EXPLORING A PROJECT MANAGEMENT DILEMMA: A CASE STUDY EXAMINING THE SHORTAGE OF QUALIFIED PROJECT PERSONNEL IN A FOUR-YEAR RESEARCH UNIVERSITY

by

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Abstract

Qualified individuals are an essential resource of project teams. A primary goal of the project manager is to ensure appropriate team members are hired to meet project objectives and stakeholder expectations. However, this is not always the case since a shortage of qualified project personnel seldom occurs, and prevents the project from being completed successfully. The project personnel shortage problem is prevalent in a four-year research university as inaccessibility to qualified individuals threatens the project deadline and delivery to sponsors. Research suggested these qualified individuals are recruited to provide scientific and technical expertise to academic projects. They possess knowledge and capabilities utilized in three dimensions of research, fundamental, applied and experimental scientific. Some results of their effort in these dimensions have produced theories, methods, algorithms, technology, equipment, instrument, mechanism, and systems. This study explored the reasons for the shortage of qualified project personnel and the actions of project managers relating to the shortage. The study utilized a qualitative methodology, along with a case study design to explore the problem, as experienced by project managers in a four-year research university in the Southeast. Findings revealed problems in the areas of compensation, leadership involvement, pipeline issues, project funding, and the need for adequate project planning. The implications of the findings were also examined, followed by recommendations to project stakeholders. As Christ cautioned his followers that before building a tower one must first consider the cost; likewise, project managers must carefully plan before execution of project resources, specifically qualified project personnel which are needed to achieve successful project completion.

Keywords: qualified personnel shortage, scientific and technical projects, four-year research university, project manager.

Dedication

This study is dedicated to my children Dwayna, Danae, my precious granddaughter Nyla, and my aunts Janet Mason and Joslyn Thomas. My dearest children, I thank God always for allowing me the opportunity of parenting you. I hope I have set a Godly example for you to follow, and your support of this work was appreciated. Also, to my aunt Janet, you are a blessing to me as you have instilled in me the importance of pursuing higher education, while Joslyn emphasized the importance of working hard to achieve a successful outcome. Losing our dear Joslyn was one of the difficult moments where God's peace sustained us. We will always cherish her memory.

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Section 1: Foundation of the Study

The shortage of qualified workers is one of the many factors that prevent a project from being successfully completed (Klaus-Rosinska & Zablocka-Kluczka, 2014). This problem is prevalent in sectors that typically engage in project management such as information technology, construction, and manufacturing; likewise, project managers in academia have experienced such challenges. King (2015) posited fewer graduates are pursuing academic careers and others are leaving academia. These graduates are part of the workforce utilized for project activities in higher education (Endacott & Whitehead, 2013). The extent of the qualified worker shortage problem gained national attention in the U.S. In 2012, the President's Council of Advisors reported the United States would need an additional one million graduates to meet the demand in fields such as science, technology, engineering, and mathematics (Cappelli, 2015). Hence, project managers in a four-year research university would benefit from the skill-set of these prospective graduates from the above-listed fields.

The shortage of qualified project personnel in a four-year research university should be of interest to the educational community, industry, and government, given the critical role of project research to the university's ecosystem (Whatley, 2016). Also, the body of knowledge concerning the problem is at a nascent stage; however, within the highest levels of government there is an awareness that a problem exists, and it demands immediate attention (Cappelli, 2015). Furthermore, the factors surrounding the shortage of qualified project personnel in a four-year research university warrant a cause for investigation by exploring the actions of project managers who are experiencing this problem.

Background of the Problem

Qualified workers are the backbone of any organizational venture. However, Rachford (2017) posited there is no established definition for a qualified worker since companies must

establish their own criteria on how to define a qualified worker. For example, one industry defines a qualified worker as one who has demonstrated skills and knowledge related to the construction and electrical equipment installations, and has received safety training to identify and avoid the hazards involved (Zoubek, 2015). Frick (2011) claimed a qualified worker is an individual valued for his or her ability to gather, analyze, interpret, and synthesize information within specific subject areas to advance the overall understanding of those areas and allow organizations to make better decisions. For the purpose of this study, a qualified worker is an academic research personnel, equipped with technical and/or scientific knowledge, and contributes to the project's objectives. Furthermore, these individuals report to the project manager and are critical to the team.

These qualified personnel are recruited to scientific projects in academia and possess knowledge and capabilities that are utilized in three dimensions of research, by way of fundamental, applied, and experimental scientific (Abdramanova, 2014). The results of their effort in the various dimensions have produced theories, methods, algorithms, technology, equipment, instrument, mechanism, material, product, system, substance, program instrument, and base data (Abdramanova, 2014). Abdramanova posited these personnel, also known as researchers, are equipped with exceptional levels of qualification and provide specialized expertise to the project team. An example of an academic project team includes researchers, scientists, statisticians, engineers, analyst, and the project manager (Sajdyk et al., 2015). Hunter (2012) claimed these researchers are valuable to the project, but are sometimes in short supply.

Fitsilis, Kirytopoulos, and Leopoulos (2011) posited the knowledge and skills of these qualified personnel are essential for the successful delivery of projects. Moreover, Kisielnicki (2014) indicated management of research-focused projects requires a high level of skills and knowledge to support organizational development, as establishments such as higher education are beneficiaries of the skills of these project workers. These project researchers are supervised by

skilled individuals referred to as project managers - professionals having knowledge and skill to manage the project's limited resources and having the responsibility of initiating, planning, executing, and closing the project (Zahra, Nazir, Khalid, Raana, & Majeed, 2014). These project managers face challenges that can prove to be difficult when overseeing project activities. One of these challenges is the shortage of qualified personnel needed for project tasks.

While project assignments are most prevalent in construction, information technology, healthcare, and manufacturing industries, they have lately emerged in areas of higher education (Austin, Browne, Haas, Kenyatta, & Zulueta, 2013). Liu and Yokoyama (2015) asserted project managers occasionally find it challenging – inadequate staff to meet scheduling- to assign members to project teams, especially for projects that require expertise rather than for those that are labor intensive. A lack of skilled personnel can hinder progress and lead to project failure. Klaus-Rosinska and Zablocka-Kluczka (2014) noted university-based projects and revealed several problems that hampered a university's ability to successfully realize the goals of the project. A central problem pointed to a shortage of qualified personnel.

These studies observed project managers who possessed qualifications in areas such as engineering, design and contracting. However, none of the preceding studies examined project managers in higher education, particularly in a four-year research university, and the way these managers plan to address the shortage of qualified project personnel. Therefore, this reveals a gap in the scholarly literature.

