and monetary) and PM skills affected the effectiveness and performance of site projects. Project failures identified for this campus are mainly attributed to not meeting schedule deadlines. Both leaders agreed that projects are typically completed, but technically could be listed as failures because they do not typically meet time deadlines. Both leaders estimated the IT department PM capability score between 3 and 4. Figure 4.3 share a word cloud created from the qualitative data collected from



compare to other public HEI IT department to determine areas of strength and weakness. Refer to Figure 4.4 for visualization of Site A strengths and weakness in PM capabilities.



**Figure 4.4 Site A Radar Plot**

The benchmark scores are shown in table 4.7. PM skills were broken down into four subgroups to provide a more useful measurement of the domain.

**Table 4.7 Site A Benchmark Scores**

Site A PM Capability Benchmark Scores									
Culture	Leadership	Resource Management	PM knowledge and skills	Communication	Scope and change management	Risk Management	Stakeholder Management	Overall	
3.85	3.08	2.50	3.31	3.38	3.04	3.46	3.31	3.43	

**Site summary.** The benchmark scores for leadership and resources management scored lower than the rest of the main domains when relationships were investigated with PM capability. Using the qualitative data from interviews, document artifacts and field notes these results may be more understandable with the knowledge that the Site A organization has been under budget constraints for the last four years, lost four positions, including a project manager and have had top leadership changeover in the three years. These details add to the understanding of data to make insightful predictions.

**Pilot results.** The mixed methodology approach, instruments, collection and analysis outlined in chapter three and at the beginning of this chapter provided favorable results. Some minor issues were identified in the collection and analysis, but nothing that would recommend stopping or changing the studies framework.

Issues identified:

- A scoring error in the survey
- Small sample compromises the accuracy of results
- Document artifacts were inaccessible to the public

The scoring error was fixed in the survey and the other test site surveys. The recruitment email plan will be changed to help improve participation. The researcher will monitor survey participation and directly contact managers at test sites with low participation to garner support and promotion from the manager internally to increase the sample size. To increase the document artifacts, the researcher will ask interviewees for help in obtaining organizational documents that would otherwise be inaccessible to the researcher.

With those adjustments, the researcher believes the consistency, reliability, and construct of the model, methods, techniques, and instruments used in the study will help determine how culture in public HEIs influences PM capability. Chapter five will share the results of the data collection and analysis.

## Chapter V. Data Analysis and Results

### Introduction

This chapter describes the combined results from the four HEI IT department test sites study results structured into three parts. The first part of this chapter provides a demographic of the site and sample that participated in the study. The second part of this chapter contains the results of the data analysis of the study including descriptive, statistical analysis of the data and domain scores. The last section of the chapter will discuss the results of the hypothesis testing, methodology used in the study and a summary of chapter five.

### Demographic Profile of Sites

To gain a better understanding of the PM capability analysis began by building a demographic profile for four participating Universities that are part of a more extensive state public school system of 13 universities. Understanding individual site characteristics aids in understanding relationships and connection of data results to sites. Table 5.1 describes the characteristics of the community, university, IT department, project management practices, and methodologies used.

**Table 5.1 Site Demographics**

<b>Site Profiles</b>				
<b>Descriptor</b>	<b>Site A</b>	<b>Site B</b>	<b>Site C</b>	<b>Site D</b>
<b>Student Population</b>	6,110	9,401	10,825	43,450
<b>Private or Public</b>	Public	Public	Public	Public
<b>Location</b>	Rural Midwestern town less than 20,000	Rural Midwestern town less than 20,000	A Midwestern town less than 100,000	A Midwestern city less than 300,000
<b>Programs offered</b>	70+ Undergrad 12 Graduate	45+ Undergrad 20+ Graduate	80+ Undergrad 13 Graduate	232 Undergrad 296 Graduate
<b>Colleges</b>	4	3	4	13

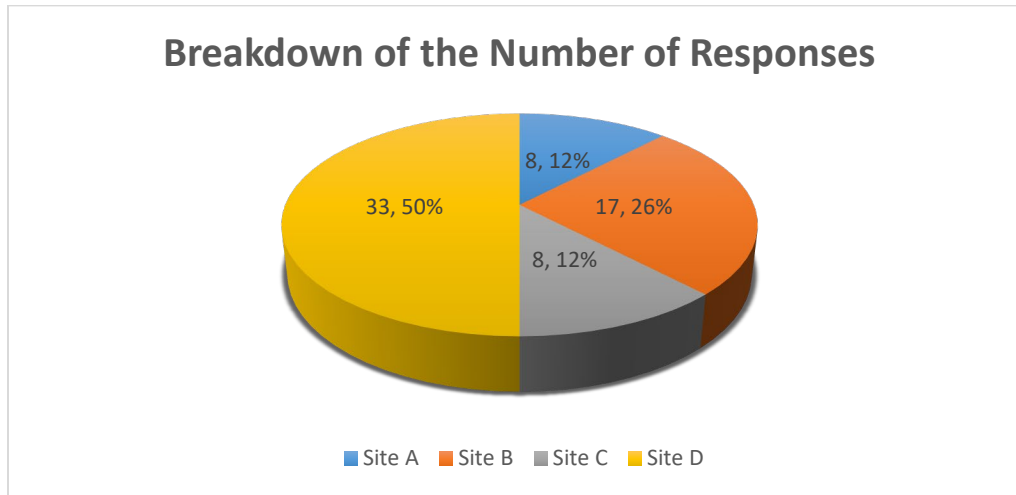
<b>Technology</b>	5	3	5	16
<b>Department</b>				
<b>Units</b>				
<b>IT workforce</b>	Small (25)	Small (36)	Small (49)	Large (613)
<b>Small (&lt;50)</b>				
<b>Medium (5-250)</b>				
<b>Large (250 – 1000)</b>				
<b>Practicing</b>	Yes	No	Yes	Yes
<b>Project</b>				
<b>Management</b>				
<b>Project</b>	No	No	No	Yes
<b>Management</b>				
<b>Office</b>				
<b>Project</b>	Waterfall	None	A3 (Continuous Improvement)	Hybrid
<b>Management</b>				
<b>Methodology</b>				

## Survey Sample

Online survey responses and site data were collected December 13, 2018, through February 10th, 2019 using Qualtrics online survey tool. The study was conducted in two parts (Pilot and main study assessments) from four test sites that were part of a one midwestern public school system. A pilot study using Site A was conducted during the first 30 days of the timeframe to collect responses and site data. The main study responses and data was collected immediately after the pilot for Sites B, C, D ending on February 10th, 2019. In total 613 individual online survey personal invitations were emailed. Errors in coding and recruitment methods were identified and modified before the final three schools in the study were administered the survey. The survey instrument using define maturity levels for each domain was found to be a valid measurement of PM capability of HEI IT departments.

The response rate of the survey is 10.7% of respondents (66 out of 613), which was lower than anticipated and was not enough to conduct a regression analysis with more than two variables. There was a 3% failure rate for respondents that started the online survey and did not

finish. This 3% would have increased the sample enough to allow regression analysis of the four variables. Refer to figure 5.1 for a breakdown of survey responses.



**Figure 5.1 Breakdown of Online Survey Responses**

### Demographic Profile of Respondents

Characteristics of the online survey are shown in Table 5.2. Sex, age and years of service are described in the table. The overall PM capability maturity scores were not significantly influenced by sex, age or years of service. T-tests and Pierson chi-square test did not find any significant differences or relationships in scores for the four domains ( $p>0.05$ ).

**Table 5.2 Participant Demographics**

Variable	Group	Number
<b>Sex</b>	Male	37 (56%)
	Female	25 (38%)
	Other	4 (6%)
Total Participants		<b>66</b>
<b>Age</b>	18 to 34 years old	12 (18%)
	35-44 years old	17 (26%)
	>45 to 65+ years old	37 (56%)
Total Participants		<b>66</b>
<b>Years of Service</b>	1-5 years	37 (56%)
	6-19 years	16 (24%)
	20+ years	13 (20%)
Total Participants		<b>66</b>
<b>PM Experience</b>	1-2 years	29 (44%)
	3-15 years	32 (49%)
	16+ years	5 (8%)
<b>Total Participants</b>		<b>66</b>

Some interesting findings from the demographic questions in the survey are described below and found in Table 5.3. Of the 66 respondents, 90% believe that PM will be crucial to the success of their IT department in the next five years (Question 54). Seventy-seven percent of respondents have novice to competent experience in PM practices (Questions 55) with 55.4% having less than five years PM experience (Questions 57). Thirty-six respondents have led projects with only five respondents having Project Management in their working title (Question 56). Respondents showed a higher involvement rate in internal IT project with 90.9% respondents stating they have been involved in internal IT project within the last three years while involvement in campus IT project fell by 10% (Questions 59 and 60). Of the 66 respondents, 54 or 81.8% identified department PM practices as formal.

**Table 5.3 Interesting Findings of Demographic Survey Questions**

No.	Demographic Survey Questions	Findings
54	How important do you think project management is to the future success of your department in the next 5 years	90% of respondents believe PM is the key to success.
55	Where would you consider your expertise in Project Management?	55% of respondents have less 5 years of PM experience.
56	What roles, if any have you performed either informally or formally for campus or departmental projects?	55% of respondents have led IT project with less than 1% having PM in their working title.
57	How many years of Project Management experience do you have?	55% of respondents have less than 5 years of PM experience.
58	Does your department use formal project management practices?	82% of respondents identify PM practices as formal.
59	Have you been involved in any campus IT projects in the last three years?	81% of respondents involved in campus IT projects.
60	Have you been involved in any departmental (internal) IT projects?	91% of respondents involved in department projects.

## Data Analysis

**Prepping data.** Before starting the analysis, responses to the online survey (66 out of 613) were imported into one Qualtrics database and missing data. During the inspection of the combined database, three questions were identified in the survey to be coded incorrectly. Codes were reversed to show the proper maturity score, and individual case study scores were corrected

to reflect the coding errors. After a review for missing data, a second review was conducted of combined data to identify outliers. This test was completed with site-level data and no outliers found in the data set, but an inspection was done for each question of the combined data to ensure the data was correctly imported into a new survey database.

**Internal consistency of reliability.** Reliability is an often-argued statistic in research when based on response rate. One scale developed for technology resources accepted a 65% response rate but recommended 70% for acceptable cutoff reliability (Powell & Dent-Micallef, 1997). Some studies reference an acceptable response rate as low as a 10% response (Sivo et al., 2018). Other studies identify surveys that state a 30% response rate indicates a non-response bias (Fincham, 2008). Based on a meta-analysis of 45 studies that examined the differences of response rates of different survey types, a web-based survey average 11% (Fan & Yan, 2010). This web-based survey response rate was 10.7% which is in line with the studies average. Due to the fluctuating response rate the researcher used SPSS 25 which measures the data of reliability of missing data and consistency. The variables for the reliability of the scale shows a high Cronbach alpha of 0.802, the standard for social sciences is 0.7 and above suggesting that the items have relatively high internal consistency for a reliable statistic (Bathgate et al., 2015).

The researcher designed two survey questions (46, and 48) for a response to further test the reliability of data and flag potential acquiescence bias in the survey. Acquiescence bias exists when respondents to surveys tend to agree to positive responses either because of doubt or fear of reprisal. To help improve the overall reliability responses question scales were reversed in 11 of the 36 questions to minimize item-order effect of respondents mindlessly responding to the first answer and flag possible response bias. The two questions represented the culmination of all questions that the respondents answered in the initial 36 survey questions about the department's capability and knowledge of PM using an underlying Likert scale based on defined maturity levels (Appendices K-N). Respondents were given definitions of maturity levels and PM knowledge areas and asked to rate their department's PM capability again.

When site respondents scored the IT department's overall PM capability with maturity level definitions in questions 48 a score of 2.55 collected compared to the benchmark score or 3.22 (Table 5.10) calculated from 36 questions, a decline of 0.67. When responding to questions 46, respondents scored IT department's PM skills and knowledge with definitions 2.44 compared to the benchmark score of 3.03 (Table 5.10), a decrease in PM knowledge and skills capability of

0.59. Based on the data, there is a reasonable likelihood of borderline response bias which reduces the reliability of the data but is typical in self-reporting surveys and acknowledged and accepted in Chapters Three and Four.

Site B was also identified in individual case analysis as having some discrepancies in the consistency review. For more details refer to Appendix H for details on the possible acquiescent response, non-response and social bias. Table 5.4 characterizes the benchmark scores with and without site B's data included in the study. The other sites in the study scored similarly when tested against questions 46 and 48 in the online survey. The influences of Site B's biased data deemed minor as it did not change the overall scores drastically and other sites exhibited the same bias, but it needed to be acknowledged in the study.

**Table 5.4 Possible Bias Influence on Benchmark Scores**

	Culture	Leadership	Resource	PM Skills	Communication	Scope and Change Management	Risk Management	Stakeholder Management
Site B Data Included	3.60	3.03	2.44	3.03	3.05	2.98	3.13	3.22
Site B Data Excluded	3.78	3.01	2.50	3.13	3.20	3.33	3.33	3.35

**Descriptive analysis.** A visual check for normality and examination of data was conducted using Pearson's coefficient to check skewness. The independent and the dependent variables of PM capability were found to have negatively skew. Refer to Table 5.5 for results. The PM score are moderately skewed in the study (-1 and -0.5), and the independent variables are minimally skewed (< 0.5). Kurtosis is acceptable normal range of -3, 3 (Kallner, 2018).

**Table 5.5 Descriptive Statistics for Domains and Project Management Capability**

	Sample	Median	Mode	Mean	Standard Deviation	Range	Actual	Skew	Kurtosis
Culture	66	3.67	3.7	3.60	0.493	1-5	2.33 to 4.44	-0.426	-0.462
Leadership	66	3.08	3.1	3.03	0.613	1-5	1.50 to 4.50	-0.245	-1.083
PM Skills	66	3.07	3.2	3.03	0.765	1-5	1.40 to 4.53	-0.157	-0.546
Resource	66	2.50	2.5	2.44	0.581	1-5	1.25 to 3.50	-0.310	-0.498
Overall PM Capability Score	66	3.34	3	3.32	0.535	1-5	2.02 to 4.23	-0.673	-0.552

**Domains.** The data collected from the online survey used 36 ordinal questions categorized into four independent domains based on a continuous scale ranging from 1-5 to represents five levels of maturity of organizational PM practices. The overall PM capability score of the four public HEI IT department test sites is 3.22. A 3.22 score represents a PM maturity level of three which personifies an organization that has defined PM practices that are starting to create value for the organization. Refer to appendices K thru N for general definitions of the maturity levels of the four domains in Table 5.6.

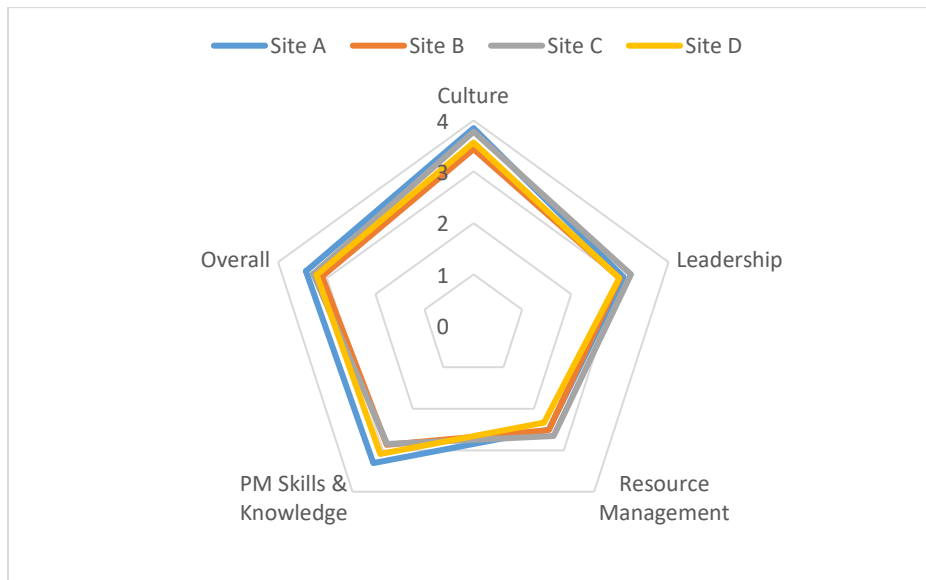
**Table 5.6 General Organizational Maturity Levels**

Level	Definition and Characteristics
1	<b>Ad-hoc</b> – No structured approach to project work and no attempt made to learn from previous mistakes and improve project performance. Sporadic stakeholder involvement in projects. Always seem to be putting out fires!
2	<b>Repeatable</b> - Developing a foundation that is growing in Project Management practices. Project Management processes are being established and often not followed all in all projects because they are viewed by many workers as being bureaucratic or an impediment to timely project progress
3	<b>Defined</b> - Starting to find value in Project Management processes. Proactive decision-making is being conducted data collected from previous project work. Project roles and responsibilities are being clearly defined and documented. Training opportunities and a position for Project Management is established as leadership if finding value in the processes
4	<b>Managed</b> - The IT department is adjusting, integrating, controlling and measuring project management practices into processes to increase efficiencies and value of projects. There is a total commitment from leadership in the department and University. Resources and risks are actively being monitored and forecasted throughout the project.
5	<b>Optimized</b> - Finding opportunities and developing innovation in IT project work and procedures. All staff are aware of Project Management and have the basic skills to participate. Proactive forecasting and planning for budget, human resources, and schedules are enforced on campus and departmental IT projects.

Note: Data for CMM, CMMI, OPM3, and ProMMM from (Synder, 2017), for P-CMM (Demir and Kocaba, 2011).

The culture domain is the highest scoring domain in the study at 3.60 meaning it is potentially the most influential independent variable when determining organizational PM capability. A level three maturity for culture characterizes an organization only using PM practices on high profile projects and information can found on the departments PM practices if requested. PM skills and knowledge domain scored a 3.03 in organizational PM capability which is tied for the second highest domain with leadership. A PM maturity level of three for

the PM skills and knowledge typifies an organization that routinely has kick-off meetings for projects, has a communication manager, developing ways to manage risks and changes in projects. The resource domain which focuses on the management of people, money and time scored a 2.44 which is the lowest domain score in the study. A level two score characterizes an organization that has does not use forecasting tools and estimates for both time and budget are often inaccurate. The overall capability and domains scores are represented in Figure 5.2.



**Figure 5.2 Radar Plot Overall Domain Scores for all Respondents**

*Deeper analysis of culture.* During the design of the survey, it was expected that culture would have a significant impact on HEI PM capability. In order fully understand culture's influence on PM capability survey questions were developed to identify common test site respondent values, understandings, opinions and expectations of behaviors for each other that shape the organization's culture over time (Schein, 2004). This comprehensive understanding of culture can "serve as a powerful framework or filter for making decisions at all levels of the organization" (Black & La Venture, 2015, p. 4). Several questions were created to identify how the respondent perceived the formality of PM practices, project teams, communication interactions and worker motivations at their organization.

When asked if culture negatively affects project management in public HEIs IT departments 68.2% of survey respondents agreed that culture had a negative impact on projects, 21.2% neither agreed or disagreed, and 10.6% disagreed that culture had any impact on projects. All nine IT leaders' interviewed thought that culture negatively influenced project management

budgets, schedules, and performance. Most respondents at two levels of the organization agree that culture hurts PM capability. To gain further insight about cultures perceived negative influence on the project the researcher investigated relationships, communication and employee motivation.

Question eight in the survey asked about the respondent how they would describe their team. The three-part question and focused on relationships with co-workers, supervisors and how they communicate. The respondents had a highly favorable response to relationships with supervisor and coworker, but some respondents (40%) thought that the communication between supervisor and employee was unfavorable. Expanding the relationship context further for other relationship identified data that 50% of respondents thought stakeholders was not adequately managed in organizational projects. Fifty-six percent of respondents believe that stakeholders are not adequately identified of which 51.5% of respondents believe stakeholders most likely unhappy with communication from the IT department.

Exploring survey results further about communication in the public HEI IT department found that 54.5% of respondents believed that the campus IT project goal was not properly communicated to IT personnel assigned to the projects. Fifty-three percent of IT respondents also believed communication led to project failures on their campus which could be attributed to communication plan maybe being created 31.8% of the time for projects.

Lastly, to understand public HEI IT department's culture respondents were asked how engaged and motivated they are in their IT department. Question 13 in the survey is a three-part question that asked about inspiration, the average work day and motivation. Ninety-seven percent of respondents are inspired to meet work goals, while 87% answered that their work day went by quickly as they were fully engaged. Fifty-three percent of workers identified with being unhappy with current compensation.

**Correlation.** The correlation results for the primary independent variables are in Table 5.7. There is a significant overall effect of the four independent variables used in the study showed on organizational PM capabilities. A statistically significant relationship evidenced using a 90% confidence interval with a 10% margin of error using the Pearson rho correlation test.

**Table 5.7 Independent Relationships with PM Capability**

<b>Pearson's Correlation Test for PM Capability</b>				
<b>Variable</b>	<b>Sample Size</b>	<b>Correlation Coefficient</b>	<b>P-Value</b>	<b>Significant Relationship</b>
<b>PM Skills &amp; Knowledge</b>	66	0.928	<0.00001	Yes
<b>Culture</b>	66	0.866	<0.00001	Yes
<b>Leadership</b>	66	0.835	<0.00001	Yes
<b>Resource Management</b>	66	0.695	<0.00001	Yes

*Simple linear regression.* To further explore the data and validate inferences made from correlation tests simple linear regression using M-Estimation was used. The test found that the domains used in the study had a positive linear relationship that could be used to predict the value of the dependent variable of PM capability with low P-values (< 0.05). Project management and capability tend to suffer in HEI because in the current the culture when the domain is used regression analysis. This could be interpreted as respondents in the current environment do not believe PM delivers the value needed for any number of reasons which this study was not designed to capture.

Three of the four domains were identified as having a significant relationship with PM capability. Of the four independent variables, resource management is the only one that was not significant in determining PM capability. Resource management had a positive relationship with PM capability, but with high coefficient variance and low R-squared value that help classify variable as not significant. Table 5.8 demonstration the significance and ranking of the four domain variables used in the study.

**Table 5.8 Linear Regression for PM Capability**

	<b>Intercept</b>	<b>Test</b>	<b>Coefficient Variation</b>	<b>Standard Error</b>	<b>P-Value</b>	<b>R-Squared</b>	<b>Significant</b>
<b>PM Skills</b>	1.24	M-Estimation	0.0624	0.201	<0.00001	0.861	Yes
<b>Culture</b>	0.224	M-Estimation	0.0839	0.270	<0.00001	0.684	Yes
<b>Leadership</b>	0.995	M-Estimation	0.0924	0.297	<0.00001	0.623	Yes
<b>Resource</b>	0.995	M-Estimation	0.121	0.389	<0.00001	0.492	No

**Multiple linear regression.** The sample size for the study for a multivariate analysis meets the minimum with a 90% confidence level and 10% margin of error. With a sample size of 62, no more than two explanatory variables can be used. The study needed 82 samples to accurately analyze the four explanatory variables in this study.

Instead of using a stepwise approach for multiple regression AIC model fit was used. Variables were first tested for multicollinearity. All four variable has been identified as having a high correlation with each other. Having a high correlation can make coefficients less interpretable and lose significance. Multicollinearity exists based on correlation testing between the domains but was not deemed substantial enough to influence results. Resource domain was dropped from the regression model as it was not significant in linear regression and when added to the regression model increases the AIC regression score, and a lower score is a more reliable fit. Comparing Table and 5.9 and 5.10 shows a better AIC or model fit without Resource Management variable. Removing the leadership domain because the sample size is only large enough to use two variables raised the AIC from regression score 61.6 to 69.2.

**Table 5.9 Regression Model with All Independent Variables**

<b>Regression Model with All Variables</b>						
Sample Size	Method	R-Squared	Standard Error	Coefficient of Variation	Model Fit (AIC)	
66 of 66	M-estimation	0.998	0.00290	0.000903	74,201,641,164,953	
<b>Regression Parameters Summary</b>						
Independent Variable	Coefficients	Lower CI	Upper CI	Standardized Coefficient	P-value	Relative Weights
PM Skills and Knowledge	0	0.349	0.349	0.550	0.00001	33%
Culture	0	0.419	0.419	0.397	0.00001	29.3%
Leadership	0	0.140	0.140	0.174	0.00001	22.5%
Resource Management	0	0.093	0.093	0.101	0.0001	15.2%
Intercept	0	0	0	0	0	0

**Table 5.10 Regression Model without Resource Variable**

<b>Regression Model with Variables</b>						
<b>Sample Size</b>	<b>Method</b>	<b>R-Squared</b>	<b>Standard Error</b>	<b>Coefficient of Variation</b>	<b>Model Fit (AIC)</b>	
<b>66 of 66</b>	M-estimation	0.968	0.0425	0.0132	61.6	
<b>Regression Parameters Summary</b>						
<b>Independent Variable</b>	<b>Coefficients</b>	<b>Lower CI</b>	<b>Upper CI</b>	<b>Standardized Coefficient</b>	<b>P-value</b>	<b>Relative Weights</b>
<b>PM Skills and Knowledge</b>	0.3846	0.369	0.401	0.550	0.00001	40.6%
<b>Culture</b>	0.4312	0.408	0.455	0.397	0.00001	33%
<b>Leadership</b>	0.1521	0.131	0.173	0.174	0.00001	26.3%
<b>Intercept</b>	0.0343	-0.026	0.094	0	0.349	0

*Interviews findings.* The interviews were conducted with nine IT leaders. Two leaders from each site apart from Site D. The researcher interviewed three leaders at Site D because it was the only test site with a PMO office, and the researcher thought there was value in capturing the perspectives of IT leaders in and outside of the PMO. A total of seven hours of interviews was collected from the site from December 13, 2019, to February 10th, 2019.

One of the main takeaways from interviewing nine IT leaders from four test sites is that project prioritization of systems and campus projects is an issue that affects all test sites. School system projects automatically take priority over campus projects. Mandated system projects often stall progress or stop campus IT projects as people resources must be reallocated mid-project to other projects causing schedule failures for site IT projects. Sites have lost people and resources for ten years and no longer have the capacity to take on extra projects. The overload of people resource affects the morale and performance of campus IT projects. This overallocation of resources is echoed by the low maturity score in the resource domain. Many of the leaders feel like the system, and the school's leadership need to work together to find a better way to gatekeeping and managing system and campus IT project resources. Site D started to find ROI or value in IT a governance process that was implemented a few years ago to help campus and IT

leadership pick and prioritize projects according to campus mission and strategy. The decision-making process was more transparent to campus stakeholders and community.

The second major takeaway from the interviews was how training was approached at each site. Each site had different approaches and budgets for training. Site C that used a continuous improvement PM methodology was the only school interviewed that had a dedicated budget and training plan PM. Site A has a division initiative to train personnel in Information Technology Infrastructure Library (ITIL) and IT Service Management (ITSM) techniques which helps integrates PM practices and processes into how this site conducts projects and IT work. Site D training plan was less apparent, but the site's approach to hiring for talent affords them the ability to be less transparent with a PM training plan. Site B leaders do not currently have a training budget for PM but intend to begin implementing PM practices in the next year and intend to invest a sizeable amount of money in PM training and professional development. Site A and C had a higher overall PM capability score. Site A the smallest IT department in the study had the highest overall PM capability score and PM skills and knowledge domain scores of all the test sites.

The IT leaders interviewed for this study thought that culture played a significant role in how the project performed. Many leaders thought that showing value in PM practices was the keys for the PM to be successful in public HEIs where governance structure, stakeholder motivations, and politics can be viewed as counterproductive. The majority of leader's interview also thought they practiced an informal method of PM and because of that struggled to get the full potential or value of the projects due to lack of resources, consistency of practices, and culture which negatively impacted project work. Leaders thought that a lack of process for prioritization system projects created a resource issue for departments that saw a decade's worth of budget cuts and reductions of full-time workers. Information Technology leaders are optimistic about PM's ability to help campus IT project perform but need more of the right people with the right skills to be successful.

***Document artifact findings.*** Document artifact defining PM practices was limited and did not produce a lot of valuable data for the study. The researcher thought this was due to the increased use of internal SharePoint sites. The researcher requested PM artifacts, but documentation collected was still limited. This lack of documents found could be interpreted as a lack of organizational PM maturity or the lack of defined formal PM practices. Leaders and IT

workers both had a hard time defining whether their IT department practiced formal or informal PM practices, indicating that many PM practices may still be ad-hoc or rely on individual heroes accomplish PM processes. Relying on a limited number of employees for their knowledge and expertise to complete PM practices is a characteristic of a level one organization.

A word cloud (Figure 5.4) was created from interviews and document artifacts collected from all the test sites to help the researcher find common themes in the qualitative data.

**Figure 5.3 Word Cloud for All Test Sites**



**Survey findings.** The overall combined PM capability score of the four volunteer universities in the study from one midwestern public school system is 3.22. Individual and groups results for PM capability and the four domains and four subcategories used in online survey assessment are represented in Table 5.11. The overall group PM capability score of 3.22 represents a “defined” organizational PM maturity level. Test sites in this study are finding value from PM practices and starting to use data collected from the project to make proactive

decisions for future project work, minimizing risks from lessons learned. Project roles and responsibilities are being clearly defined and documented while training opportunities for PM are becoming more readily available as IT and campus leadership support PM practices in the IT departments. The maturity level definitions that serve as the measurement standard for internal PM capability processes for the four domains located in Appendix K (Culture), L (Leadership), M (Resources) and N (PM skills and knowledge).

Resource management scored in the lowest in organizational PM capability assessment of the four domains and while the culture domain scored the highest of the domains and sub-categories. When compared with interview findings resource management and culture were identified as essential factors in PM performance for public HEI IT departments. Resource management and culture variables were identified by multiple levels of the organization as being key to influencers both positively and negatively in public HEI IT departments PM capability.

**Table 5.11 Site Benchmark Scores**

Variable	Site A	Site B	Site C	Site D	Grouped
<b>Overall Score (PM capability)</b>	3.43	3.10	3.28	3.21	3.22
<b>Culture</b>	3.85	3.44	3.78	3.57	3.60
<b>Leadership</b>	3.08	3.00	3.23	2.99	3.03
<b>Resource Management</b>	2.50	2.51	2.66	2.34	2.44
<b>PM skills and Knowledge Areas</b>	3.31	2.87	2.85	3.09	3.03
<b>Communication</b>	3.38	3.04	3.10	2.96	3.05
<b>Scope and Change Management</b>	3.04	2.49	2.83	3.26	2.98
<b>Risk Management</b>	3.46	2.90	3.04	3.18	3.13
<b>Stakeholder Management</b>	3.31	2.93	2.41	3.06	2.98

**Red** = lowest score **Green** = Highest score

## Hypothesis Testing

The purpose of this study was to identify factors that significantly influence PM capability in a public HEI IT organization by examining the four domains of culture, leadership, resource management, and PM skills. The culture was the domain chosen for the hypothesis because of its overall influence on organization behaviors. As discussed in chapter two, culture comprises everything in an organization, and it shapes how the behaviors, decisions, and actions of all members and how project work gets conducted (Suda, 2007). Domains were correlated to each, and culture is thought to be the variable that influences variables.

The studies hypothesis is that culture significantly influences PM capability in HEIs is accepted. Based results from correlation, regression tests, and benchmark scores, culture has a significant positive correlation between the culture and PM capability is primarily validated.

Table 5.5 identifies that culture has a strong relationship with a probability below 5% and a correlation coefficient that is 0.866 indicating a significant relationship between the two variables. The 0.866 score indicates the strength and the positive direction of the association between two variables. Interpretation of the linear regression test in Table 5.8 identified a significant relationship due to a coefficient variance of 0.0839, low P-value < 0.5) and a higher R-squared value of 0.684. Multiple regression using AIC as a barometer identified a rise in AIC score when culture domains were removed from regression. The PM capability assessment identified a benchmark score of 3.60. The culture domain scored the highest and as a significant influence in determining organizational PM capability.

Correlation, regression and benchmark scores identify the culture independent variable as having a significant association or relationship with PM capability the dependent variable in the study.

**Methodology.** A pragmatic world view guided the concurrent mixed methodology collection of test site data through interviews, online survey, and document artifacts analysis instruments. The instruments were intended to develop a deeper understanding and identify gaps and strengths of PM practices in public HEI IT context. The instruments developed for the survey are grounded along with the theoretical concept that PM practices can identify and be measured by defining maturity levels based on best practices and industry standards. The capability model used in the study evolved through the critical analysis of the literature review,

research on established capability models and the researcher's fifteen years of experience and empirical observations working and conducting IT project in public HEIs. The models effectively identified and measured organizational PM gaps and strengths in HEI context.

The capability model designed using a five-level maturity framework defined maturity levels of the four domains. PM processes and practices were scored from low (immature) to high (mature) at test sites. The definitions of the maturity levels for each domain can be found in appendices K thru N. A level one maturity, in general, is defined as an ad-hoc PM process, which is characterized by over budget and schedule projects that rely on experts or heroes to complete. A level two maturity is an organization that is developing a foundation for a growing PM practice that is often characterized by over commitment of resources where participants still view PM practices as bureaucratic. Level three maturity defined as an organization that is starting to find value in PM practices, often characterized by project scope planning with communication and risk plans with training for staff. Level four maturity is an organization that is adjusting, integrating, controlling and measuring project management practices into departmental processes. Lastly, level five maturity is characterized by organizations that use PM to optimize and innovate practices to prioritize strategic goals and continuous improvement of the organization.

The online survey assessments using the maturity framework were designed to capture IT workers' perceptions of PM practices to identify the test sites overall PM capability. The interviews and document artifact analysis designed using the maturity framework was used to provide supporting evidence and context to the benchmark scores of the four domains. The sampling strategy used by the researcher of using one public school system and any IT worker regardless of PM experience may have inadvertently introduced acquiescence bias to the results of the study. Six percent of the respondents that completed the survey left feedback about their frustration over the inability to skip questions in the survey that they did not understand or felt did not apply to them.