Additionally, project managers in a four-year university are commonly called research project managers, study coordinators, project investigators or project directors (National Institutes of Health, 2017a). These individuals will be referred to as project managers in this study based on their technical competencies as this is a salient element of a project manager (Chipulu, Neoh, Ojiako, & Williams, 2013). Their responsibilities range from the overall direction and

management of the project to recruiting individuals with the right qualifications, at the right time. Furthermore, project managers in a four-year research university provide meaningful benefits to communities, mainly through pilot ventures (Lewis et al., 2016). Whatley (2016) acknowledged project output from universities is beneficial to many constituents; therefore, the shortage of qualified workers significantly affects the project manager's ability to deliver meaningful results to stakeholders. Hence, this study is relevant.

Problem Statement

The problem to be addressed is project managers are experiencing a shortage of qualified project personnel. Kazaz, Ulubeyli, and Tuncbilekli (2012) stated one of the factors that caused a project to go beyond schedule is attributed to a shortage of qualified workers. Kazaz et al. (2012) claimed the frequency of this qualified labor shortage occurs approximately 30% of the time. Further research by Jarkas and Younes (2014) reported of 43 project factors examined, the shortage of qualified labor and technical staff ranks 10th among these factors. The preceding figures are an indication of a general business problem. The specific business problem addressed by this study is project managers in a four-year research university in the Southeastern United States are experiencing a shortage of qualified project personnel needed to complete projects successfully. This research may be of interest to project managers more generally, and particularly to those who manage projects in a four-year research university.

Purpose Statement

The purpose of this qualitative single-site case study was to explore the reasons why project managers in a four-year research university in the Southeastern United States are experiencing a shortage of qualified project personnel. Therefore, in this study, the researcher intended to understand project managers' perceptions of the specific business problem and the actions that could be taken by project managers to address the problem.

Nature of this Study

The research method chosen for this study is qualitative, and the rationale is based on seminal thinkers in the field. Creswell (2003) stated it is important to utilize a research approach that fits the research problem. Stake (2010) posited qualitative research relies primarily on human perception and understanding, whereby information is obtained from individuals within organizations and communities. This study relied on the perception of project managers by gathering data from these individuals in a four-year research university. Creswell (2013a) further stated qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. This study sought to explore and understand the meaning which project managers in a four-year research university attribute to the problem of qualified project personnel shortage. A recent study claimed qualitative research is typically conducted by collecting data from and about one or more groups of people, and addresses similarities and differences within, between, and across groups (Rudnick, 2014). This study collected data from project managers while analyzing patterns, themes, and trends between these individuals and report findings relevant to the research questions. Moreover, the study focused on exploring theories and seeking to understand individual perceptions, in this case, that of project managers, a characteristic of qualitative studies (Stake, 2010). A quantitative approach focuses on validating theory (Yin, 2014) and a reliance on linear attributes, measurements, and statistical analysis (Stake, 2010), which was not the aim of this study. The primary objective of this study was to understand project managers' perception of the problem, which is best achieved through a qualitative method. Unlike quantitative research, qualitative methods take the researcher's communication with the field and its members as an explicit part of knowledge instead of deeming it an intervening variable (Flick, 2014). Also, the study did not consider a mixed-methods approach; this approach involves numerical analysis (quantitative) followed by interviews with

participants (qualitative) to determine how they viewed the experiment, thereby confirming the results (Migiro & Magangi, 2011). Since a quantitative method was not used, a mixed-method approach was not appropriate for this study.

This study utilized a case study with the sample originating from a single site that involves collecting data through face-to-face, semi-structured interviews (Creswell, 2013a). The use of a case study design is appropriate as it allowed the researcher to explore and collect detailed information from individuals at a single location during a sustained period (Creswell, 2013a). Løkke and Sørensen (2014) posited the overall advantage of a case study is that it can close-in on real-life situations and test views directly in relation to phenomena as they unfold in practice. These views were those of project managers in a four-year research university who experienced a shortage of qualified project personnel.

The use of an alternate design such as a grounded theory would be impracticable for this study. Grounded theory is a design of inquiry in which the researcher derives a general abstract theory of a process, action, or interaction grounded in the views of the participants (Creswell, 2013a). Creswell claimed the process involves using multiple stages of data collection and the refinement and interrelationship of categories of information. In contrast to the case study that examines relationships among the data, the grounded theory focuses on the development of a theory (Cho & Lee, 2014; Houghton, Murphy, Shaw, & Casey, 2015). Similarly, an ethnographic design was not utilized as it allows the researcher to study the shared patterns of behaviors, language, and actions of an intact cultural group in a natural setting over a prolonged period; in contrast to a case study that involves a sustained shorter period (Creswell, 2013b). Additionally, a phenomenological design that allows the researcher to describe the lived experiences of individuals about the shared phenomenon as described by the participants was not utilized. Even though the participants of this study are a homogeneous group, the study's purpose does not require these

individuals describe their lived experiences, but instead it requires they share their perception of the problem they are facing.

Research Question

Defining the research question is a particularly significant step in research as it narrows the research aim and objective down to specific areas the study will address (as cited in Doody & Bailey, 2016). Doody and Bailey (2016) further posited that research questions are vital as they guide the choice of methodology, methods, sample, sample size, data collection instrument and data analysis techniques. The following questions guided this study as they focus on the problem's impact and the project manager's response to the problem. These questions are:

RQ1. Why are four-year research university project managers experiencing a shortage of qualified project personnel?

RQ2. What actions could be taken by project managers to address a qualified project personnel shortage?

Conceptual Framework

The conceptual theories used in this study are, Path-Goal Theory, McClelland's Theory, Theory of Constraints (TOC), and Resource Based View (RBV). Path-Goal theory was developed by House in 1996, which states the primary goal of leaders is to help subordinates attain their goal effectively by providing necessary support to achieve their own goals (Ag Budin & Wafa, 2015). Path-goal theory is a leadership tool which is used to identify, analyze, solve and effectively manage situational issues arising from either unfavorable external factors or follower characteristics (Zabihi & Hashemzehi, 2012). According to this theory, a leader's behavior is acceptable to subordinates as long as they view it as a source of immediate or future satisfaction. House believed leaders are responsible for assisting their followers in attaining their goals (as cited in Ag Budin & Wafa, 2015). Moreover, leaders should provide direction, support, and clarify the

path for followers, while increasing rewards and removing goal obstacles through adapting their leadership style (as cited in Ag Budin & Wafa, 2015).