## **Summary**

Due to the lack of PM capability studies identified in the public HEI industry a PM a model and survey was created from examples in the literature review from other industries. The data that was collected and analyzed in the study did contain bias which is expected in self-report surveys and did show a correlation of the independent variables which can reduce the reliability

and accuracy of results. Because of these factors, the results from the correlation and regression cannot be taken for granted and should be used with caution. The researcher thinks the theoretical construct and trustworthiness of the capability model and survey is appropriate for measuring project management in the public HEI context. The findings that culture played a significant role in public HEI IT departments PM capability was expected at the onset of the study.

Chapter Six will present a summary of the study, discuss the findings concerning the research question and hypothesis, and share future implications for research and practice and how these results can be used to help HEI IT practitioners and higher education achieve increased organizational PM capability which may create improved project performance.

## **Chapter VI. Discussion and Conclusion**

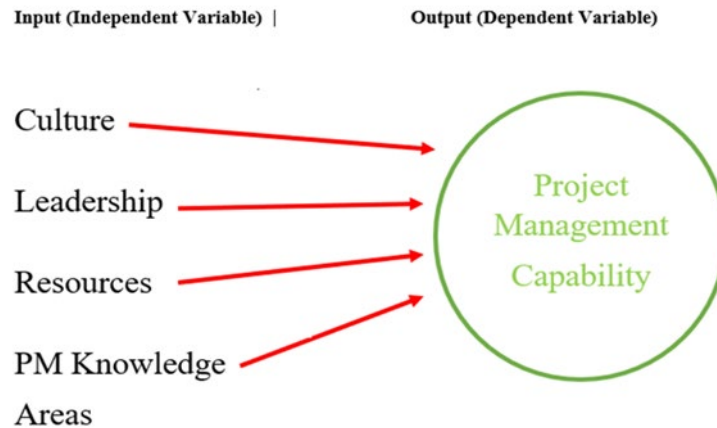
### **Introduction**

Chapter 6 contains discussions about the research method used and the implications of findings for the researcher, HEI leaders, practitioners, and future studies about organizational PM capability in public HEIs. This chapter examines how culture, PM formality, and training may contribute to organizational PM capability in the Midwestern public schools used in the study. The chapter also inspects the limitations of the study and discusses the implications of the findings to further research. Lastly, the researcher identifies and discusses areas recommended for future study, ending with a conclusion of the chapter.

### **Summary of Study**

This study reports the findings of the literature review, online survey, interviews and document artifact analysis used in conjunction with the theoretical framework of capability maturity models in determining the current PM capability of four domains assessed in the public HEI IT context. The results of the survey, interview, and document artifact analysis were used to identify gaps and strengths of project work and practices in HEI environments. A mixed methods approach was used to investigate and explore the PM capability of HEI IT departments using a capability maturity model designed to be used in a public HEI context. The literature review identified a lack of research and standards in using capability maturity models designed to use public HEI context. Dr. Diane Synder doctoral dissertation identified “26 of 895 (< 3%) peer-reviewed articles published since 1990 related to higher education institutional maturity, capability or performance” (2017, p. 37). The researcher believes that this study has added to the context of project maturity, capability, and performance in public HEI context.

The study used correlational statistics to determine the association of four domains to determine the current and represent HEI IT organizations overall PM capability. The four domains used were found to be highly correlated and influential in determining an HEI organizational PM capability. One of the studies goals was to examine the variables represented in Figure 6.1, especially organizational culture’s influence on PM capability in a HEIs IT departments that may arguably be during operational, social and economic change.



**Figure 6.1 Project Management Capability Relationships**

The researcher and others in the field believe that the changing needs of students, technology, politics, in combination with increased competition and reduced budgets have “sparked a re-examination of the modern university’s mission and its role within networked society” (Anderson et al., 2017, p. 2). Previous research found links between maturity and project performance and this study’s intent was to examine further how culture and three other domains influenced public HEI IT organizational PM capabilities. The study uses maturity levels to characterize and measure the PM capabilities of an organization. Immature PM domain scores represent PM practices that are often flexible but lack definability, repeatability, and predictability in PM processes (Pasian, 2011). A mature or higher-level domain score represents PM practices and processes that contribute to the overall capability of an organization. Mature PM practices are often characterized by defined processes, roles and responsibilities that are consistent and predictable.

Knowing and understanding organizational PM capability allows leaders and participants to better determine the likelihood of project success. Understanding how an organization performs can provide valuable insight allowing leaders the ability to build needed PM capability that has the most positive influence on organizational project performance. This study is committed to helping HEI practitioners and leaders develop a more in-depth understanding of organizational PM capability. The methods and capability maturity model used in the study provided the means to measure current PM practices and relationships and assign benchmark scores. Benchmark scores represented PM capability of the four test sites and the one public school system. Understanding and building organizational PM capability is a means to

effectively increase the likelihood of IT project performances which could help reduce overall organizational costs that may have raised tuition costs.

Project management can be used as a conduit for implementing innovative institutional strategies and changes in HEIs. Projects in other industries were used for decades to deliver organizational change successfully. The difference between other industries and HEI is the economic drivers, motivations, values, and ideologies of the stakeholders who form the norms of the culture that ultimately make the decisions that form a strategy. The study's intent was to explore culture through the perception of practitioners and managers at multiple levels of the organization. The researcher believes that the IT departments in public HEIs are often at the forefront of strategy changes and debates in HEI due to the role that technology plays in delivering change. The findings from this research support future studies interested in exploring the characteristics of the relationship between public HEI culture and PM capability.

### **Discussion of Findings**

This study examines the characteristics of HEI IT departments that influence the maturity and capability of PM practices. Research into the variables that influence communities such as higher education deepens the theoretical understanding PM and helped provide a way of refining and substantiating the thoughts and ideas of the researcher that HEI culture, leadership, resource management, and PM skills significantly influenced PM capability significantly. The Pearson correlation test runs on the data collected from the small sample which limited regression tests and showed signs of bias, identified at a 90% confidence rate with a 10% margin of error that the four domains used in the study were significantly correlated to PM capability (Table 5.5). Corroborating the study's hypothesis that culture significantly influences PM capability in public HEIs.

The midwestern public school system assessment identified an overall PM capability benchmark score of 3.22. A three-level organizational PM maturity score is indicative of an organization that is finding value from PM practices and is integrating more PM practices into the departmental processes. The interviews and document analysis data collected to supports a level two maturity assessment that may be transitioning to level three. A level two is an organization that struggles with overcommitting resources, both human and monetary which is often referred to in interviews. A lack of documentation artifacts indicates a level two maturity level. The researcher thinks a level 2 score is a more accurate assessment in this assessment due

to the potential of partially overinflated scores caused by survey bias flag in the study and discussed in chapter 5.

The results of this study are lower than two other studies, but two factors need to be considered that are unknown. The first factor is it is unknown how long institutions had been conducting PM practices before being assessed. The second factor is one of the test sites in this study is not performing PM practices formally but was allowed into the study because of the nature of IT work which is very project oriented. This factor must be considered in the lower score overall PM capability score for this study. Table 6.1 describes the similarities between the three studies.

**Table 6.1 Comparison of Capability Studies**

Researcher	Year	Domains	HEI Institute	Sample	Study Methodology	Overall PM Score
<b>D. Bryde &amp; D. Leighton</b>	2006	10	1 HEI UK	212 across organization	Quantitative	2.94
<b>D. Synder</b>	2016	7	44 US Community Colleges	86 experienced PMs	Quantitative	2.72
<b>D. LeDoux</b>	2019	4	4 public HEIs in 1 public school system	66 IT with varied experience in PM	Mixed Methodology	*2.55

\*With potential bias is removed (-0.67). The overall score was 3.22.

Culture, as perceived by the respondents in the survey and interviews, has a significant influence on public HEI IT departments PM capability. The benchmark score for culture is the highest of all four domains measured. In statistical testing that used correlation and regression, the culture showed a significant relation to organizational PM capability. PM and capability tend to suffer in HEI because of the current culture, according to regression analysis tests. The survey was not built to capture why HEI culture why respondents did not value PM. Interviews eluded that it could be because of the expense involved to train and implement PM is currently not seen as valuable due to time constraints and budget concerns or the idea that PM may be perceived as not delivering value because expectations or results are not adequately communicated to IT workers. Whatever the reason, the current culture domain scores lower HEIs organizational PM capability when the culture domain is used in regression analysis.

Test sites had differing perspectives in the study between IT workers about the state of formality PM practices. Leaders interviewed questioned the definition of formal and informal PM with a majority identifying PM practices as informal. Organizations that identify PM practices as informal find themselves in an immature state, unable to solve or identify organizational factors affecting their practices because they have yet to define the PM processes in their organization formally. The definition of formal and informal PM practices was not given to either group, but informal was defined for the study as any PM process that is ad-hoc or hard to repeat while formal implies an adherence to a preferred methodology that has defined and documented PM practices. The document artifact analysis for this survey did not find supporting evidence of defined PM practices which could be misleading due to the increased use and storage of document on internal SharePoint sites. Eighty-Two percent or 54 out of 66 survey respondents in the survey identified their institutes PM practices as formal. This contradiction is interesting and may indicate things which this study was not designed to capture.

One of the takeaways from the interviews was the approach to training taken by Site A and C. Each site used a different PM methodology but approached training from an organizational perspective rather than an individual. Leadership in these two sites believed that in order to be successful in PM the whole IT department needed to possess knowledge and experience. This finding is interesting because these two sites had the highest PM capability scores in the survey. This study missed the opportunity to capture the significance of the correlation between training and PM capability.

In summary, the test sites have some characteristics of a level three PM practice, but the bias found in the survey and the qualitative evidence collected supports a level two maturity score. It is because of the qualitative findings that the researcher would classify the midwestern school system overall score as a level two organization still trying to prioritize and manage resources transitioning to a level three which is finding value in integrated and defining PM practices into campus and departmental IT work. Culture identified as having a significant influence on PM capability which is highly correlated and lowers PM capability scores. The two interesting findings from the study have to do with the contradiction in the identification of the formality of PM practices and what role the training approach influences PM capability.

**Limitations of the study.** The study outcomes were as expected, but the validity was reduced or limited by a small sample and response bias. The survey sample was fixed to the

number of schools that volunteered (4 out of 13) from the midwestern public school system. By not having most of the schools in the system participating the generalizability of the findings was limited. The small sample of respondents also reduces the power and validity of statistical tests, especially at the individual test sites. Because of the small sample size, regression testing is limited to only two domains in order to ensure consistency and accuracy of tests.

Response bias is prevalent in research that involves collecting data using self-reporting techniques such as web-based surveys (Fincham, 2008). If a survey achieves less than a 30% response rate, it lowers reliability and validity of survey findings and may have a non-response bias. Two test sites and the combined results (Table 6.2) indicate a non-response bias. The survey length and commitment of 20 minutes may have been a factor in the small response rate at some test sites, but completion rates indicate that most respondents finished the survey once started. Consideration of the possible impacts of response bias needs to be considered when interpreting the results of the online survey in this study.

**Table 6.2 Response Rates for Test Sites**

<b>Test Site</b>	<b>Responses Recorded</b>	<b>Response Rate</b>	<b>Completion Rate</b>
<b>Site A</b>	8 out of 17	47%	80%
<b>Site B</b>	17 out of 28	61%	94%
<b>Site C</b>	8 out of 43	18%	50%
<b>Site D</b>	33 out of 525	7%	64%
<b>Combined</b>	66 out of 613	11%	80%

The results of the study may also be limited by the findings of acquiescence and social desirability bias. Acquiescence and social bias were acknowledged as a potential bias for respondents early in the study and profoundly influenced the design of the survey. An effort to control acquiescent response bias was designed into a study with various techniques discussed in chapter three to combat and flag bias. In chapter five analysis and results, it was determined that the likelihood of bias still existed.

Lastly, the document artifact analysis instrument used in the study results were limited. Documents artifacts show physical evidence of PM practices and maturity which is an integral part of supporting the findings of the surveys and interviews from the study. Artifacts represent the IT department processes, practices, and decision making which provides an insight into the norms and culture of the department. A lack of documentation artifacts represents an immature PM process that is not defined and managed.

The researcher thought the lack of document artifacts was due to one of three things, internal SharePoint sites that were not accessible to the researcher, immature PM practices and or a misunderstanding between researcher and leaders on the importance of documents artifacts. All sites leaders were asked on several occasions for supporting documentation about their PM practices, but it may have also been the inability of the researcher to communicate what the study was looking for in documents. The test site D test was the only site with internal SharePoint sites that also created an abundance of public facing PM document artifacts, and it was likewise the only school in the survey with a PMO office. One of the primary duties of a PMO office is to define PM standards and processes for an organization.

**What I learned.** I learned more about being a project manager conducting this research study than I did in the previous eleven courses for this degree. I will take more away from this experience personally and professionally, than can be communicated in words in this thesis. This study taught me that learning is a lifelong and invaluable journey of acquiring knowledge. What I have learned during this study changed my perspective on my role as a PM and how important that role is to both in HEI and society. I have a new respect and appreciation for individuals that seek higher level degrees as a level of dedication and thirst for knowledge is required. Learning is living, and we are all students in this world. This research study was one of the most prolonged and focused periods in my life to date and shown me that total commitment is needed to be successful in PM. This study taught me to be authentic and find the courage within myself to voice my thoughts and be more self-reliant. I am thankful for the learning opportunities and the ability to be a leader and example in my community.

**Project management.** Project management success depends on people, trust and culture. A project manager is more than a taskmaster or planner, a project manager is a broker and nurturer of relationships between the organization and individual. Keeping project team members involved and engaged means understanding individual motivations and values. Being cognizant of people's motivations and values provides valuable insight into how and why people make their decisions and conduct themselves. Valuing employee's work and treating team members with respect makes a huge difference in an individual's attitude. Listening and showing appreciation for people's work, making extra sure to acknowledge any contributions out of the normal. It the PM job to ensure that tasks get accomplished and the researcher believes the best way is to show that is by the PM showing genuine interest in seeing them be successful

as an individual. Building a bond of trust is an asset, an asset that organization's need to value and build because they shape perceptions, assumptions, attitudes, and behaviors which in turn affect the overall performance of an organization. Building a healthy collaborative culture that promotes helping an individual meet their own professional goals, in turn, helps build a dynamic team that in my opinion is more apt to find innovation that can transform an organization or industry.

**Implications for Higher Education.** Technology, social and economics are thought by many to be current catalysts or drivers of current change in HEIs. The change will not happen overnight in higher education and PM will produce or meet full expectations until the culture is addressed at each campus. The values, beliefs, and attitudes of the people in the community, administration, faculty, students can and will undermine organizational strategy that does not align with their goals. The question that many administrators and PM find themselves trying to answer is how to change the culture in a complex organization. This researcher believes that culture can be changed through carefully measured small steps integrated into projects.

This study concentrated on using a capability maturity model to quantify and understand how the current environment is influencing the development of organizational PM capabilities of public HEI IT departments. Capability maturity models have been used for over three decades to build organizational PM capabilities, and part of the intent of this study was to demonstrate the ease of use, interpretability of the results, and strategic value using capability maturity models to improve project outcomes, performance, and value gathered from campus project work. "The CMM model embodies a simple principle: if organizations wish to develop predictability and repeatability in their processes, process areas needed development" (Cooke-Davies & Arzymanow 2003, p. 3).

Capability maturity models allow a leader to systematically plan and grow PM practices in their institutes by targeting areas of institutional need identified in the assessment. This assessment creates an organizational baseline that can be used to determine whether the investment in PM has paid dividends and accomplished their original intent. Identify and understanding the current state of organizational PM capability is a valuable tool for leaders integrating PM practices into complex organizations where culture has a significant role in determining project performance and success. Understanding the current organizational PM

capability of an organization allows leaders the ability to predict the likelihood of project based on PM ability and make informed decisions reducing the risk of failure.

Demonstrating and showcasing the value created from PM practices may garner the buy-in and support from campus stakeholders that many HEI IT leaders need. Creating PM practices that are definable, repeatable, and well managed to meet the needs of the institution will create opportunities for innovation that many institutions are striving to achieve. Reducing time, cost and showing the value of campus projects will help diminish and alleviate some of the current issues with resource management and perceptions in public HEs that PM is another bureaucratic process that slows project progress and limits flexibility. Virginia and Texas have a state legislature that requires public funded universities to use a formal PM analysis and tracking process for the project over a certain dollar amount (Wierschem & Johnston, 2005). Perception of PM in public HEIs is crucial to its success. Having the current pulse collected from the PM capability model assessment presents leaders with the opportunity and ability to manage the narrative.

**Implication for Practitioners.** This study is a demonstration of how to broadly capture variables that influence PM capability in public HEI IT departments. Understanding how the culture, leadership, resource management, and PM skills and knowledge is perceived, and influences project outcome is an essential tool for practitioners looking to reduce risk while increasing project performance in an organization. Using the model's assessment of organizational PM capability which is based on PM standards and defined organizational PM goals provides the baseline and framework to develop and measure PM capabilities. Roadmaps or systematic plans of change can be developed by practitioners to fine-tune an organizations PM capability to meet the needs of the organization. "The project management maturity assessment can provide a methodological and deliberate mechanism of the competency health of an organization in a detailed, objective and formalized fashion" (Rad & Levin 2006b, p. 4). Having the ability to identify and then measure the impact of changes in process areas that are struggling is an effective and efficient way to invest and draw more value from limited resources.

This study identifies culture as a significant influence in determining PM capability. A project manager in HEI must be aware that he or she is an ambassador and teacher of the PM practices. Relationships building and demonstration of the value of PM practices must be promoted heavily as many stakeholders may have already perceived organizational PM practices

as complicated and slow with low return investment. Culture does not change overnight, and there is no one right answer or magic bullet for reaping the most out of an organizations PM practices. An organization's leaders and practitioners need to define what is essential and valued by the organization and find ways to advance and continuously improve PM practices to achieve those goals. This study for practitioners implies that organizational capability models can be adapted and be effectively used to measure PM capability in complex HEI IT departments. The approach was easily adapted to HEI organizational characteristics to provide more in-depth insight into the influences of PM capability.

**Implications for Future Research.** This study used a concurrent mixed methods methodology which is the first known use of the methodology for PM capability in the HEI context. Dr. David Bryde and Diane Leighton developers of one of the first known models to measure PM capability in UK HEIs used an empirical study that interviewed two PM experts and used the literature to develop the domains (factors) and questions used in the quantitative survey (2009). Dr. Diane Snyder's 2017 study of United States community colleges reduced the domains to seven and used the same questions in her quantitative survey. Dr. Beverly Pasion, a leader in the project management field, used a multimethod which used multiple qualitative approaches to identify the factors that influence the perception of maturity for non-process factors that attribute to PM capability (2011).

Mixed methods provided the researcher with greater insight and depth to capability in site assessments. It allowed the researcher to elicit and to understand people's experiences at multiple levels of the organization using multiple instruments giving equal weight in the study to both qualitative and quantitative data. By using a triangulation convergence design collecting data concurrently, the researcher was able to validate and limit personal bias while ensuring data findings were not askew, thus creating a solid foundation for drawing conclusions about the four variables impacts public HEI PM capability. A mixed method approach helpful in trying to establish meaning and depth to quantitative measurements by gathering subjective perspectives and motivations of individuals in complex organizations, moving research past the descriptive level. This is methodology was key to a better understanding of how a complex organization culture, leadership, and knowledge influences the development of organizational PM capabilities.

## Areas for Future Research

The results of this study provide the preliminary testing of a capability maturity model designed for use in a public HEI context. The study establishes the basis for future testing of the model components, instruments and concepts used by the model for assessment of HEIs. The areas recommended for future research based on the results, methodology, instruments, and study limitations. Beyond the test results and modification of the model, this study results raised questions about how the cultural influences the decision making and IT department process integration of PM practices. More work needs to be done to understand why some HEIs do not always value PM.

Based on the finding from the study one of the most important issues that future research should address is establishing a clear relationship between project management capability and successful project delivery. Due to the complexity of the environment and multiple stakeholders with different values, the study indicates that defining project success is often difficult for HEI IT department personnel. The practice of PM teaches not to start a project with a clear definition of what success is because it leads to miscommunication and unnecessary risk in projects.

The researcher also recommends expanding, refining and adding additional domains to the capability maturity model used in this study for future studies. The modified model should also focus on project quality, success, PM training and expansion of resource management domain; mainly focusing on prioritization of resources. The two test sites in this study that scored the highest overall PM capability both approached PM training from an organizational approach rather than an individual. Adding a training domain to the survey would help further explore the relationship between training and PM capability in HEIs. In addition to the modification to the model, the researcher would also recommend adding community and stakeholders' perceptions to sample pool, providing a more insightful assessment of the current PM capabilities for leaders and practitioners to build organizational PM capability.

It was the researcher's hope in developing capability benchmark scores into the assessment results that it would encourage a competitive culture advancing to PM maturity to level four (innovating) and five (optimizing) of the capability model. More research needs to be conducted around benchmark scoring how HEI culture may impede advancing maturity levels in HEIs. Studies need to focus on understanding how HEI culture influences project performance,

value, and results. Concentrating attention on how shifting values of the community and stakeholders impact PM practices.

## **Conclusion**

This chapter discussed the methods and tools that were successfully used to understand further and link the four domains in the study to organizational PM capability. Discussing what the benefits and implications of having current organizational PM capability knowledge are for the researcher, HEI leaders, practitioners, and future studies. The culture identified in the findings has a significant role in determining organizational PM capability. The studies limited sample and identified bias limited the power of the results which likely overinflated the midwestern school system's overall organizational capability score.

Organizational PM capability when conducted in a disciplined and realistic way is believed by this researcher and others to have significant returns on its investment (Ibbs & Kwak, 2000; Hillson, 2003; Bryde & Leighton, 2009; Albrecht & Sprang, 2014; Crawford, 2015; Synder, 2017, Levin, 2018). If HEIs are going to mature into a project-based organization that takes advantage of the efficiencies offered to the reliability of operational practices and organizational performance, culture needs to adapt. Further work and understanding of HEI's organizational culture are needed because the path taken by HEI in gaining PM capability is different from the corporate path.

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## Appendices

### Appendix A. IRB Approval



UNIVERSITY OF WISCONSIN  
**PLATTEVILLE**  
INSTITUTIONAL REVIEW BOARD

11/21/2018

Don LeDoux  
Sponsor: Ginger Levin  
Department of Project Management  
University of Wisconsin-Platteville

RE: IRB Protocol #2018-19-14

Project Title: Project Management Capability: An Assessment for Higher  
Education Information Technology

Approval Date: 11/21/2018

Your project has been approved by the University of Wisconsin-Platteville IRB via an Expedited Review. This approval is subject to the following conditions; otherwise approval may be suspended:

1. No participants may be involved in the study prior to the IRB approval date listed above.
2. All unanticipated or serious adverse events must be reported to the IRB.
3. All modifications to procedures, participant selection, and instruments used (surveys, consent forms, etc.) must be reported to the IRB chair prior to their use.
4. Starting July 2018, "expedited" and "exempt from continuing review" protocols no longer have an end date for approval. However, as stated in item 3 above, if you add participants or modify the project, a modification form must be submitted.

If you have any questions, please contact the IRB chair at the address below. Include your protocol # on all correspondence.

Sincerely,

Dr. Barb Barnett  
Institutional Review Board Chair Professor,  
Mathematics Department Gardner 451  
University of Wisconsin-Platteville (608)

342-1942  
barnetb@uwplatt.edu

## **Appendix B. Site Consent**

### **Welcome to the Higher Education Institute Project Management Capability Study!**

My name is Don LeDoux, and I have worked at UW-Stout as an IS Tech. Senior for 15 years in various positions. For the last 4 years, I have been working toward obtaining my Master of Science degree in Project Management (MSPM) from the University of Wisconsin- Platteville.

**Why is this study being performed?** The first reason is to complete my graduate study requirements and secondly, to hopefully improve the work IT work experience in Higher Education Institute (HEI) projects.

**Why am I inviting you and your department to participate?** I am inviting you, your department and institution to take part in the study because of your first-hand knowledge and experience leading and managing technical projects in a Higher Education IT department.

**What is the purpose of this research study?** The intent of this research is to learn more about why many Higher Education Institute's (HEIs) struggle to realize the efficiency and effectiveness of project management practices. Efficiencies that other industries have come to expect with consistency seems to elude many HEIs. I have heard the rationalization for years that HEIs organizations have "unique or intangible characteristics" that affect project performance but can't be measured and or even identified because it is too complex.

To help further the discussion and understand why and how to identify these traits, I have developed an HEI specific capability model and assessment tool. The model will help determine the project management (PM) capability of IT departments through known critical PM components and best practices. The assessment will measure and assign benchmark scores to critical elements that can be used to quickly gauge PM ability of an IT department. The aim of this study is to help find better ways to ensure efficiency, effectiveness and return on investment when conducting project work in HEIs IT departments. This is critical especially in a time when both fiscal and knowledge resources are limited.

#### **Benefits of participating:**

- A voice in identifying traits and improving project management practices in HEI.
- A case study report summarizing the department's overall project management capability
- A benchmark score that can be used to compare against peers and competition.
- A roadmap that can be used to help leadership strategically focus both energy and resources in four critical areas of your department to get a maximum return.

**What will be needed for the site to participate?** Verbal or email consent from CIO to move forward with the study. No one will be contacted until consent from CIO is granted.

#### **What will be requested of the site:**

- CIO participates in a recorded discussion about project management (30-60 mins)
- 1-2 volunteers from management to participate in interviews about project management.
- Volunteers from current department employees to take self-administered online Qualtrics questionnaire (Email with a link to all employees asking for their participation)
- Help in obtaining internal documentation that will help define and validate departments project capabilities. (Link to form and directions sent later)

- The commitment of 3-4 weeks for the researcher to collect data interviews, document artifact analysis, field notes, and questionnaire.
- Help to promote participation in interviews and questionnaire.

**Benefits of participating:**

- A voice in identifying traits and improving project management practices in HEI.
- A case study report summarizing the department's overall project management capability
- A benchmark score that can be used to compare against peers and competition.
- A roadmap that can be used to help leadership strategically focus both energy and resources in four critical areas of your department to get a maximum return.

**Are there any risks in participating in the study?** Minimal risks have been identified, such as unflattering or unfavorable results to the institution and for this reason, anonymity will be practiced for both you personally and your institute.

**What happens to the data collected from the questionnaires, interviews and document artifact analysis?** All the data will be stripped of any identifying information before moving to data analysis. The data will be used to create statistics, benchmark scores and theories about HEI and project management. The data collected from the site will be stored securely by myself and/or my advisor, Dr. Ginger Levin and handled and disposed of according to the data management practices of the University of Platteville.

**Has this research received ethical clearance?** Yes, it has. If you should have concerns about your treatment as a participant of this research, please call or write:

Barb Barnet, Chair, UW-Platteville IRB  
(608) 342-1942  
barnetb@uwplatt.edu

**Do I have to say yes?** No, you do not have to say yes.

**How do I indicate my agreement to participate?** If you would like to participate in this research study respond to this email or call me stating your intent to participate.

**If I say yes to participating, can I change my mind later?** You can change your mind and pull of the study at any time without reason.

**Statement of confidentiality:** I may quote your remarks to open questions in presentations or articles resulting from this interview. A pseudonym will be used for your identity, and any notes or any identifying information from transcription will be stripped to protect your identity.

If you would like to commit to studying, comment, share, or be removed from the study results at any time please contact me or my advisor at:

**Don LeDoux – Researcher**  
ledoux@uwplatt.edu  
(715) 232-5291

**Dr. George Watson, Faculty Sponsor**  
watsong@uwplatt.edu

**Thank you** so much for your time and consideration in participating in this study. I am hopeful that this study can help create a better HEI IT environment to conduct projects in!

Don LeDoux

## **Appendix C. Interview Consent**

### **Welcome to the Higher Education Institute Project Management Capability Study!**

My name is Don LeDoux, and I have worked at UW-Stout as an IS Tech. Senior for 15 years in various positions. For the last 4 years, I have been working toward obtaining my Master of Science degree in Project Management (MSPM) from the University of Wisconsin- Platteville.

**Why is this study being performed?** The first reason is to complete my graduate study requirements and secondly, to hopefully improve the work IT work experience in Higher Education Institute (HEI) projects.

**Why am I inviting you?** You have the first-hand experience in an HEI IT department, and your CIO agreed to participate in the study.

**What is the purpose of this research study?** The intent of this research is to learn more about why many Higher Education Institute's (HEIs) struggle to realize the efficiency and effectiveness of project management practices. Efficiencies that other industries have come to expect with consistency seems to elude many HEIs. I have heard the rationalization for years that HEIs organizations have "unique or intangible characteristics" that affect project performance but can't be measured and or even identified because it is too complex. To help further the discussion and understand why and how to identify these traits, I have developed an HEI specific capability model and assessment tool. The model will help determine the project management (PM) capability of IT departments through known critical PM components and best practices. The assessment will measure and assign benchmark scores to critical elements that can be used to quickly gauge PM ability of an IT department. The aim of this study is to help find better ways to ensure efficiency, effectiveness and return on investment when conducting project work in HEIs IT departments. This is critical especially in a time when both fiscal and knowledge resources may be limited.

### **Benefits of participating:**

- A voice in identifying traits and improving project management practices in HEI.
- A case study report summarizing the department's overall project management capability
- A benchmark score that can be used to compare against peers and competition.
- A roadmap that can be used to help leadership strategically focus both energy and resources in four critical areas of your department to get a maximum return.

**What will be requested of the interviewee?** The interviewee will need to commit to a 30 to a 60-minute recorded discussion about project management practices in their department via Skype, phone or in person.

**Are there any risks in participating in the study?** Minimal risks have been identified, such as unflattering or unfavorable results to the institution and for this reason, anonymity will be practiced for both you personally and your institute.

**What happens to the data from this interview?** The interview will be transcribed and analyzed for common themes and then compared with other universities interviews to help in the identification of common traits for theory development. The data collected from the site will be

stored securely by myself and/or my advisor, Dr. Ginger Levin and handled and disposed of according to the data management practices of the University of Platteville.

**Has this research received ethical clearance?** Yes, it has. If you have concerns about your treatment as a participant of this research, please call or write:

Barb Barnet, Chair, UW-Platteville IRB

(608) 342-1942

[barnetb@uwplatt.edu](mailto:barnetb@uwplatt.edu)

**Do I have to say yes?** No, you do not have to say yes. **Note:** You can change your mind and pull out of the study at any time without reason, and I will thank you for your time.

**How do I indicate my agreement to participate?** If you would like to participate in this research study, please respond to this email or call me stating your intent to participate.

**Statement of confidentiality:** I may quote your remarks to open questions in presentations or articles resulting from this interview using a pseudonym name. The code name will also be used to hide your identity on any documents such as interview notes and transcription before it is stored and prepped for analysis.

If you would like to commit to studying, comment, share, or be removed from the study results at any time please contact me or my advisor at:

**Don LeDoux – Researcher**

ledoux@uwplatt.edu

(715) 232-5291

**Dr. George Watson, Faculty Sponsor**

watson@uwplatt.edu

University of Wisconsin-Platteville

**Thank you** so much for your time and consideration in participating in this study. I am hopeful that this study can help create a better HEI IT environment to conduct a project in!

Don LeDoux

## Appendix D. Survey Consent

Welcome!

### Higher Education Institute Project Management Capability Study

Thank you for taking the time to participate in the survey. You have been specifically selected to participate in the study because of your experience working in higher education IT department. Your participation in the study will lead to a better understanding of how project management practices and efficiencies are affected by the working environment in which they are conducted. My name is Don LeDoux, and I have worked in higher education IT department for 15 years at UW-Stout. For the last 4 years, I have been working toward obtaining my Master of Science degree in Project Management (MSPM) from the University of Wisconsin-Platteville.

**What is the purpose of this study?** To learn more about why the Higher Education Institute's (HEIs) IT department's struggle to realize the efficiency and effectiveness of project management practices. Efficiencies that other industries have come to expect with consistency seems to elude any HEIs. The studies aim is to identify and measure organizational traits that affect project management efficiency for a better return on investment.

**How do I indicate my agreement to participate?** Clicking "I consent" and the Next button to begin the survey.

**If I say yes to participating, can I change my mind later?** You can change your mind and pull out of the study at any time without reason. I will thank you for your time in the study, remove your responses and not contact you again about the study.

**Are there any risks in participating in the study?** Minimal risks have been identified, and for this reason, anonymity will be practiced for both you personally and your institute.

**What happens to the data from the questionnaire?** The data collected from each user and its site will be used to compare against other institutes to identify any trends or patterns. The data collected will be stored securely by myself and/or my advisor, Dr. George Watson and handled

and disposed of according to the data management practices of the University of Wisconsin-Platteville.

**The benefits of participating:**

- An anonymous voice in identifying organizational traits and improving project management practices in the HEI IT department.
- Help leadership understand the difficulties of conducting projects in HEI.
- Link to report for the combined results of your institute.
- \$50 Amazon Gift Card Raffle

**Financial Information:** Once the survey is completed an ending survey message will contain an anonymous link to a second survey. The information in this survey will be used to award and deliver a \$50 Amazon gift card. The data between the main survey and the raffle surveys are not linked.

**Has this research received ethical clearance?** Yes, it has. If you should have concerns about your treatment as a participant of this research, please call or write:

Barbara Barnet, IRB Chair

(608) 342-1942

barnetb@uwplatt.edu

**Statement of confidentiality:** All identifying information will be stripped before data is analyzed and used in the study.

If you would like to comment, share, or be removed from the study results at any time, please contact me or my advisor at:

Don LeDoux– Researcher

Dr. George Watson, Faculty Sponsor

ledoux@uwplatt.edu  
(715) 232-5291

watson@uwplatt.edu

Thank You for your time! I am hopeful that this study can help create a better environment to conduct IT projects!