Project managers are designated leaders responsible for assisting team members in attaining and realizing their goals. These leaders need to devise ways to allow qualified workers to accomplish this end while incorporating benefits from attaining these achieved goals. Incorporation of Path-Goal theory can be a driver for effective management of the team by project managers. This technique can serve as a means of preventing the shortage problem, especially when workers feel a sense of accomplishment.

McClelland's theory, developed in 1961 by House offers a classification of needs according to their intended effects (i.e., they satisfy employee needs for achievement, affiliation, and power; Neagu, Teodoru, & Macarie, 2013). This theory has also been referred to as McClelland's theory of needs, McClelland's Achievement Motivation Theory, and McClelland's Achievement Need Theory (Panda, Pradhan, & Mishra, 2014; Lazaroiu, 2015; Liu & Wohlsdorf Arendt, 2016). Need theories, as explained by McClelland's, suggested that individuals have specific physical and psychological needs they attempt to satisfy. Neagu et al. (2013) also posited motivation is a force that results from an individual's desire to satisfy these needs. Managers use motivation as an effective instrument in inspiring the workforce (Panda et al., 2014). It is the major task of every manager to motivate his subordinate or to create the will to work among the subordinates. It is an important function which every manager performs for educating the people to work for the accomplishment of objectives of the organization or the project. Therefore, project managers have a critical role in meeting these needs of team members who are assets to both the project success and stakeholder needs.

Having in-depth knowledge of the problem is critical for resolution. Making these assessments require the inclusion of theories that are being used by project managers to mitigate

and resolve scare resources. Hence, two such theories supporting this framework are Theory of Constraints and Resource Based View (RBV).

Goldratt published the Theory of Constraints (TOC) in 1988; however, it was initially considered a management philosophy designed to provide a process for continuous improvement (Johnson, Creasy, & Fan, 2016). Over time, other scholars have offered insights on TOC. Lin, Lee, and Lee (2009) have summarized TOC as anything that limits a system's performance, and in this study, a shortage in qualified personnel restricts a project from meeting its desired outcome promptly, specifically in the university setting. The TOC has been incorporated in the field of project management to facilitate the utilization of resource allocation and project scheduling to reduce project duration (Johnson et al., 2016). The objective of the project manager is to manage these scarce resources efficiently with adherence to the project schedule. Therefore, incorporating the TOC can serve as means of managing scarce resources to accomplish the purpose of project efficiency, ultimately resulting in success.

Also, TOC's guidelines are summarized by a review process which involves identifying constraints, improving the capacity of the constraint and restructuring the rest of the organization (project) around it (Tulasi & Rao, 2012). As it relates to this study, a project manager that is faced with a shortage of qualified project personnel needs to regard this problem as a constraint to the project, since the shortage threatens the project scope, schedule, costs, and limits performance. The project manager's next focus regarding TOC is to maximize resource capacity. This requires utilization of the available resources on project activities that are critical to the project with a stringent capacity planning of these resource. Ultimately, this can serve as a means of reducing the shortage of qualified personnel, and lead to a timely and successful completion.

The RBV was conceptualized during the 1950s-1970s and is considered one of the most dominant frameworks in strategic management (Jugdev, 2004). The RBV focuses on managing

limited resources to generate a competitive advantage (Cullen & Parker, 2015). A resource is anything that could be a strength or weakness of the firm (as cited in Govan & Damnjanovic, 2016). Resources are commonly considered to be tangible or intangible assets such as capital, labor, machinery, and natural resources; company brand technology, education and skill set (Cullen & Parker, 2015). Cullen and Parker claimed resources are a source of competitive advantage if they are valuable, scarce (rare), inimitable, non-substitutable, durable, appropriate, and organizational focused. The RBV perspective is essential to project-based performance management, as it focuses on the use and deployment of a firm's resources and development of strategic assets for achieving a competitive advantage. Jugdev and Mathur (2015) claimed project management resources are most likely to be strategic resources such as those that are human. Regarding the RBV, these strategic resources are valuable, and a firm achieves competitive parity when it has these valuable resources. Therefore, a dearth of these skilled human resources limits a project's progress and success.

The shortage of qualified personnel experienced by project managers in a four-year university will present a challenge. However, deploying these scarce resources to where they are most needed is important, such as on projects that are critical. For example, a project that is seeking to discover a lifesaving drug is more important than one that is working on a newer version of an iPhone. As project managers strategically manage these limited resources, the goal is to resolve the overall problem either through utilization of the theory of TOC or RBV. However, in like manner, project managers need to motivate and design a path that foster personnel success by use of theories such as Path-Goal and McClelland's theories.

Definition of Terms

Project: a temporary endeavor undertaken to create a unique product, service or result (PMI, 2013).

Project Director/Project Investigator: individuals designated by the sponsor, and approved by NSF, who will be responsible for the scientific or technical direction of the project. (National Science Foundation, 2017a).

Project Manager: a professional having knowledge and skill to manage the project in limited resources is called project manager. He/she has the responsibility of initiating, planning, executing and closing the project (Zahra et al., 2014).

Qualified Worker: a qualified worker is an academic research personnel, equipped with technical and/or scientific knowledge, and contributes to the project's objectives (Lyken, 2017).

Assumptions, Limitations, and Delimitations

Assumptions

The study participants shared information to the best of their knowledge, as the researcher sought to secure participants' honesty by ensuring anonymity, as this allowed individuals to be truthful in their responses. Also, the participant's background is homogeneous; for example, they are all project managers with technical or scientific qualification and employed in a four-year university in the Southeast.

Limitations

The population of this study was project managers from one four-year university within the state of Georgia, and thus, the findings may not be generalizable to project managers in another state. Also, the use of a purpose sampling procedure decreases the generalizability of findings. Community colleges and those that are non-research focused were excluded from this study. Also, the interview sessions may exclude meaningful information that would be helpful for better understating reasons why project managers are experiencing a shortage of qualified project personnel. Additional research could expand this work by examining a different set of research

questions and studying other organizations. Also, due to time constraints and the accessibility of study participants, the sample size is being limited.

Delimitations

This study explored the perception of project managers regarding the reasons of the shortage of qualified project personnel in a four-year research university within the state of Georgia where project management is a fundamental aspect of their organization's ecosystem. Therefore, the study's relevancy is being restricted to project managers who manage technical and scientific projects. The purpose statement described the researcher's intent with the aim of selecting informants who best answered the research questions.

Significance of the Study

The contributions of this study would be of interest to scholars in the project management discipline and practicing project managers in project-based industries. This study is particularly significant to project managers in a four-year research university as these individual's contribution to the project involves overseeing research activities that are scientific or technical. Therefore, assigning the appropriate individuals to these complex projects is essential to its success. This study contributes to this literature by informing university leaders and their project managers of the need to understand the factors that have contributed to academia's qualified project personnel shortage. Plans need to be devised to address this problem and counter any erroneous perception that might deter, graduate students, research scientists, engineers and technical scientists who are considering this sector as a lifelong career. Research has shown that although individuals pursue graduate degrees, only a small fraction choose academic careers that involve some form of research (Ibraev, Kul'evskaya, Ulez'ko, & Galants, 2015). Therefore, this information contributes to the understanding of the limited number of qualified professionals who are available to work on projects. Also, research of this nature is critical in universities since many pilot projects become

the foundation for more extensive research work that is critical for discoveries in healthcare, information technology, and the biomedical fields. Consequentially, there is the need for qualified personnel to address these problems via project activities. Moreover, this study added to the body of knowledge that provided valuable knowledge to the existing project management literature.

Reduction in Gap

Scholars have discussed the shortage of qualified project personnel in industries such as construction (Barker & Ingram, 2011; Kim, Lee, Nguyen, & Luu, 2016); healthcare (Niederhauser, Schoessler, Gubrud-Howe, Magnussen, & Codier, 2012) and manufacturing (Kuen & Zailani, 2012). However, some have claimed project management is not prevalent in academia as in other project management-based industries (Austin et al., 2013). Therefore, research surrounding this problem is insufficient. It is the aim of this applied doctoral research project to explore the factors surrounding the shortage of qualified project personnel by examining the perceptions of project managers in a four-year university and to understand how their department is impacted, their response to the problem, and further determine the impact of this shortage on the project's success.

Implications for Biblical Integrations

Biblical principles are relevant to this study in several aspects. Jesus asked his audience about the importance of individuals first counting the cost before deciding to commence a project. "For which of you, intending to build a tower, sitteth not down first, and count the cost, whether he has sufficient to finish it?" (Luke 14: 28, KJV). This question gives insight into the importance of planning based on the available resources before execution, an important antecedent for project success. Project managers need to ensure qualified personnel are available with the right qualifications relative to the project tasks. Having verified the appropriate resource is available in both quality and quantity will serve as one of the critical factors that will aid in the project's successful conclusion.

Additional biblical principles provide guidance in handling scarce resources, and are critical to project success can prove helpful to project managers. These individuals within the university can incorporate these principles into their processes so there are qualified personnel available for future project activities. For example, the apostle Paul was passionate about educating and training those who would succeed him in the ministry. He devoted his time to invest in Timothy, Titus, and other Christians to ensure continuity and the success of the gospel's influence globally (Acts 18: 26; II Timothy 1; Titus 1-2; KJV). The above strategy is one of the solutions that can serve to mitigate a qualified personnel shortage problem. Also, Jesus is our prime example as it relates to this problem. Our Lord chose twelve men and trained them for three years to continue his work upon his return to heaven (Luke 6). Christ was aware the task would have been enormous for these few individuals. He advised them to first wait for the Holy Spirit (Acts: 1), then firmly advocated spiritual reproduction, through salvation, followed by discipleship so that his priorities and purposes would continue for generations (Matthew 28, KJV). Fundamentally, Christ addressed the problem of spiritual TOC through the mandates of the great commission (Matt 28:19-20). Christian project managers can reference these biblical accounts to garner knowledge and wisdom in addressing this problem.

Further application of this study biblically relates to the shortage of Christian workers to spread the message of Christ throughout the world. Not only is there a shortage, but many are unqualified – lacks spiritual maturity (1 Peter 2:2). The definition of a Christian is one who believes, receives and adheres to the teachings of Christ, and the individual has a specific designation or seal and has been equipped with the grace of God to proclaim his message (John 8:13, Matthew 28:19, Eph. 1: 13). However, Jesus pointed out the harvest indeed is great, but the workers are few (Luke 10:2). Likewise, Peter (3:15) stated we should be ready always to answer every man that asks a reason of the hope that is in us with meekness and fear. Readiness is a

symbol of preparedness. Hence, the lack of readiness poses a problem for the church and the ministry of evangelism. Although this is the work of the Holy Spirit, it is the responsibility of each Christian to take the gospel to the world. The challenge is there are more lost people to reach than there are willing Christians to proclaim the truth, so as a result, this creates a shortage in the Christian workforce who are unqualified to witness or even teach. Church leaders need to prepare, develop and mobilize Christians for this vital work so more lost souls can be evangelized.

This issue of Christian shortage and their unqualified state to witness intertwines with the resource base view (RBV) framework. One critical approach of RBV focuses on the use and deployment of a firm's resources and development of strategic assets for achieving a competitive advantage. Christians are priceless assets to God's kingdom in proclaiming the gospel to a lost world; however spiritual development is necessary so that our message can be compelling to the world. Since many false doctrines are vying for the souls of men, God commands that we seek his wisdom (James 1:5). God's wisdom is that qualifying element that allows believers to be strategic with a competitive advantage even though there is a shortage of qualified or unprepared believers.

Relationship to Field of Study

The goal of project management is the application of knowledge, skills, tools, and techniques to carry out project activities to meet stakeholders' needs and expectations from a project (Zahra et al., 2014). This study is central to the project management field and focuses on project managers in academia, specifically in a four-year university, who encounters a shortage of qualified personnel. The project manager's reaction to this challenge will determine the project's performance and outcome, so applying PM knowledge is essential from planning to closing to obtaining project success. A project manager will need to consider the above factors as they manage the project. The literature examined content that highlights this issue; therefore, considering strategies to remedy and alleviate the challenge is necessary to project

accomplishment. Shannon and Hartshorne (2013) made a strong point of the inclusion of project management in higher education:

> While scholarly research projects may appear to be distinctly different from projects in a business context, all projects have unique goals and requirements, and all projects, regardless of size, can benefit from the use of project management processes and tools. By approaching research projects with a structured process and set of tools, professors may gain time-, resources, and funding efficiencies. (p. 1)

Shannon and Hartshorne (2013) suggested the applicability of project management is useful in the academic landscape although the work is distinctly different from that of the business world.

Project stakeholders trust project managers to deliver a timely project while accomplishing all the agreed-upon requirements. The research questions that are foundational to this study sought to obtain information based on the project managers' perceptions as they relate to the specific business problem. This provided insight as to how the problem impacted each project manager participant. Also, the research findings provided significant information about the project manager's capability to address this problem. This yielded valuable data that added to the body of project management knowledge and advance the field of project management.