## Appendix E. Interview Questions

The interview will be comprised of ten questions that will ask about perceptions and beliefs about how IT project is conducted at your University; please be as forthright as possible. This is not an exercise to point out where we have failed, but an exercise to find a better more efficient path to success.

This studies is premise is to determine the IT department's capability to conduct projects while identifying ways to improve project efficiency and effectiveness. In order to determine if your project processes are capable, this study uses five maturity levels to describe organization process characteristics. A quick way to determine where you are, and where you want to be. Please read the maturity levels below before the interview and be ready to talk where your department is and where you want to go.

### Before the interview date:

- Review questions
- Be prepared to have an open discussion about project management practices in higher education.
- Be prepared to share some examples.

### Interview Day:

- Please be supply a quiet area to be interviewed in person or be in a quiet area to receive agreed-upon Skype or phone call.
- Be prepared to talk about your department and your perceptions of how it handles the project work.

I look forward to our conversation, and I am hopeful that our work and this study can create valuable metrics and roadmaps for IT departments to gain more value from Project Management practices on their campuses.

Thank You,

Don

## Levels of Organizational Maturity

**Level 1 - Initial** - Ad-hoc and informal processes. No structured approach to project work and no attempt made to learn from previous mistakes and improve future projects. Sporadic stakeholder involvement in projects. Risk assessment is not done, so projects are often delayed and over budget. Always seem to be putting out fires!

**Level 2 - Repeatable** - Developing a foundation that is growing in Project Management practices. Project Management processes are being established and often not followed all in all projects because they are viewed by many workers as being bureaucratic or an impediment to timely project progress. There is minimal training for and expertise in Project Management in the department, so any repeatable processes are dependent on worker experience. Data collection is starting to take place with generic templates, but data collection is not advanced enough to accurately forecast project cost, time and success so full commitment from leadership missing.

**Level 3 - Defined** - Starting to find value in Project Management processes. Proactive decision-making is being conducted with the use of consistent data that is being collected from project work. Project roles and responsibilities are being clearly defined and documented. Training opportunities and a position for Project Management is established as leadership if finding value in the processes. Project Management value is recognized at both the department and University levels, and there is a desire but lack of knowledge to integrate into more campus processes. Project charters and change management process are being created and enforced in all IT projects.

**Level 4 - Managed** - The IT department is adjusting, integrating, controlling and measuring project management practices into processes to increase efficiencies and value of projects. There is a total commitment from leadership in the department and University. Resources and risks are actively being monitored and forecasted throughout the project.

**Level 5 - Optimized** - Finding opportunities and developing innovation in IT project work and procedures. All staff are aware of Project Management and have the basic skills to participate. Proactive forecasting and planning for budget, human resources, and schedules are enforced on campus and departmental IT projects.

#### **Interview Questions:**

1. Does your unit practice Project Management? Would you consider your PM processes formal or informal?
2. Can you identify how a typical IT project is chosen, conducted and completed on your campus?
3. Do you feel that your IT projects meet their full potential? Why or why not?
4. This study hypothesizes that culture, especially in HEI, plays a significant role in how effective and efficient projects are. Do you think that statement is true? Why or why not?
5. Have you had project failures in the last three years? What do you think could have improved the success rates of your projects?
6. Have you had an IT project fail at your campus that you believed was due to a lack of resources (\$) or human skills? Which one? Why do you think your campus experienced or didn't experience this shortage?
7. What do you think is the greatest impediment of conducting IT projects on your campus?
8. Do you dedicate a certain amount of your annual resources to project management training or improvement?
9. After reading the maturity level definitions, where would you consider the IT department? Campus? Please explain why the level you choose is an accurate representation of your department's project management operations?
10. What insight or advice you would give to another leader implementing project management practices in IT?

## Appendix F. Survey Questions

### The first screen of the survey:

#### Q1 Things to know before beginning:

- Must be 18 to take the survey
- Results are anonymous
- The survey consists of 52 questions (20 min approximately)
- You can stop and start at any time by using the survey link in the invitation email  
Consent has been granted by your institution.
- Consent has been granted by your institution.
- The link at the end of the survey will show the anonymous combined results report.

#### Instructions:

1. Read the consent question and click the "I consent" button to start the survey.
2. Answer all the questions to the best of your ability (You are not expected to be experts in project management practice)
3. All questions must be answered in order to complete the survey and enter the giveaway
4. If you have any feedback, questions, or concerns, there is space at the end of the survey.

#### Q2 Survey consent (Appendix D.)

Q3 Culture is the “tool kit” of habits, skills, and styles from with which individuals construct strategies of action. In a university context, this is how people negotiate daily challenges, interact and behave. Understanding how culture and ideology influences decisions in higher education is critical to finding the value and efficiency in project management practices.

#### Q4 Are project management processes applied to all projects?

- Almost always
- Often
- Sometimes
- Seldom
- Never

#### Q5 Do you think project management can be successful in a University IT environment?

- Definitely
- Probably
- Possibly
- Probably not
- Not

Q6 In your opinion does the culture of the University negatively affect project success (Time, budget, and goals)?

- Strongly agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Strongly disagree

Q7 A project is usually completed by staff from within my department only?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q8 How would you describe your team?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
My supervisor and I have a strong working relationship?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coworkers and I have a good working relationship?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The communication between leaders and employees is good in my department?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Management and employees trust each other?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees treat each other with respect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you feel there is a strong commitment to teamwork the department?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees in my department are willing to accept change?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees are willing to take on new tasks as needed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 How often do Individuals (heroes) save projects from failing?

- Strongly agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Strongly disagree

Q10 How often do Individuals (heroes) save projects from failing?

- Always
- Most of the time
- About half the time

- Sometimes
- Never

Q11 Would you describe the internal processes used to complete IT projects as informal (ad-hoc)?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

Q12 Overall, how satisfied are you with your job?

- Extremely satisfied
- Somewhat satisfied
- Neither satisfied nor dissatisfied
- Somewhat dissatisfied
- Extremely dissatisfied

Q13 How engaged or motivated are you?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I am inspired to meet my goals at work?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am often so involved in my work that the day goes by very quickly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel like my organization is dedicated to my professional development?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am satisfied with my overall compensation?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q14 Leadership** has never been more important in higher education as it is in the current environment. Transformational changes are being driven by students, government, taxpayers and global businesses need to compete. A good leader will understand and be aware of their organization's traits and be able to use that understanding to motivate and influence stakeholders to one common good. The power to galvanize faculty, staff and IT workers across a complex organization will be needed to succeed in an era where resources are limited.

Q15 I understand how my work impacts the University's business goals?

- A great deal
- A lot
- A moderate amount
- A little
- None at all

Q16 Do you think leadership is aware of project risks before a project is started?

- Not at all aware
- Slightly aware
- Moderately aware
- Very aware
- Extremely aware

Q17 Are the benefits of project management promoted by senior leadership?

- Usually
- Frequently
- Sometimes
- Occasionally
- Rarely

Q18 Do you feel like your leadership provides opportunities for growth outside of your core area of skills?

- A great deal
- A lot
- A moderate amount
- A little
- None at all

Q19 Do you think a lack of leadership has caused an IT project to fail in the last three years?

- Strongly Agree
- Somewhat agree
- Neither agree nor disagree

- Somewhat disagree
- Strongly disagree

Q20 Do you think projects have been thoroughly reviewed before they are started to see if they align with the campus's strategy?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

Q21 Resources

With lower governmental funding and increased competition from other schools such as online for-profit schools, traditional higher education institutes find themselves in an undesirable position of trying to compete with less. “A decade since the Great Recession hit, state spending on public colleges and universities remains well below historic levels, despite recent increases” (CBBP.org, 2017). These numbers should raise flags for educators that the public is losing faith in the importance of spending more public dollars on education to compete. Higher education institutes need to do a more efficient job of providing credible measurements or evidence of return on investment. This assessment is a good step toward finding and defining measurements to help schools find gaps that can help improve their project success and efficiency.

“**Resource Management** includes the processes to identify, acquire and manage the resources needed for the successful completion of the project. These processes help ensure that the right resources will be available to the project manager and project team at the right time and place.” (PMBOK, 2017, p. 307).

**Forecasting** is an informed opinion about the future performance of project activities that a project manager can be used to predict the likelihood of outcomes or project resource needs.

Q22 Do you feel that a lack of resources has caused a project failure in the last three years?

- Extremely likely
- Somewhat likely
- Neither likely nor unlikely
- Somewhat unlikely
- Extremely unlikely

Q23 Do you think people are used effectively in your IT department?

- Extremely effective

- Very effective
- Moderately effective
- Slightly effective
- Not effective at all

Q24 Are project schedules often delayed?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

Q25 Are any project forecasting tools used to predict if projects will go over budget?

- None at all
- A little
- A moderate amount
- A lot
- A great deal

Q26 **Risk:** How do you implement a project management approach that lowers risk of failure while increasing efficiency in public higher education institutes that have less resources and organizational characteristics that are known to be counterproductive? There is no simple answer to that question. The intent of this study is to guide schools in identifying, measuring and benchmarking organizational traits that effect project performance and efficiency.

A **risk** is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project specifications (PMI, 2017).

The objectives of a **risk management plan** are to develop the overall risk management strategy for the projects, to decide how the risk management processes will be executed, and to integrate into other project management activities (Practice Standard for Project Risk Management, 2009, p. 19).

Q27 Do you think a proper analysis of project risks is completed before starting an IT project?

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q28 Are risks properly managed throughout an IT project?

- Always

- Most of the time
- About half the time
- Sometimes
- Never

Q29 Has mismanagement of project risks caused a project to fail in the last three years?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q30 **Communication:** Organizational culture and leadership are often siloed in higher education institutes due to the complexity of the organizations and motivations of the individuals. Badly communicated project goals lead to conflicts of interests, unmotivated workers and even sabotage. Proper communication and strategy can bridge the gaps between silos by communicating effectively the vision or the goals of a project.

**The communication management plan** is the process to ensure the timely and appropriate planning, collections, creation, distribution, storage, retrieval, management control, monitoring and ultimate disposition of project information” (Kloppenborg, 2015, p. 9).

Q31 Do you feel project stakeholders are typically happy with the level of communication from the IT department?

- Extremely happy
- Somewhat happy
- Neither happy nor unhappy
- Somewhat unhappy
- Extremely unhappy

Q32 Do you feel like project plans are properly communicated within the department?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q33 Are communication plans developed for all IT projects?

- Always
- Most of the time
- About half of the time

- Sometimes
- Never

Q34 Do you feel that the goals of campus IT projects are clearly communicated to the IT workers assigned to the project?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q35 Have communications issues led to a project failure in the last three years?

- Often
- Sometimes
- Occasionally
- Seldom
- Never

Q36 Scope and Change Management:

There has been a long history of stability in higher education, but that is a thing of the past. Traditional higher education institutes are now confronted with an array of challenges both internally and externally. Competition is increasing, and funding is falling. To survive, higher education institutes will need to be more efficient in the use of its limited resources. This means picking the right projects and defining what will make them successful and valuable to the institute before even starting the project. This approach will be different for many higher Education Institutes. Inevitably there are always changes in projects, it is how these changes are effectively managed that will determine project success. Un-managed changes will derail any tight budget and cut into the overall value of the project. This is an expense school can no longer afford

“**Scope** is the work performed to deliver a product, service, or result with the specified features and functions” (PMI, 2017, p. 131).

**Scope Management** includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully.

“**Change management** is the process that is used to establish standardized methods or procedures for managing and documenting all changes or modifications to the project deliverable

of projects. The procedures are intended to effectively and efficiently reduce change related issues and improve day-to-day operations of the project” (PMI, 2017, 553).

“A project **deliverable** is any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project” (PMI, 2017, p.4).

Q37 When a project deliverable is changed is there any review or approval of change needed?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q38 Are change management methods used whenever the project plan is changed?

- N Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q39 Do you feel project plans often go out of scope and cause project failures?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q40 Stakeholder Management

**Stakeholder management** is vital to the success of higher education projects. If you don't talk to your stakeholders and gather their requirements, you can never really define what success is for a project. Schedules and budget deadlines can be met, but the project can still be deemed unsuccessful because the stakeholder's expectations were not met. Stakeholder management is important, particularly in higher education institutes because it is a complex system with many silos and people with different motivations and values. Seeing how these motivations and values affect projects will be key to project success.

**Stakeholder management** is a process to identify the people, groups, or organization, that could impact or be impacted by the project, analyze their expectations and impact, and develop strategies for engaging them and managing conflicting interests.

**Stakeholder register** is a project document that contains stakeholder identification, assessment, and classification of the project stakeholders.

Q41 Do you think your department manages campus stakeholder expectations?

- Definitely yes
- Probably yes
- Might or might not
- Probably not
- Definitely not

Q42 Is a stakeholder register used to manage stakeholder expectations?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q43 Are all the stakeholders identified before a project starts?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q44 Are project roles and responsibilities, including the stakeholders documented before a project starts?

- Always
- Most of the time
- About half of the time
- Sometimes
- Never

Q45 Project Management Knowledge Areas

**“Project Integration Management** includes the processes and activities needed to identify, define, combine, unify and coordinate the various processes and project management activities” (PMI, 2017). It involves making trade-offs among competing objectives and alternatives to meet or exceed stakeholder needs and expectations.

**“Project Scope Management** includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully” (PMI, 2017). Scope involves collecting business and technical needs of stakeholders to ensure that the project or service delivered to meet stakeholder expectations.

**Project Time Management** refers to a component of project management in which time is analyzed and created for the completion of a project or deliverable. Project time management defines the order in which deliverables must be completed to complete the task efficiently and effectively.

**Project Cost Management** is a group of activities that estimate, allocate and control project costs. The process creates budgets that help in controlling spending.

**Project Quality Management** includes the processes and activities of performing organization that determine the quality policies, objectives, and responsibilities to implement projects and ensure that objectives and requirements are met.

**Project Risk Management** is the process of “identifying, analyzing and responding to any risk that happens during the project to help the project stay on track” (PMI, 2017). IT includes the processes of conducting risk management, planning, identification, analysis, response planning and controlling risk on a project.

**Project Communication Management** “includes all the processes that are required to ensure the timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring and the ultimate disposition of project information.” (PMI, 2017).

**Project Stakeholder Management** “includes the processes of identifying all people in the organization that are impacted by the project, analyzing stakeholders’ expectations and impact on the project and developing appropriate management strategies for effectively engaging stakeholders in project decisions and execution” (PMI, 2017).

### **Maturity Levels**

Below is a list of levels developed to measure your department’s culture, resources, leadership, and Project Management knowledge area maturity that will help determine the department's project management capability. The levels will be used to help identify key characteristics of internal processes that best represent your department. Please use they levels to assess the department and university in the next set of questions.

**Level 1 - Initial** - Ad-hoc and informal processes. No structured approach to project work and no attempt made to learn from previous mistakes and improve future projects. Sporadic

stakeholder involvement in projects. Risk assessment is not done, so projects are often delayed and over budget. Always seem to be putting out fires!

**Level 2 - Repeatable** - Developing a foundation that is growing in Project Management practices. Project Management processes are being established and often not followed in all projects because they are viewed by many workers as being bureaucratic or an impediment to timely project progress. There is minimal training for and expertise in Project Management in the department, so any repeatable processes are dependent on worker experience. Data collection is starting to take place with generic templates, but data collection is not advanced enough to accurately forecast project cost, time and success so full commitment from leadership missing.

**Level 3 - Defined** - Starting to find value in Project Management processes. Proactive decision-making is being conducted with the use of consistent data that is being collected from project work. Project roles and responsibilities are being clearly defined and documented. Training opportunities and a position for Project Management is established as leadership if finding value in the processes. Project Management value is recognized at both the department and University levels, and there is a desire but lack of knowledge to integrate into more campus processes. Project charters and change management process are being created and enforced in all IT projects.

**Level 4 - Managed** - The IT department is adjusting, integrating, controlling and measuring project management practices into processes to increase efficiencies and value of projects. There is a total commitment from leadership in the department and University. Resources and risks are actively being monitored and forecasted throughout the project.

**Level 5 - Optimized** - Finding opportunities and developing innovation in IT project work and procedures. All staff are aware of Project Management and have the basic skills to participate. Proactive forecasting and planning for budget, human resources and schedules is enforced on campus and departmental IT projects.

Q46 Using the maturity levels defined about, assign a maturity level to your IT department for each project management knowledge area.

	Level 1	Level 2	Level 3	Level 4	Level 5
Project Integration Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Scope Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Time Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Cost Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Quality Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Risk Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Communication Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Stakeholder Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q47 Using the maturity levels defined about, assign a maturity level to your University for each project management knowledge area.

	Level 1	Level 2	Level 3	Level 4	Level 5
Project Integration Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Scope Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Time Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Cost Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Quality Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Risk Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Communication Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Stakeholder Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q48 Overall, in your opinion, what level of maturity would you rank your IT department when it comes to project management?

- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

Q49 Overall, in your opinion, what level of maturity would you rank your University when it comes to project management?

- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

Q50 How many years have you worked at the University in the IT department?