Further application of this study to the project management field relates to management of human resource which is one of the tenets of the project management body of knowledge (Zhang & Tian, 2012). Having the ability to manage these scarce human resources efficiently is important for project managers in general, particularly those in a four-year research university. As the project manager is key to the project, his or her ability to manage scarce resources efficiently, particularly human personnel, is an important project management principle. Taghavi, Taghavi, and Taghavi (2013) claimed conducting research projects successfully is becoming more significant, where the role of a project leader is critical to the project. Tajinder Pal (2009)

emphasized that effective people management is vital for effective project management. Tajinder Pal (2009) further emphasized this entails recruiting highly committed and talented staff to project activities. This is one of the many possible solutions to the study's problem as expressed by Tajinder Pal in the project management context.

A Review of the Professional and Academic Literature

Researchers in the field of project management have conducted studies on topics ranging from performance, teamwork, and methods to tools and techniques, all of which are essential to the field. Very few have examined project management in higher education. The content in this section includes a review, examination, analysis, and synthesis of the extant literature with the intent of showing the relevance for this study and to reveal gaps in the literature based on relevant scholarly articles. Topics covered are organized into four major headings: Defining a Project and Project Management; Project Management in Higher Education**;** Qualified Project Personnel and Their Importance, and Research Collaboration and the Issue of Qualified Personnel Shortage in Research Universities. Within these major headings were minor sections ranging from defining project success to graduate students: a key component to project research.

Defining a Project and Project Management

Humaidi and Asarani (2012) posited it is crucial for managers to understand the concept of a project before discussing any aspects of project management. The Project Management Institute (PMI) defined a project as a temporary endeavor undertaken to create a unique product, service, or result (as cited in Larson & Gray, 2014, p. 6). Humaidi and Asarani (2012) further posited a project can be either large or small-scale and may involve one or thousands of individuals, implying the need for efficient management of the project. Additionally, Zahra et al. (2014) defined project management as the application of knowledge, skills, tools, and techniques to carry out project activities to meet stakeholder's needs and expectations for a project. Wei, Lai, Wei,

and Peng (2013) offered an alternative definition of project management, as a management methodology that can help enterprises to efficiently and effectively solve problems and create opportunities. Wei et al.'s (2013) definition expressed the application of project management methods is beneficial to solving organizational problems, and in this case the study's problem of the shortage of qualified project personnel which threatens the project's success. Furthermore, as the field of project management increases in popularity, the literature suggested stakeholders have different perceptions of what constitutes project success (Davis, 2014).

Defining Project Success

The discipline of project management is relatively new, so a more precise definition and understanding of project success took some time to develop (McLeod, Doolin, & MacDonell, 2012). Joslin and Müller (2016) believed project success is the achievement of a combination of objective and subjective measures, disclosed in the success criteria and measured at the end of a project. Howsawi, Eager, Bagia, and Niebecker (2014) provided an alternative definition of project success. These authors claimed that from the late 1950s up to the 1970s, project success was defined as completing projects according to time, cost, and quality, which is known as the iron or golden triangle. Blaskovics (2016) supported Howsawi et al.'s (2014) study by suggesting that during the early years of project management, the literature mainly focused on the project triangle as the central criteria for project success. Ika (2009) believed this triangle was, and still is widely accepted, but is criticized for being insufficient to fully define project success, since the project success concept has more criteria than that of the iron triangle. Williams (2016) added to this discussion and claimed that by the late 1980s a more comprehensive definition was being sought that would capture both the success of the management of the project and the success of the project output. Williams further claimed the most influential framework that sought to widen this definition was developed through work with the U.S. Agency for International Development

(AID). The U.S. AID's characterization of project success listed five variables which are: efficiency, effectiveness, relevance, impact, and sustainability.

These researchers further examined the project success definition concerning the use of project management in the British aviation industry during World War II. The analysis of this project pointed to at least six challenges - a shortage of qualified workers was among these challenges. As a critical component to the success of this project, the situation required the shortage of qualified worker problem be promptly investigated, followed by a resolution. Furthermore, the utilization of these scarce resources by the project manager was the key, which would guard against project impediment that can impact success.

A few of the previous scholars have expanded the discussion of project success to include the need for qualified project personnel. For example, Howsawi et al.'s (2014) study observed the importance of qualified individuals to the projects' success. Similarly, other recent research has examined project success based on critical success factors discussed by Boynton and Zmud in the 1980s (Blaskovics, 2016). Critical success factors are defined as those few aspects that must go well to ensure project success for a manager or an organization (Blaskovics, 2016). Of the nine groups of factors covered, Blaskovics' (2016) study examined the qualification of the project workers, where it was noted a shortage of the appropriate skills would subsequently jeopardize the project's success. The resource-based view theory, which focuses on managing limited resources to generate a competitive advantage, would prove valuable to the project manager, whereby strategically deploying these scarce resources appropriately to the project, which will improve performance and further result in success. Moreover, the firm's performance is influenced strongly by its resources (Jugdev, Mathur, & Fung, 2007). Resources that are valuable and scarce, and can benefit the organization, can bring a temporary competitive advantage to the organization (Hulland, Wade, & Antia, 2007). Therefore, a major factor in the success of the organization's

project requires strategic resources that are valuable, rare, non-imitable, and non-substitutable (Jugdev et al., 2007). Qualified personnel with skills that are valuable, and not easily imitable, as in the case of those who conduct research in a four-year research university fits into this mold. Effective management of these scarce resources to gain a competitive advantage for the university demonstrates the organization's ability to be competitive, which is an objective that is congruent to the resource-based theory (Cullen & Parker, 2015).

The preceding literature indicates that over time the definition of project management and project success has changed. In the case of project success, the focus has shifted from the iron triangle- cost, time, quality/scope- to other variables such as efficiency, effectiveness, relevance, impact, and sustainability which are also considered critical success elements. These elements are critical to the business practice; moreover, the RBV theory with its focus on managing limited resources to generate a competitive advantage can serve as a critical guidepost for achieving project success as project managers address the challenge of qualified project personnel shortage particularly in a four-year research university.

The Role of a Project Manager

Zahra et al. (2014) asserted that as project management emerged as a field, its importance within organizations led to the hiring of a skilled professional referred to as the project manager. This individual is essential to the project's governance; therefore, recruiting the right project manager can be a challenge for organizations, as the individual is vital to the project's success (Ahsan, Ho, & Khan, 2013). Klaus-Rosinska and Zablocka-Kluczka (2014) supported Ahsan et al.'s study, the success of project management, required careful appointment of a skilled project manager. Maghareh and Mohammadzadeh (2013) emphasized the success of the project is highly dependent on the effectiveness of the project manager. The individual is responsible for

overseeing the entire operation from start to finish and addressing all activities related to the project.