- 1-2 years
- 3-5 years
- 6-11 years
- 12-19 years
- 20+ years

Q51 What is your current position title? Please use space below to identify.

---

Q52 What is your gender?

\*None of the following questions can be used to identify you. All of your answers will be kept strictly confidential and will only be used to aggregate.

- Male
- Female
- Non-binary/third gender
- Prefer to self-describe
- Prefer not to say

Q53 Age?

- 18 - 24
- 25 – 34
- 35 - 44

- 45 - 54
- 55 - 64
- 65+

Q54 How important do you think project management is to the future success of your department in the next 5 years?

- Very important
- Important
- Moderately important
- Slightly Important
- Not important

Q55 Where would you consider your expertise in Project Management?

- Novice
- Advanced Beginner
- Competent
- Proficient
- Expert

Q56 What roles, if any have you performed either informally or formally for campus or departmental projects? Please check all that apply.

- Leader
- Subject Matter Expert
- Team Member
- Consultant
- Other (Please Specify) \_\_\_\_\_

Q57 How many years of Project Management experience do you have?

- 0-2 years
- 3-5 years
- 6-10 years
- 11-15 years
- 16+ years

Q58 Does your department use formal project management practices?

- Yes
- No

Q59 Have you been involved in any campus IT projects in the last three years?

\*Project is a term used to describe a temporary endeavor or work that is undertaken to accomplish a specific goal or services that has a start and end date. In an IT educational setting project work often occurs informally due to the nature of the IT work or formally using Project Management practices. The aim of this study is to capture both informal and formal

practices of IT project work on your campus and in your department to determine an accurate measurement of capability.

- Yes
- No

Q60 Have you been involved in any departmental (internal) IT projects?

- Yes
- No

Q61 Does a Project Management Office (PMO) exist on your campus?

\*PMO office is an organizational structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques.

- Yes
- No

Q62 Is PMO office under IT leadership?

- Yes
- No

Q63 If you have any feedback about the survey, issues with questions or if there is anything else you would like to share about your project management practices or experiences in Higher Education IT, please feel free to share below:

---

End of Survey:

Thank You for Completing the Survey! Your responses will be used to further study the organizational maturity and project management capability of your department through a Higher Educational lens. This study can help your department create improvement paths forward that are based on metrics. These paths can be used to focus on department energy and resources for optimal returns.

**Site Results:**

LINK

**Raffle Entry:**

This link will take you to a separate survey where you will enter the Amazon \$50 gift card giveaway for taking the survey. The information collected in this survey will only be used to select the winner and electronically deliver gift card. Good luck! Note: The separate survey is used to keep the studies survey responses anonymous.

LINK to separate survey for gift card entry

If you have any questions or concerns about your treatment as a participant of this research, please call or write:

Barb Barnet, Chair  
UW-Platteville IRB  
(608) 342-1942  
barnettb@uwplatt.edu

Thank you again as your participation is greatly appreciated,

Don LeDoux, Researcher  
UW-Platteville  
(715) 232-5291

Dr. George Watson, Faculty Sponsor  
UW-Platteville

## Appendix G. Site A Case Study (Pilot)

**Table G.1 Site A Correlations Tests and Rankings**

Site A - Correlation of Independent Variables to PM Capability Score (Ranked)					
Statistical Rank (*Sample Size: 8)	P-value	Effect Size	Confidence Interval	R-Squared	Statistically Significant
<b>1. Resource Management</b>					
Correlation (recommended test)	0.00541	<b>0.866</b> (Pearson's r)	0.524 to 0.968	0.750	Yes
Ranked Correlation	0.0639	0.679 (Spearman's rho)	0.092 to 0.916		No
Paired T-Test	0.0000115	3.88 (Cohen's d)	0.770 to 1.09		No
<b>2. Risk Management (non- linear distribution)</b>					
Correlation	0.0767	0.657 (Pearson's r)	0.052 to 0.909	0.432	No
Ranked Correlation (recommended test)	0.0159	<b>0.805</b> (Spearman's rho)	0.360 to 0.952		Yes
Paired T-Test	0.887	0.521 (Cohen's d)	-0.390 to 0.334		No
<b>3. Project Management Skills &amp; Knowledge (non- linear distribution)</b>					
Correlation	0.0580	0.690 (Pearson's r)	0.11 to 0.92	0.477	No
Ranked Correlation (recommended test)	0.0283	<b>0.761</b> (Spearman's rho)	0.257 to 0.940		Yes
Paired T-Test	0.356	0.350 (Cohen's d)	-0.112 to 0.355		No
<b>4. Stakeholder Management (non- linear distribution)</b>					

Correlation	0.954	0.628 (Pearson's r)	0.003 to 0.900	0.394	No
Ranked Correlation (recommended test)	0.0438	<b>0.721</b> (Spearman rho)	-0.171 to 0.928		Yes
T-Test	0.422	0.302 (Cohen's d)	0.144 to 0.379		No
<b>5. Communication</b>					
Correlation (recommended test)	0.121	0.594 (Pearson's r)	-0.052 to 0.889	0.353	No
Ranked Correlation	0.191	0.515 (Spearman's rho)	-0.164 to 0.863		No
Paired T-Test	0.747	0.119 (Cohen's d)	-0.257 to 0.367		No
<b>6. Leadership</b>					
Correlation (recommended test)	0.322	0.403 (Pearson's r)	-0.299 to 0.822	0.162	No
Ranked Correlation	0.641	0.196 (Spearman's rho)	-0.490 to 0.733		No
Paired T-Test	0.0405	0.887 (Cohen's d)	0.0849 to 0.609		?
<b>7. Scope and Change Management</b>					
Correlation (recommended test)	0.521	0.268 (Pearson's r)	-0.431 to 0.766	0.0718	No
Ranked Correlation	0.353	.0380 (Spearman's rho)	-0.32 to 0.81		No
Paired T-Test	0.136	0.596 (Cohen's d)	-0.0483 to 0.825		No
<b>8. Culture</b>					
Correlation (recommended test)	0.574	0.236 (Pearson's r)	-0.459 to 0.751	0.0555	No

Ranked Correlation	0.704	0.161 (Spearman's rho)	-0.518 to 0.715		No
Paired T-Test	0.00103	-0.424 (Cohen's d)	-0.553 to -0.275		No

\*Sample size is small and confidence intervals are less reliable

**bold red** is rational for choosing the test as recommended

## Appendix H. Site B Case Study

**Site Characteristics.** Site B is a regional public university situated in a rural Midwestern town with a population less than 20,000. Site B services approximately 9,401 full and part-time students in 45 undergrads and 20 graduate programs. Site B comprised of 3 colleges with a small on-site IT department made up of 3 departmental units with less than 36 non-management workers. Employer turnover in the IT department in the last five years is roughly about 33%. The IT department does not practice formal project management and does not have a project manager on staff. The CIO indicates an inclination to integrate PM practices into IT work within the next year.

**PM Capability Assessment.** The HEI capability assessment was scheduled in the main study group after CIO verbally consented to study. The assessment conducted on January 11, 2019, to February 11, 2019, for a total of 30 days. The PMO director verified a list of active IT employees, and a direct email invitation to the online survey, signaling the beginning of the site's capability assessment for seventeen non-management IT workers. Document artifacts, field notes and interviewee recruitment, consent, and recording of interviews began and completed before online survey assessment expired.

**Survey Results.** Of the 36 eligible IT workers, 17 consented and completed the survey that was incentivized with a chance to win a \$50 gift card giveaway awarded on February 12, 2019. One participant started and failed to complete 90% of the survey and responses were removed from data before being analyzed. The response rate for the survey was 61% with a 94% completion rate for respondents that started the test.

**Analysis.** Due to the small population that completed the survey truth of the confidence was not met. A sample size of 24 was needed to meet a 90% confidence level, of which only 17 were completed. The margin of error for the sample collected was 15% which is higher than the acceptable 10% margin of error rate for the study. The small sample increases the likelihood of Type II errors that can skew the results and inaccurately reflect the views of the population, thus reducing the strength and effectiveness of the analysis findings.

**Internal consistency review.** To test the reliability of data and flag potential response bias in the survey responses the researcher designed two survey questions (46, and 48). To help improve the reliability responses question scales were reversed in 11 of the 36 questions to minimize item-order effect of respondents mindlessly responding to the first answer and flag



<b>1. Project Management Skills &amp; Knowledge</b>					
Correlation (recommended test)	0.00001	<b>0.910</b> (Pearson's r)	0.80 to 0.96	0.828	Yes
Ranked Correlation	0.0000260	0.839 (Spearman's rho)	0.651 to 0.930		Yes
Paired T-Test (2 tail)	0.00910	0.719 (Cohen's d)	0.0935 to 0.945		Yes
<b>2. Culture</b>					
Correlation (recommended test)	0.00001	<b>0.873</b> (Pearson's r)	0.718 to 0.909	0.761	Yes
Ranked Correlation	0.0000119	0.856 (Spearman's rho)	0.684 to 0.937		Yes
Paired T-Test	0.00192	1.17 (Cohen's d)	-0.347 to 0.221		Yes
<b>3. Risk Management</b>					
Correlation (recommended test)	0.00001	<b>0.868</b> (Pearson's r)	0.709 to 0.9243	0.753	Yes
Ranked Correlation	0.0000763	0.812 (Spearman's rho)	0.599 to 0.917		Yes
Paired T-Test	0.183	0.337 (Cohen's d)	-0.0501 to 0.422		No
<b>4. Leadership</b>					
Correlation (recommended test)	0.00001	<b>0.865</b> (Pearson's r)	0.703 to 0.942	0.748	Yes
Ranked Correlation	0.0000174	0.848 (Spearman rho)	0.669 to 0.934		Yes
Paired T-Test	0.303	0.258 (Cohen's d)	-0.0602 to 0.248		No
<b>5. Communication</b>					
Correlation (recommended test)	0.0000129	<b>0.854</b> (Pearson's r)	0.681 to 0.937	0.729	Yes

Ranked Correlation	0.000994	0.725 (Spearman's rho)	0.445 to 0.876		Yes
Paired T-Test	0.585	0.135 (Cohen's d)	0.0626 to 0.259		No
<b>6. Stakeholder Management</b>					
Correlation (recommended test)	0.000375	<b>0.762</b> (Pearson's r)	0.509 to 0.894	0.581	Yes
Ranked Correlation	0.00142	0.710 (Spearman's rho)	0.42 to 0.87		Yes
Paired T-Test	0.139	0.377 (Cohen's d)	-0.0209 to 0.364		No
<b>7. Scope and Change Management</b>					
Correlation (recommended test)	<b>0.0261</b>	0.537 (Pearson's r)	<b>0.159 to 0.778</b>	0.289	Yes
Ranked Correlation	0.0887	.425 (Spearman's rho)	0.015 to 0.713		No
Paired T-Test	0.00871	0.725 (Cohen's d)	0.253 to 0.963		Yes
<b>8. Resource Management</b> – Not normally distributed and the sample size is too small					
Correlation (unranked)	0.0662	0.455 (Pearson's r)	-0.459 to 0.751	0.207	No
Ranked Correlation (recommended test)	0.0802	0.436 (Spearman's rho)	0.028 to 0.731		No, correlated but not significantly
Paired T-Test	0.00155	0.923 (Cohen's d)	0.316 to - 0.851		Yes

\*Sample size is small and confidence intervals are less reliable

**Bold red** is rational for choosing the test as recommended

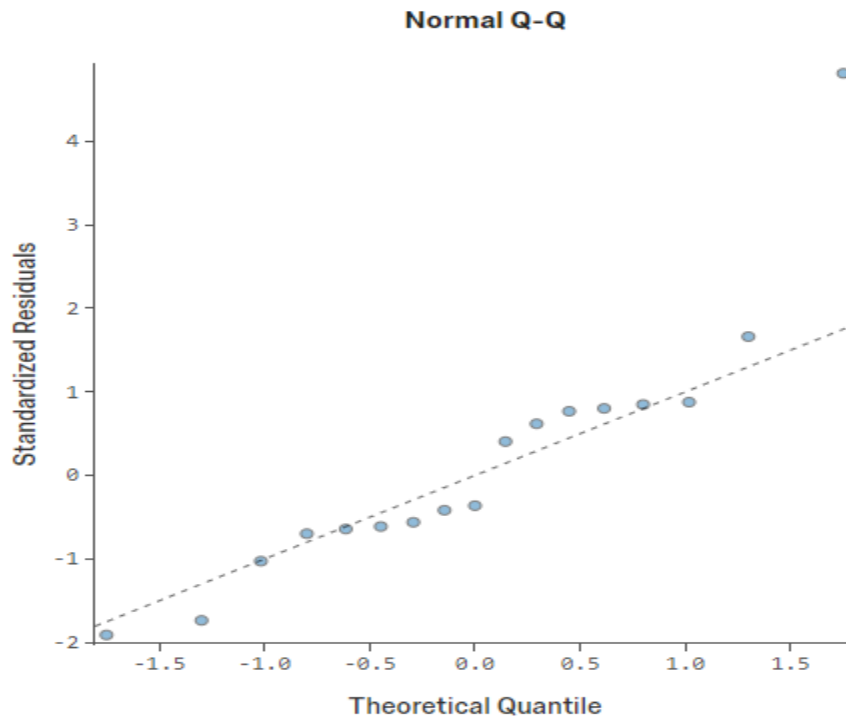
*regression.* Due to the small sample size, regression may not be consistent. The four domain variables (culture, leadership, PM skills and resources) all are significantly correlated to

each other, meaning multicollinearity will occur and reduce the effectiveness of the results. Considering the small sample size and multicollinearity a regression model created based on Akaike information criterion (AIC) or model fit, R-squared, the coefficient of variation, confidence intervals and P-values (< 0.05). The regression model created from the data collection used PM skills and culture domains.

**Table H.3 Site B Regression Tests**

Sample Size	Relative Weights	R-Squared	Standard Error	Coefficient of Variation	Confidence Interval	Model Fit
17						
PM Skills & Knowledge	53.8%	0.930	0.0830	0.0268	0.467	29.2
Culture	46.2%	-	-	-	0.457	-

Regression tests were completed using M-estimation for analysis, which had a high R-squared value and low model fit score which is considered more accurate. Figure H.1 represents is a visual check of data plausibly that assumes the dependent variable is normally distributed. There is one outlier in the dataset, possibly representing bias.



**Figure H.1 Site B Normal Q-Q Distribution**

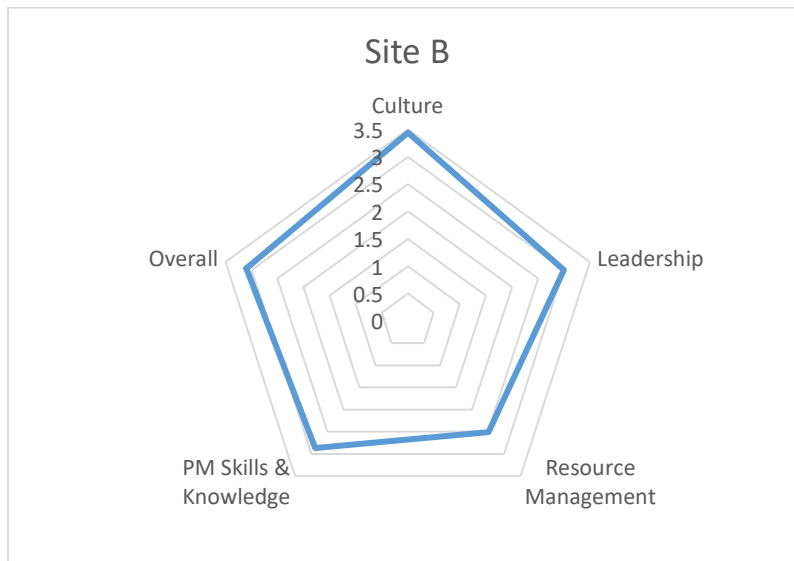
*interview results.* Two forty-five-minute semi-structured interviews comprised of ten questions were conducted in person. The interviews were recorded and transcribed and coded to



**Figure H.2 Site B Word Cloud**

**Document Artifacts Results.** The document artifact analysis was limited at Site B as there are no formal established project management practices. No real research value was gathered using a document artifact analysis instrument for this site.

**Benchmark scores.** One of the primary outputs of this study was to create benchmark scores that both visualize the public HEI IT department PM capability and compare sites to other public HEI IT departments to determine areas of strength and weakness. Refer to Figure H.3 for visualization of Site B strengths and weakness in PM capabilities.



**Figure H.3 Site B Radar Plot**

The benchmark scores collected from the online survey are in Table H.5. PM skills are further broken down into four subgroups to provide a more useful measurement of the domain.

**Table H.4 Site B Project Management Capability Benchmark Scores**

Culture	Leadership	Resource Management	PM knowledge and skills	Communication	Scope and change management	Risk Management	Stakeholder Management	Overall
3.44	3.00	2.51	2.87	3.04	2.49	2.90	2.93	3.10

**Site Summary.** The benchmark scores for resources management and PM skills scored lower than the rest of the domains in the PM capability assessment. The qualitative data from interviews validate the lower scores because the site is currently struggling to manage and prioritize projects and people resources. A lack of PM skills and dedicated PM staff lowers the organization's overall PM capability. The sites score in the sub-category of communication, and overall PM capability score has most likely been boosted by the recent hire of a full-time communication manager that can assist in improving internal and external department communication of IT projects.