Blaskovics (2016) stated one of the critical success factors, as it relates to project managers, is their competency in applying project management techniques. For example, organizations such as the National Institutes of Health (NIH), which are large funders of research projects, recognize the importance of these individuals overseeing project activities and have stipulated presiding project managers must possess a specific amount of expertise. According to the NIH, the following is the eligibility requirement for a project manager: an individual judged by the applicant organization to have the appropriate level of authority and responsibility to direct the project supported by the grant (NIH, 2017b). The applicant organization may designate multiple individuals who share the authority and responsibility for leading and directing the project, intellectually and logistically (NIH, 2017c).

Other authors have commented about the importance of the project manager's role. For example, Sommerville, Craig, and Hendry (2010) viewed the project manager as the person accountable for delivering a project safely, on time, within budget, and to the desired performance or quality standards determined by the client. Blaskovics (2016) believed a project manager has a considerable role in all phases of the project, and his knowledge and competency are essential to achieving project success. Ahsan et al. (2013) provided a synopsis of the project manager's importance to the project:

> The project manager manages the project through identifying project requirements; establishing clear and achievable objectives; balancing the competing demands for quality, scope, time and cost; adapting plans and approaches to the different concerns and expectations of the various stakeholders; and managing projects in response to uncertainty.

> The project manager's role is one of the most challenging jobs in any organization because it requires a broad understanding of the various areas that must be coordinated. (p. 1)

Ahsan et al. (2013) suggested the project manager needs to be a competent individual with a comprehensive range of skills and adapts to the varying demands of the job.

Further studies have observed the role of project managers. Saadé, Wan, and Dong (2015) posited project managers form the nucleus of the project, and their contribution is extremely valuable to ensuring the project concludes successfully. Although these writers acknowledge the project manager's importance to the project, they assert there is the need for these professionals to be trained. Henderson, Stackman, and Koh (2013) observed a more significant problem within the project management role, which is, women working in the profession of project management are not breaking into the significant role of project manager. Henderson et al. (2013) pointed to results of the U.S.-based project management institute's (PMI) 2008 "professional survey" showed only 32% of project management professionals (PMP) are women, with 68% being men. Similarly, the 2008 gender breakdown of overall membership in the PMI showed 30% female and 70% male possessing this designation. Henderson et al. (2013) commented while these percentages vary according to industry and geographic region, it is interesting to note the number of women project managers appears to have decreased in the 2008-2011 timeframe. In 2008, for example, the PMI reported female membership in North America at 41.9%. Yet by 2011, this percentage had decreased to 36%.

Regardless of the gender disparity, managing a project is not a straightforward task; instead, project managers face challenges that demand a large amount of time and energy from them Zahra et al. (2014). This involves recruiting and assigning the appropriate personnel to the various project activities. However, the absence of suitable individuals can test the project's ability to be completed successfully. Maghareh and Mohammadzadeh (2013) agreed a significant factor

among the necessary issues should be considered in the implementation of a project is estimating the right type of human resources required for the project. Such resources are an essential component to realizing the success of the project. Shannon and Hartshorne (2013) posited project managers are responsible for managing projects of various size and complexity; therefore, as highly skilled academician the need to be trained in project management-specific processes provide critical competencies that will assist with the project success.

These skills are essential to address problems that emerge concerning the project over its duration. One of the many problems is addressing the project's shortage of qualified individuals which Zack termed as the greatest project risk (2007). Minimizing this risk can be addressed through the incorporation of the Path-Goal theory, where the primary goal of leaders such as project managers is to help subordinates attain their goal effectively, by providing necessary support to achieving these goals. Assisting team members in achieving their goals is a practical reason to address a qualified project personnel shortage. Application of Path-Goal principles can also serve as evidence of member value and appreciation. This response by the project manager to this challenge could determine the success of the project.

Project Management in Higher Education

Shannon and Hartshorne (2013) claimed despite the importance of project management in business contexts, project management is not as pervasive in higher education. Although some professors manage projects as part of their research, higher education is generally not viewed as being project-driven (Shannon & Hartshorne, 2013). Since Shannon and Hartshorne's (2013) study pointed to a dearth of project management practice in higher education, there is the need for this study and reveals a gap in this study. Furthermore, the research knowledge derived from its findings would be valuable to both higher education and the field of project management.

Other studies claimed there is a lack of use of project management in higher education, specifically focusing on professors (Bryde & Leighton, 2009; Gainsboro, 2006; Tracey & Riha, 2009). Austin et al. (2013) argued formal project management concepts are more prevalent in well-established industries such as construction, healthcare, and information technology but seem to be lacking in higher education. Austin et al. (2013) also noted due to the scarcity of research related to project management in higher education initiatives, it is a challenge to validate any academic-specific principles relative to this discipline. There is a consensus from the preceding scholars, that project management is not established in higher education as in other industries, yet others claimed it is workable, but with special stipulations. For example, Burgher and Snyder (2012) emphasized project management in higher education is practicable. However, they believed specific conditions must apply, stating

> Project management in higher education can work - provided you establish goals, milestones, schedules, accountability, and assessment, and proper management plans internal to project work plans. Work plans start projects on the right track and ensure their progress - and, most important - their completion. (p. 2)

Burgher and Snyder (2012) underscored the need for higher education to include project management in their operations, but it needs to be incorporated methodically to achieve successful results.

A more recent study reported its observation of the incorporation of project management and project-related activities into the academic setting (Fowler, Lindahl, & Sköld, 2015). This study claimed in countries such as Sweden, the tools and techniques inherent to traditional, linear, and instrumental project management have in recent years made a subtle entrance into academia and particularly the scientific laboratory with the project having become the preferred vehicle of choice for controlling government-sponsored research activities. Fowler et al. (2015) further

reported the project model, which has sprung from traditional industry and out of work oriented toward traditional product development, has now expanded and is being imposed on the academic realm to monitor scientific projects and cover their progress and expenditures.