The scores from Site B's survey most likely contain an acquiescent, non-response, and social desirability bias may have overinflated PM capability scores. Site B does not practice formal project management and seemingly higher scores compared to peers that formally practice PM seems likely suspect. Information Technology work in general uses many components informally of project management and therefore the researcher accepted Site B results but acknowledged a high likelihood of bias present in results.

The researcher believes Site B has an opportunity to change the department's culture and by choosing a PM methodology to move forward with. The personal changeover in the last three years has allowed leadership to hire candidates with PM skills that can help improve the organization's project management capability. Hiring a communication manager to repair campus relationships and demonstrate transparency in IT decisions making may help garner workers and campus stakeholders buy-in. It is recommended by the researcher to create easily repeatable PM processes that show the value of project management and to convince IT, workers and stakeholders, that project management is not another bureaucratic process impeding or slowing down the progress of a project.

## Appendix I. Site C Case Study

**Site Characteristics.** Site C is a regional public University that is part of the identified state school system used in this study, located in a midwestern town with a population less than 100,000. Site C services approximately 10,825 full and part-time students in 80 undergrads and 13 graduate programs. Site C has four colleges with a small on-site IT department made up of 5 departmental units with less than 50 non-management workers. Site C has lost 34 full-time positions in the last ten years due to technology changes and budgets restraints. To maintain service levels Site C has increasingly relied on the part-time student workers (140) to fill the gaps. The researcher and Site C leadership have identified that the IT department practices formal PM using the A3 problem-solving approach for continuous improvement. It has used this approach and trained the workforce to use this methodology for over five years.

**PM Capability Assessment.** The HEI capability assessment for Site C was scheduled with the main study group after CIO verbally consented to study in a phone conversation. The site assessment was conducted January 11, 2019, to February 11, 2019, for a total of 30 days. CIO verified a list of active IT employees, and a direct email invitation to the online survey, signaling the beginning of the site's capability assessment for seventeen non-management IT workers. Document artifacts, field notes and interviewee recruitment, consent, and recording of interviews began and completed before online survey assessment expired.

**Survey Results.** Of the 43 eligible IT workers, eight consented and completed the survey that was incentivized with a chance to win a \$50 gift card giveaway awarded on February 12, 2019. Eight participants started and failed to complete 90% of the survey, and the removal of those responses was done before data analysis. The response rate for the survey was 18.6% with a 50% completion rate of respondents that started the survey.

**Analysis.** Due to the small population that completed the survey truth of the confidence was not met. A sample size of 27 was needed to meet a 90% confidence level, and only eight surveys were completed. The margin of error for the sample collected was 26% which is higher than the acceptable 10% margin of the error rate for the study. The small sample increases the likelihood of Type II errors that can skew the results and inaccurately reflect the views of the population, thus reducing the strength and effectiveness of the analysis findings.

***internal consistency review.*** To test the reliability of data and flag potential response bias in the survey responses the researcher designed two survey questions (46, and 48). To help

improve the reliability responses question scales were reversed in 11 of the 36 questions to minimize item-order effect of respondents mindlessly responding to the first answer and flag possible response bias. The two questions represented the culmination of the all the questions that the respondents answered in the initial 36 survey questions about the department's capability and knowledge of project management using an underlying Likert scale based on defined maturity levels (Appendices K-N).

When site C respondents scored the IT department's overall PM capability with maturity level definitions in questions 48 a score overall score of 2.44 compared to the benchmark score or 3.28 (Table 5.8) calculated from 36 questions, a decline of 0.84. When responding to questions 46, respondents scored IT department's PM skills and knowledge with definitions 2.2 compared to the benchmark score of 2.85 (Table 5.8), a decrease in PM knowledge and skills capability of 0.65. There is a good likelihood of response bias with a small sample which reduces the reliability of the data but is typical in self-reporting surveys and acknowledged and accepted in chapter three and four.

**correlation.** The correlation results for the primary independent variables are in Table I.1. All four independent variables show a statistically significant relation using a 90% confidence interval with a 10% margin of error. Pearson, Spearman and Cohen's d test were used to test the relationship with Pearson being the recommended test for the main four domains. Table I.2 shows the correlation tests for all domains and subdomains ranked.

PM Skills and culture are identified as having the most influence of the four domains being measured to determine the PM capability of Site C. Both interviewees believed HEI culture influenced how projects were performed and conducted. One leader attributed culture's influence comes from the governance structure of public HEI while the other leader attributed cultures influence to PM capability to a lack of understanding of the value PM practices by campus stakeholders.

**Table I.1 Site C Domain Correlation Tests**

	Statistical Test	P-value	Effect Size	Confidence Interval	R-Squared	Significant Relationship
PM Skills & Knowledge	Pearson	0.0001	0.985	0.138	0.970	Yes
Culture	Pearson	0.000168	0.981	0.173	0.962	Yes

<b>Resource Management</b>	Pearson	0.00218	0.902	0.67	0.814	Yes
<b>Leadership</b>	Pearson	0.00747	0.850	0.88	0.576	Yes

Table I.2 Site C Correlation Tests

Site C – Correlation of Independent Variables to PM Capability Score (Ranked)						
Statistical Rank (*Sample size: 8)	P-value	Effect Size	Confidence Interval	R-Squared	Significant	Statistically
<b>1. Project Management Skills &amp; Knowledge</b>						
Correlation (recommended test)	0.00001	<b>0.985</b> (Pearson's r)	0.860 to 0.998	0.970	Yes	
Ranked Correlation	0.000269	0.952 (Spearman's rho)	0.604 to 0.995		Yes	
*Paired T-Test (2 tail)	0.00403	1.49 (Cohen's d)	0.0712 to 0.781		Yes	
<b>2. Culture</b>						
Correlation (recommended test)	0.0000168	0.981 <b>(Pearson's r)</b>	0.825 to 0.998	0.962	Yes	
Ranked Correlation	0.00001	0.994 (Spearman's rho)	0.942 to 0.999		Yes	
Paired T-Test	0.0000626	3.00 (Cohen's d)	-0.718 to 0.229		No	
<b>3. Communication</b>						
Correlation (recommended test)	0.000636	<b>0.936</b> (Pearson's r)	0.500 to 0.993	0.875	Yes	
Ranked Correlation	0.00111	0.922 (Spearman's rho)	0.423 to 0.992		Yes	
Paired T-Test	0.396	0.320 (Cohen's d)	-0.506 to 0.858		No	
<b>4. Resource Management</b>						

Correlation <b>(recommended test)</b>	0.00218	<b>0.902</b> (Pearson's r)	0.320 to 0.990	0.814	Yes
Ranked Correlation	0.00525	0.868 (Spearman rho)	0.169 to 0.986		Yes
Paired T-Test	0.000498	2.15 (Cohen's d)	0.263 to 0.976		No
<b>5. Stakeholder Management</b>					
Correlation <b>(recommended test)</b>	0.00287	<b>0.892</b> (Pearson's r)	0.275 to 0.989	0.796	Yes
Ranked Correlation	0.00850	0.843 (Spearman's rho)	0.081 to 0.983		Yes
Paired T-Test	0.0000590	3.03 (Cohen's d)	0.514 to 1.23		No
<b>6. Scope and Change Management</b>					
Correlation <b>(recommended test)</b>	0.00515	<b>0.868</b> (Pearson's r)	0.173 to 0.986	0.754	Yes
Ranked Correlation	0.0154	0.807 (Spearman's rho)	-0.033 to 0.979		Yes
Paired T-Test	0.0441	0.866 (Cohen's d)	-0.190 to 1.08		No
<b>7. Leadership</b>					
Correlation <b>(recommended test)</b>	0.00747	<b>0.850</b> (Pearson's r)	0.10 to 0.98	0.576	Yes
Un-Ranked Correlation	0.0289	.759 (Spearman's rho)	-0.156 to 0.973		No
Paired T-Test	0.00871	0.725 (Cohen's d)	0.253 to 0.963		No
<b>8. Risk Management</b>					
Correlation <b>(recommended test)</b>	0.00826	<b>0.845</b> (Pearson's r)	0.086 to 0.983	0.714	Yes

Ranked Correlation	0.00747	0.850 (Spearman's rho)	0.10 to 0.98		No
Paired T-Test	0.424	0.300 (Cohen's d)	-0.733 to - 1.20		No

\*Sample size is small and confidence intervals are less reliable

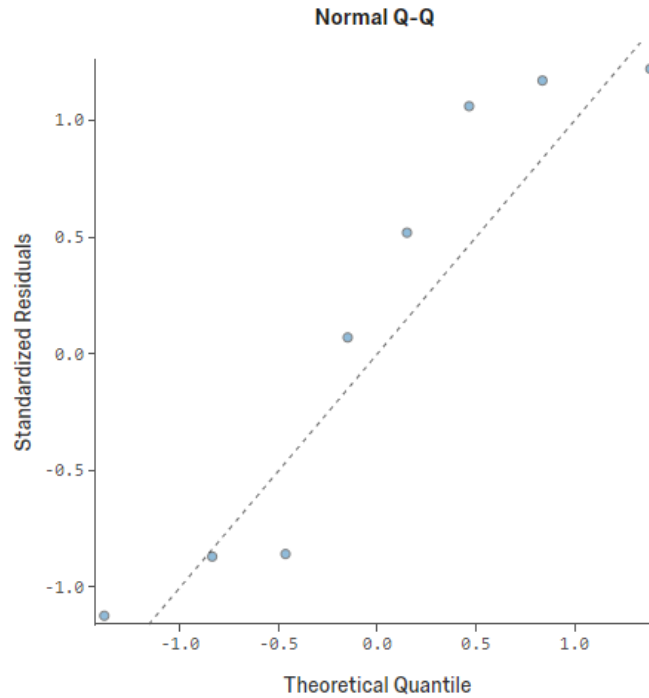
**Bold red** is rational for choosing the test as recommended

*regression.* Due to the small sample size, regression may not be consistent. The four domain variables (culture, leadership, PM skills and resources) all are significantly correlated to each other, meaning multicollinearity will occur and reduce the effectiveness of the results. Considering the small sample size and multicollinearity a regression model created based on Akaike information criterion (AIC) or model fit, R-squared, the coefficient of variation, confidence intervals and P-values (< 0.05). The regression model created from the data collection used PM skills and culture domains.

**Table I.3 Site C Regression Model**

Sample Size 8	Relative Weights	R- Squared	Standard Error	Coefficient of Variation	Confidence Interval	Model Fit
PM Skills & Knowledge	50.4%	0.975	0.0560	0.0171	0.381	6.53
Culture	49.6%	-	-	-	0.599	-

Regression tests were completed using M-estimation for analysis, which had a high R-squared value and low model fit score which is considered more accurate. Figure I.4 represents is a visual check of data plausibly that assumes the dependent variable is normally distributed. The data is considered normally distributed.



**Table I.4 Site C Normal Q-Q Distribution**

*interview results.* Two 30-minute semi-structured interviews comprised of ten questions were conducted by Skype video chat. The interviews were recorded and transcribed and coded to find common themes using NVivo 12.

Some of the common themes for Site C revolved around building relationships with stakeholders to increase campus IT project performance. Adapting PM approaches to make them less bureaucratic to campus stakeholders was key to their project success. The leadership at this Site C people focused and value employees. They recognize and reward workers and invest in employee’s success and growth through A3 and leadership training. Five percent of the annual budget dedicated to training. It was stated by one of the leaders that the department success was directly dependent on people their ability to understand the campus culture and make good decisions holistically. Employees are trained and given a book about the A3 continuous improvement methodology.

Project failures were limited on this campus but are attributed to not meeting schedule deadlines because of shortages caused by school system projects that are mandated. Site C uses a formal process that assesses the visibility, cost, and risk of every project to help prioritize them and minimize failures. Both leaders see silos and people with different motivations or missions

as an impediment to campus IT projects. Both leaders when asked believed that culture plays a huge role in their PM practices perform.

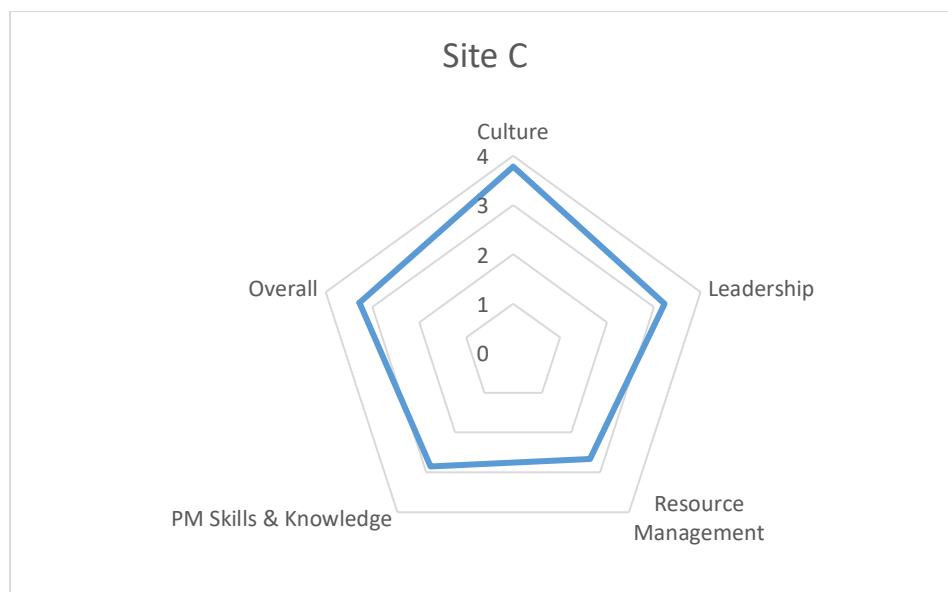
Both leaders are committed to PM practices and developing the skills needed in the department. Both leaders estimated the IT department's PM capability maturity score between 4 and 5 slightly higher than the survey results of 3.28. The word cloud created for Site C from interviews and document artifacts indicates the project management leadership and culture is an essential part of this organization.



**Figure I.1 Site C Word Cloud**

**Document Artifacts Results.** The document artifact analysis was limited because much of the internal documentation is hosted on internal campus SharePoint sites. The researcher was able to obtain documentation from leaders of Site C to help support the PM maturity scores and online survey results.

**Benchmark Scores.** One of the primary outputs of this study was to create benchmark scores that could be used to both visualize the public HEI IT department PM capability and to compare to other public HEI IT department to determine areas of strength and weakness. Refer to Figure I.2 for visualization of Site B strengths and weakness in PM capabilities.



**Figure I.2 Site C Radar Plot**

The benchmark scores are shown in table I.5. PM skills are further broken down into four subgroups to provide a more useful measurement of the domain.

**Table I.5 Site C Project Management Capability Benchmark Scores**

Culture	Leadership	Resource Management	PM knowledge and skills	Communication	Scope and change management	Risk Management	Stakeholder Management	Overall
3.78	3.23	2.66	2.85	3.10	2.83	3.04	2.41	3.28

**Site Summary.** The overall benchmark score for Site C from the online survey is 3.28, and the leaders indicated a level four or five PM capability score. There is some discrepancy in the scores, but the document artifact supports a score of three (Defined) transitioning to a level four (Managed) maturity as Site C is using more PM practices to adjust, control, integrate and increase the value of campus IT projects. Site C is the only school in the study that actively planned and promoted training for PM practices.

The A3 continuous improvement methodology has created evidence of innovation for Site C, but stakeholder buy-in and resource management in the current environment are considered impediments. The leadership and employees both feel that more work needs to be

done when dealing with campus stakeholders. The researcher believes that the continuous improvement methodology provides opportunities for innovations to consistently improve and build PM capability and project performance for Site C.

## Appendix J. Site D Case Study

**Site Characteristics.** Site D is a regional public University that is part of the one identified state school system used in this study, located in a Midwestern city with a population less than 300,000. Site D services approximately 43,450 full and part-time students in 232 undergrads and 296 graduate programs. D comprised of 13 colleges with a large on-site IT department made up of 16 departmental units with roughly 525 non-management workers. Site D has in the only site in the study with a PMO office. The researcher and Site D leadership have identified practices as formal and the hybrid methodology as the PM methodology used in the IT department.

**PM Capability Assessment.** The HEI capability assessment for Site D was scheduled with the main study group after CIO consented to study by email. The site assessment was conducted January 11, 2019, to February 11, 2019, for a total of 30 days. The PMO director verified a list of active IT employees, and a direct email invitation for the online survey was sent to 525 Site D IT employees, signaling the beginning of the site's assessment. Document artifacts, field notes, and interview conducted and collected before the February 11 assessment end date.

**Survey Results.** Of the 525 eligible IT workers, 33 consented and completed the survey. Sixteen participants started and failed to complete 90% of the survey, and those responses were removed data set before the analysis started. The response rate for the survey was 6.2% with a 64% completion rate for respondents that started the survey.