Although the preceding literature pointed to a gradual entrance of project management activities into higher education, there have been signs of problems. Abou-Warda (2014) recognized that organizationally-oriented projects waste manager competencies after the end or expiration of their projects. Abou-Warda (2014) further explained that frequently a project manager - mainly professors- from his university is selected to manage a project. At the end of the project, he returns to his original work. This leads to the waste of several competencies the project manager has acquired during the lifetime of the project, as the knowledge gained is not utilized. This is different from the functionality of a project manager in other countries, as project management is a continuous activity in faculty life in some universities, particularly in a four-year research university (Koehn, 2014). Abou-Warda (2014) pointed out one of the project barriers in implement his project was resource management and allocation, but declined to mention specific resources.

The previous literature pointed to the emergence of project management in higher education or higher education personnel, with some studies indicating this action is useful to academia while opposition has been noted. Resource management and allocation continue to be a factor, so the theory of constraints - anything that limits a system's performance- is a practical solution to the project's problem. Also, the use of project management techniques is being incorporated to manage academia project activities. Project research is an integral part of some four-year academic institutions who have seen the benefits of utilizing project management techniques. Further investigation of project managers in a four-year research university at the data

collection phase of this study explored whether project management techniques have impacted the study's problem of qualified project personnel shortage.

Project Managers in Research Universities

Some research universities have observed an increase in project management activities that are being performed by professors (Shannon & Hartshorne, 2013). Their contributions differ from project managers in non-academic fields. Mangematin, O'Reilly, and Cunningham (2014) emphasized through training and experience these individuals are discipline grounded. They perform tasks as traditional project managers from defining a project to closing; however, they possess highly specialized skills such as statistics, coding and programming, and software development. Mangematin et al. (2014) further added that existing contributions by these project directors or project investigators had highlighted their role as project managers and their responsibility for the scientific or technical direction of a project. Project sponsors such as the National Science Foundation (NSF) and the National Institutes of Health (NIH) emphasized these professionals are responsible for managing and coordinating work across various research projects.

Shannon and Hartshorne (2013) observed the success of the utilization of project management techniques by professors who were at the time graduate students and had the opportunity of obtaining project management training. For example, Professor Derek described the experience of having mentors in his graduate program who gave him pointers regarding how to manage projects as he conducted his research. Shortly after Derek described his positive mentoring experiences, he also reflected on learning what to avoid as it relates to project management. Derek remarked how other faculty members had existed who mismanaged projects. The early experiences have shaped how graduate students, who are now professors, implement efficiency and effectiveness in project management techniques that involve situations, which cover qualified personnel shortage.

Projects Rooted in Scientific Research

Research projects are a core part of a four-year research university's mission where most of their faculty base possess a scientific or a technical background (Georgia Tech, 2017a). These projects vary in complexity and size and are awarded under various mechanisms such as a grant, cooperative agreement or a contract (NIH, 2017a). These instruments are a critical part of the governance of university research. Nadal-Burgues and Bonet (2016) discussed the emergence of scientific research projects that are conducted in research universities. They claimed after the Second World War, scientific research was organized into projects and were managed through the methods of project management, thereby suggesting scientific research now involved some methodical approach. Therefore, incorporating some form of project management technique is helpful to the individuals who spearhead these assignments.

Nadal-Burgues and Bonet (2016) also claimed the rules of project management conflicted with the ideas of scientific research since the undertakings of scientific research are known as a creative and an intensely personal activity which is strongly dependent on the ideas and imagination of individuals or groups of individuals. Project management, on the other hand, involved the division of the project into simple tasks. It also required the precise formulation of the project's goal, constraints (related to costs and time) and operations, but focusses on productivity, control, and accountability of precisely specified projects (Nadal-Burgues & Bonet, 2016). These scholars explained that tensions exist in the management of scientific research as it relates to project management guidelines. On the one hand, there is a connection to creativity and freedom of choice to foster discovery; and on the other hand, there is an idea of management as being grounded in rational control, planning, and the coordination of the production of scientific output. Rapoliene and Jakube (2015) added since monitoring agencies impose numerous, confusing, niggling, and illogical requirements, the burden of project administration seems

unbearable. They conclude the complex nature of scientific projects does not fit the mold of established project management principles. Consequentially, this struggle may serve as a base for exacerbating the qualified shortage of skilled personnel issue in a four-year university.

Serrant-Green (2008) acknowledged that conducting research is challenging for researchers as these individuals are negotiating their way through a project while maintaining a balance between planning, and the anticipation of outcomes, and proactively dealing with the unexpected events that inevitably occur. Serrant-Green (2008) observed researchers with research experience are aware that each project requires developing the capacity to address a different set of challenges in what appears to be an ever-changing landscape. However, due to the researcher's willingness to engage with the known and unknown, they are often rewarded with discoveries, different insights, and interesting experiences that in turn sometimes result in the most exciting aspects of the work. Serrant-Green (2008) believed the overall success of a project is therefore dependent on the ability of the researcher to coordinate and plan activities, combined with a mixture of luck, judgement and determination. It is also in part due to the many stages that are involved in the research process from the formulation of initial ideas, through ethical considerations, data collection, analysis and completion. Serrant-Green (2008) observed managing research is paramount if the planned objectives and requirements of the project are to be completed. It is the project manager's responsibility to manage their projects efficiently, whether working independently or with others, which gives them the ability to complete their work confidently and competently while remaining open to the surprises that occur in the process along the way. Nadal-Burgues and Bonet (2016) explained project managers in the scientific space require flexibility in their governance of project activities as their work involves creativity. However, these scholars admitted this conflicts with the principles of project management which require the project manager to adhere to constraints of costs, time and other specific variables outlined by the project stakeholders. Moreover, a more

pressing challenge as it relates to creativity is whether these project management constraints serve as an impediment to project personnel in a four-year research university, from allowing these needed qualified individuals to share their creative knowledge on the project. Should this be the case, then recruiting the appropriate individuals who are passionate about research projects in the university space may be problematic and may lead to the project activities being void of these knowledgeable individuals that are important to the success of the project.

Additionally, recent changes by the NIH will impact the scientific community's project activities. In a recent post, Laurer (2017), NIH Deputy Director of Extramural Researcher wrote:

> NIH is supporting programs as opposed to projects, supporting more staff scientists, raising post-doc salaries, training scientists for non-academic careers, and assuring more efficient funding of expensive core facilities. (para. 5)

Laurer's message suggested that research projects will experience a decline in resources, more so academia will be impacted by this change where qualified researchers who are the engine that contributes to project success will be impacted by these newly formulated NIH guidelines.