**Analysis.** Due to the small population that completed the survey truth of the confidence was not met. A sample size of 60 was needed to meet a 90% confidence level and, only 33 surveys were completed. The margin of error for the sample collected was 14% which is higher than the acceptable 10% margin of error rate for the study. The small sample increases the likelihood of type II errors that can skew the results and inaccurately reflect the views of the population, thus reducing the strength and effectiveness of the analysis findings.

***internal consistency review.*** To test the reliability of data and flag potential response bias in the survey responses the researcher designed two survey questions (46, and 48). To help improve the reliability responses question scales were reversed in 11 of the 36 questions to minimize item-order effect of respondents mindlessly responding to the first answer and flag possible response bias. The two questions represented the culmination of the all the questions

that the respondents answered in the initial 36 survey questions about the department’s capability and knowledge of project management using an underlying Likert scale based on defined maturity levels (Appendices K-N).

When site D respondents scored the IT department’s overall PM capability with maturity level definitions in questions 48 a score overall score of 2.64 compared to the benchmark score or 3.21 (Table 5.8) calculated from 36 questions, a decline of 0.57. When responding to questions 46, respondents scored IT department’s PM skills and knowledge with definitions 2.67 compared to the benchmark score of 3.09 (Table 5.8), a decrease in PM knowledge and skills capability of 0.42. There is a good likelihood of response bias which reduces the reliability of the data but is typical in self-reporting surveys and acknowledged and accepted in chapter three and four.

**correlation.** The correlation results for the primary independent variables are in Table J.1. All four independent variables show a statistically significant relation using a 90% confidence interval with a 10% margin of error. Pearson, Spearman and Cohen’s d test were used to test the relationship with Pearson being the recommended test for the main four domains. Table J.2 shows the correlation tests for all domains and subdomains ranked.

PM Skills and leadership are identified as having the most influence of the four domains being measured to determine the PM capability of Site D.

**Table J.1 Site D Domain Correlation Tests**

	Statistical Test	P-value	Effect Size	Confidence Interval	R-Squared	Significant Relationship
PM Skills & Knowledge	Pearson	0.00001	0.952	0.072	0.906	Yes
Leadership	Pearson	0.00001	0.893	0.154	0.797	Yes
Culture	Pearson	0.00001	0.864	0.191	0.746	Yes
Resource	Pearson	0.00001	0.815	0.249	0.665	Yes

**Table J.2 Site D Correlation Tests and Rankings**

Site D – Correlation of Independent Variables to PM Capability Score (Ranked)									
Statistical Rank (Sample size: 33)		P-value		Effect Size	Interval	Confidence	R-Squared	Significant	Statistically

<b>1. Project Management Skills &amp; Knowledge</b>					
Correlation (recommended test)	0.00001	<b>0.952</b> (Pearson's r)	0.904 to 0.976	0.906	Yes
Ranked Correlation	0.00001	0.948 (Spearman's rho)	0.896 to 0.974		Yes
*Paired T-Test (2 tail)	0.0523	0.351 (Cohen's d)	-0.00126 to 0.235		No
<b>2. Risk Management</b>					
Correlation (recommended test)	0.00001	0.897 (Pearson's r)	0.800 to 0.948	0.804	Yes
Ranked Correlation	0.00001	0.909 (Spearman's rho)	0.823 to 0.955		Yes
Paired T-Test	0.685	0.0714 (Cohen's d)	-0.111 to 0.168		No
<b>3. Leadership</b>					
Correlation (recommended test)	0.00001	0.893 (Pearson's r)	0.792 to 0.946	0.797	Yes
Ranked Correlation	0.00001	0.898 (Spearman's rho)	0.803 to 0.949		Yes
Paired T-Test	0.0000612	0.803 (Cohen's d)	0.125 to 0.323		Yes
<b>4. Communication</b>					
Correlation (recommended test)	0.00001	<b>0.875</b> (Pearson's r)	0.761 to 0.937	0.766	Yes
Ranked Correlation	0.00001	0.854 (Spearman rho)	0.722 to 0.926		Yes
Paired T-Test	0.0142	0.412 (Cohen's d)	0.0530 to 0.440		Yes
<b>5. Culture</b>					
Correlation (recommended test)	0.00001	<b>0.864</b> (Pearson's r)	0.740 to 0.931	0.746	Yes

Ranked Correlation	0.00001	0.840 (Spearman's rho)	0.70 to 0.92		Yes
Paired T-Test	0.00001	1.29 (Cohen's d)	-0.465 to - 0.264		No
<b>6. Resource Management</b>					
Correlation (recommended test)	0.00001	<b>0.815</b> (Pearson's r)	0.656 to 0.905	0.665	Yes
Ranked Correlation	0.00001	0.808 (Spearman's rho)	0.643 to 0.901		Yes
Paired T-Test	0.00001	2.52 (Cohen's d)	0.747 to 0.991		No
<b>7. Stakeholder Management</b>					
Correlation (recommended test)	0.00001	<b>0.809</b> (Pearson's r)	0.645 to 0.902	0.655	Yes
Ranked Correlation	0.00001	0.821 (Spearman's rho)	0.665 to 0.908		No
Paired T-Test	0.130	0.270 (Cohen's d)	-0.0465 to 0.345		No
<b>8. Scope and Change Management</b>					
Correlation (recommended test)	0.00001	<b>0.787</b> (Pearson's r)	0.608 to 0.890	0.619	Yes
Ranked Correlation	0.00001	0.775 (Spearman's rho)	0.587 to 0.883		Yes
Paired T-Test	0.655	0.0785 (Cohen's d)	-0.291 to - 0.185		No

\*Sample size is small and confidence intervals are less reliable

**Bold red** is rational for choosing the test as recommended

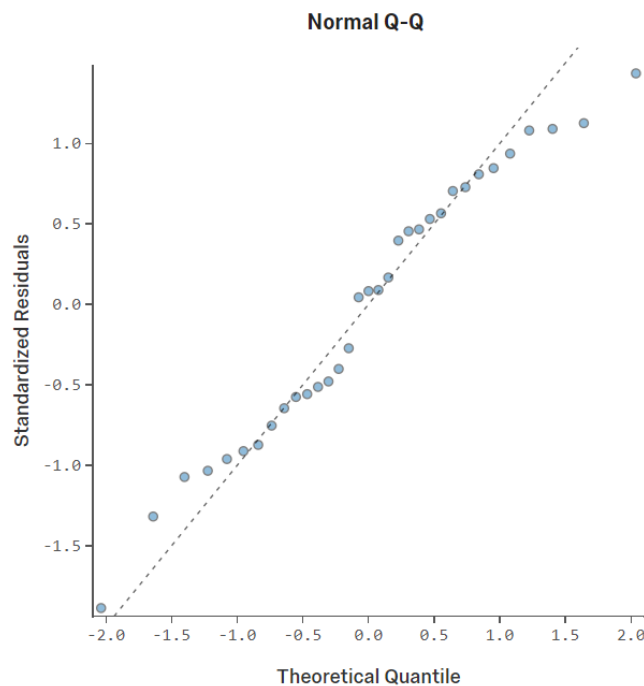
*regression.* Due to the small sample size, regression may not be consistent. The four domain variables (culture, leadership, PM skills and resources) all are significantly correlated to each other, meaning multicollinearity will occur and reduce the effectiveness of the results. Considering the small sample size and multicollinearity a regression model created based on

Akaike information criterion (AIC) or model fit, R-squared, the coefficient of variation, confidence intervals and P-values (< 0.05). The regression model created from the dataset used leadership, culture and resource domains.

**Table J.3 Site D Regression Model**

Sample Size 33	Relative Weights	R- Squared	Standard Error	Coefficient of Variation	Confidence Interval	Model Fit
<b>Leadership</b>	35.6%	0.903	0.136	0.0423	0.358	24.1
<b>Culture</b>	35.3%	-	-	-	0.486	-
<b>Resource</b>	29.1%	-	-	-	0.290	-

Regression tests were completed using M-estimation for analysis, which had a high R-squared value and low model fit score which is considered more accurate. Figure J.1 represents is a visual check of data plausibly that assumes the dependent variable is normally distributed. The data is considered normally distributed.



**Figure J.1 Site D Normal Q-Q Distribution**

**Interview Results.** Three 45-minute semi-structured interviews comprised of ten questions were conducted by Skype video chat. The interviews were intended to capture and provide further or more in-depth insight into the organization PM practices and validate findings from the online survey and were successful in accomplishing that goal in this study. The

interviews were recorded and transcribed and coded to find common themes using NVivo 12. Three interviews were conducted at this site to capture leadership belief in and outside of the PMO office.

Each leader ranked Site D's PM capability at a different maturity level. The leader that ranked site D the lowest scored the site at a level two PM maturity level (Repeatable). This leader attributed the lower score to lack of PM training, lack of risk assessment of projects, and inconsistent or ad-hoc PM practices. The low maturity score was also attributed to change of campus and IT leadership in the last three years. This leader believed that the development of the IT governance process for managing campus IT projects is improving Site D maturity level ranking to a level three (Defined). This leader credits increased transparency in decisions making for improving PM capability in the IT department and a changing culture that is more conducive to project management.

The Site D leader that ranked PM maturity score in the middle at a three (Defined). This leader supported attributed the three score because the department is finding value in PM and is developing and managing more PM processes. Processes are clearly defined and documented. This leader also believes that roles and responsibilities are clearly defined in project charters supporting the level three ranking. The leader that ranked the PM capability maturity level the highest for site D ranked PM maturity a level four (Managed). This leader attributed the score to the continued investment in the PMO meaning the department and campus is finding value in PM practices. This leader believes the department is more proactive because lessons learned and data from past projects to increase the organization's PM capability.

Some common themes that were identified and discussed were issues with gating projects ensuring to ensure that all the resources both human and monetary are available to complete campus IT projects. Some leaders believed that heroes are still present even in a larger IT force and relied upon heavily complete project work.

The word cloud created for Site D (Figure J.4) from interviews and document artifacts indicates governance, management, knowledge, and people is an integral part of this organization growth in project management.





**Figure J.2 Site D Radar Plot**

The benchmark scores are shown in Table J.5. PM skills are further broken down into four subgroups to provide a more useful measurement of the domain.

**Table J.5 Site D Project Management Capability Benchmark Scores**

Culture	Leadership	Resource Management	PM knowledge and skills	Communication	Scope and change management	Risk Management	Stakeholder Management	Overall
3.57	2.99	2.34	3.09	2.96	3.26	3.18	3.06	3.21

**Site Summary.** The overall benchmark score for Site D from the online survey is 3.21, and the leaders interviewed indicated a PM capability level score between two and four. There is some discrepancy in the scores, and the document artifact analysis supports a score of three is transitioning to a score of four (Managed) which is a site adjusting, integrating, controlling and measuring project management practices into department processes. This is evident in how the IT governance process is used to choose campus IT projects. Site D is the only site in the study with a PMO office and is believed because of that PM practices are much more defined and managed because there are dedicated PM professionals maintaining documentation and

collecting data to make the strategic decisions from lessons learned to reduce project risk and increase project performance.

Resource management is the lowest scoring domain for site D. It is also the lowest score compared to all the sites in the study of the domain. A decade's worth of budget cuts has influenced how IT decisions are made. It is expected that respondents would score resource management low as leaders that were interviewed for this site also identified it as an impediment to organizational project management capability. The IT governance process for choosing projects at Site D seems to fall short in the researcher's and some leaders' opinions because it does not provide the resources for a project that are accepted. The review process is intended to ensure projects meet campus mission and goals but does not include the funding which could be an opportunity for this site.

## Appendix K. Culture Maturity Level Definitions

### Level 1 – Initial

- No understanding of the benefits and value that project management principles can give to a department
- Firefighting project issues instead of being proactive
- Many in the department are unwilling to change or adapt to new processes

### Level 2 – Repeatable (Developing a foundation that is growing project management practices)

- Project management practices are being implemented
- Project processes and activities are viewed as bureaucratic and often are skipped
- Struggling to realize the benefits and value of project management
- Project management practice repeatability are dependent on the individual knowledge and influence of individuals

### Level 3 – Defined (Starting to find value)

- Project management only used in high profile projects
- Documentation of Project Management can be found and is available if requested

### Level 4 – Managed (Adjusting, integrating, controlling and measuring project management practices into department processes)

- Teamwork is being established as a norm for completing all project work.
- Department or University is committing resources to gain the benefits of project management.

### Level 5 – Optimized (Finding opportunities and developing innovation)

- Full commitment to project management practice
- Proactive management of projects is benefiting project success and efficiency
- Continuous improvement in project management is encouraged.

## Appendix L. Leadership Maturity Level Definitions

### Level 1 – Initial

- Project plan and goals not communicated to department or project team
- Project budgets are loosely known
- Department strategy not aligned with projects
- No selection criteria for IT projects

### Level 2 – Repeatable (Developing a foundation that is growing project management practices)

- Some projects have been assessed to ensure they align with department and university strategies
- Over-commitment of resources
- Business value not defined
- Project success parameters have not been defined and communicated
- Data collected from projects is only for an existing project not for future planning

### Level 3 – Defined - (Starting to find value)

- Proactive decisions are beginning to be made based on reliable and consistent data collected from project management practices.
- Projects are being analyzed and approved based on the value that they bring to the department and the University

### Level 4 – Managed (Adjusting, integrating, controlling and measuring project management practices into department processes)

- Project portfolio management is being used to prioritize project selection
- Models are being used to help create valid and measurable budget estimation, resource allocation and project prioritization
- Project Management support at the University level

### Level 5 – Optimized (Finding opportunities and developing innovation)

- Portfolio management defines how project work is prioritized.

- Proactive planning and forecasting of budget, human resources and schedules for IT projects
- Business goals tracked to ensure return on investment

## **Appendix M. Resource Management Maturity Level Definitions**

### **Level 1 – Initial**

- Projects started without determining the staff that is needed to complete
- Estimates for project budget are informal and are not communicated to the project team or department
- Roles and responsibilities are not defined
- Lack of knowledge of current employee skills
- Most workers in the IT department have little to no experience or background in project management.

### **Level 2 – Repeatable** (Developing a foundation that is growing project management practices)

- Resource plans are created, but estimates are not very accurate
- No forecasting

### **Level 3 – Defined** - (Starting to find value)

- Project roles are clearly defined and documented
- Resources plans are planned and monitored for accuracy

### **Level 4 – Managed** (Adjusting, integrating, controlling and measuring project management practices into department processes)

- Resource pools are used across the department and the University
- The resource being monitored, forecasted and monitored throughout projects

### **Level 5 – Optimized** (Finding opportunities and developing innovation)

- Resource management is being integrated with Human Resources

## **Appendix N. PM Skills and Knowledge Maturity Level Definitions**

### **Level 1 – Initial**

- No formal risk analysis
- Risks that are identified are dependent on the knowledge and experience of individuals (hero) to solve or avoid
- Ad hoc and informal PM practices
- No consistent channel of communication or plan
- Sporadic stakeholder involvement in projects
- Project charter used, but it's dependent on experience and knowledge of individuals
- Documentation limited or very informal

### **Level 2 – Repeatable (Developing a foundation that is growing project management practices)**

- Risks are discussed by the project team and are identified early in IT projects, but still, occur because risk are not properly managed
- No risk mitigation plans
- Communication is largely dependent on the knowledge and experience of individuals
- No communication standard is endorsed by management
- Faculty and staff were informed, but no input on the project is gathered from them
- Relationships are strained unnecessarily due to lack of communication
- Scope management being applied to only large high-profile projects
- Informal project charters are created for most projects
- Work breakdown schedules are created but are typically not adhered to or followed
- Change management applied to some projects, but very inconsistently
- Change management is viewed as bureaucratic and an impediment to project progress

### **Level 3 – Defined - (Starting to find value)**

- Risks are identified and managed during the project (Risk mitigation plan)
- Risks are being tracked through the risk register or other identified tools
- Plan and implement risk responses
- The role of the communication manager is assigned
- Documentation process assigned version numbers
- Stakeholder roles and responsibilities properly defined in the project

- Project kick-off meetings are held routinely.
- Management and project teams recognize communication is critical to project success
- Formal project charter created
- Project manager roles exist or is established
- Scope planning and validation are managed
- Training for change management encouraged by management
- Begin to research change management best practices

**Level 4 – Managed** (Adjusting, integrating, controlling and measuring project management practices into department processes)

- Risks are identified, evaluated and prioritized
- Risk are assigned an owner
- Organizational tolerance for risk assessed
- Communications are effective and timely
- Communications are developed to meet stakeholder needs
- A formal change management process applied to all projects
- Project performance is measured against other IT and campus projects
- A standard change method applied to all projects
- Positions established or dedicated to managing change management
- Change management enforced and accepted by the department and organization

**Level 5 – Optimized** (Finding opportunities and developing innovation)

- Risk fully managed and tracked
- Starting to identify opportunities from risk awareness
- Proactive communication is the norm
- Communication plans are created for every project with specific strategies adapted for stakeholders
- Metrics are developed to help make informed decisions on project scope
- Change management in an integral part of IT and University strategy
- IT workers understand why change management is critical to project success
- Data is collected to support continuous improvement both at IT department level and University level