Research: Its importance in academia. Research is critical for individuals, communities, and societies since it aids in many discoveries. According to Nadim, Jan, and Amin (2013), academic research is one of the most significant facets of research activities conducted in a country. Research can be scientific or technical, but regardless of its form, some universities have these project activities embedded within the curricula. For example, academic staff, particularly individuals on tenure-track, usually perform project research. Brew and Lucas (2009) claimed research has increasingly been emphasized at most universities in the world, even at the ones who formerly followed a teaching orientation. Other studies (Chen, Gupta, & Hoshower, 2006; King, 2004) found research has become one of the vital functions of academic staff in the 21st century. The academic staff that is drawn to the research setting can be found in universities with a strong

research component. Maintaining this pipeline of researchers who are passionate about research can be accomplished through McClelland's needs theory – which seeks to satisfy employee needs for achievement, affiliation, and power. Since this qualified workforce is the impetus for project work in research universities, then needs base motivation can serve as a retention tool to the research environment.

Also, research universities are viewed as providers of long-term impact through research and subsequent knowledge transfer (Breznitz & Feldman, 2012). The U.S. is considered an important entity for research activities (Shin & Lee, 2015). Shin and Lee claimed within the U.S., universities conduct most research in a variety of fields in contrast to other independent organizations, such as companies with research and development units. This is significant, since research initiatives within universities are the basis from which many projects evolve, and results from the project output continue to attract external organizations for viable partnerships. These nonacademic entities recognize there are significant benefits from these relationships with research universities (Lee, 2000). Collaborating on projects can be beneficial to the needs of various constituents because of the knowledge and skills that derive from the project managers' workforce (Lee, 2000). These project activities are an integral part of the operation of many four-year research institutions, which result in scientific and technical breakthroughs.

Projects continue to evolve in four-year research universities where there is a need by a sponsor, usually a private or a federal agency, to solve a problem or design a product (Wu & Merriman, 2017). The sponsor will issue a call or request for proposal (RFP) that involves a list of criteria or guidelines, which the proposed project manager must follow (Wu & Merriman, 2017). The prospective project manager submits a proposal to the sponsor, which is usually a competitive peer review process (Wu & Merriman, 2017). Then, once awarded, the project manager enters into an agreement with the sponsor and commences the work (National Science Foundation [NSF],

2017a). Project sponsors such as the NSF require these projects have a broad impact on society (NSF, 2017a). These projects vary in size, scientific or technical focus, and sometimes are complex. Managing these projects is an integral part of the research university's day-to-day process, which means project managers are accountable to sponsors to meet the requirements outlined in the scope of work. However, there can be impediments to project success such as the lack of qualified personnel. Consequently, the project manager needs to formulate strategies to address this obstacle.

The literature revealed execution of research is done through project activities on various scales. Research faculty undertakes the project manager role with the help of qualified researchers aimed at steering the project to a successful conclusion. These research projects that are rooted in the scientific field requires qualified workers that can bring scientific and technical creativity to the project which the literature indicated is often against the methodological practices of project management. Maintaining qualified and suitable personnel sometimes calls for motivating these individuals with theoretical underpinnings such as McClelland's needs theory. Overall, one primary objective of managing scientific projects is to adequately staff with the appropriate expertise, as a lack of these individuals can disrupt project success.

Qualified Project Personnel and Their Importance

Qualified personnel employed on research projects are essential to the project within the university environment. These individuals are required to exercise competence due to the complex nature of these project activities. Their qualifications are critical to a project, and according to Hamilton (2016), qualified researchers can contribute effectively at numerous points along the path of a project. Hamiliton (2016) observed a new and emerging role for research-trained personnel, particularly individuals who have earned a doctorate and have traditionally found their way into academia or the science professions. Hamilton observed such individuals are now shifting their

focus, as other professions are beginning to recognize the value of research expertise in project activities. The consequence of this paradigm shift of these qualified individuals is resulting in a shortage in academia to facilitate project activities and thereby further limiting the success of academic projects. This challenge impacts the project's performance which essentially is a constraint. The TOC approach which points to anything that limits a system's performance can be considered while applying the TOC review process which involves identifying the constraints, improving the capacity of the constraint and restructuring the rest of the organization (project) around this problem is a viable solution. Hence, project managers would find it challenging to manage diminishing resource, and furthermore, academia would be less competitive in its research initiatives as a reason for this shift of resources. In addition to TOC, Path-Goal theory – which is used to identify, analyze, solve and effectively manage situational issues arising from either unfavorable external factor or follower characteristic - can serve as a means of mitigating the shift in qualified resources that are leaving academia for other industries. Since project managers are responsible for resolving project issues, then application of processes to address the qualified shortage challenge is necessary for remedying unfavorable people characteristics and project success.

Larsen (2010) believed when selecting people to serve on a project team; project managers should consider their strengths, skills, experience, and development potential. Most importantly, project managers should consider matching the project tasks with the skills and interests of each team member. As project managers consider the need for skilled project personnel, Walter and Zimmerman (2016) argued that in many types of projects such as information technology, and research—skilled personnel is the most important resource, and the demand for highly-skilled workers has risen. Therefore, it makes it a challenge to fill the positions of these workers on the

project team. Evidently, project managers in a four-year research university can also anticipate the previous challenge.

Impact of Qualified Personnel Shortage on the Project

As academia seeks to incorporate the discipline of project management, challenges such as qualified personnel shortage will impact the project's scope. Pasian, Sankaran, and Boydell (2012) claimed the variety of project types and project management environments have greatly expanded for some project-oriented businesses (e.g., manufacturing, health care, and construction). However, these researchers question whether the same can be said for organizations such as academic institutions that have increased their use of project management. Project managers in the academic setting require workers to possess highly specialized skills that are critical for research and meaningful for communities. De Silva, Darmicka, and Fernando (2014) further observed in a shortage of qualified staff can significantly influence elements such as project cost, schedule, quality, and overall progress.

Project cost. Jarkas, Radosavljevic, and Wuyi (2014), whose research studied the shortage of experienced and skilled personnel in project-oriented sectors, observed the lack of these individuals is detrimental to project costs. These researchers concluded unskilled personnel are commonly characterized by low and faulty outputs and are connected to unjustifiably high inputs. Their outputs are rejected, either in whole or in part by the inspection engineers; however, this results in extensive and expensive rectifications, repairs, or reworks. It is important to note this type of incident is likely to occur in other settings beyond project-oriented sectors (e.g., higher education).

Project schedule. Project schedule is the scheduling of the activities of a project so the total cost and the completion time of the project are balanced, while the precedence constraints between the activities are satisfied (Ji & Yao, 2017). Hartmann and Briskorn (2010) claimed the

presence of scarce resources makes project scheduling a difficult task. Chatzimichailidou, Katsavounis, Chatzopoulos, and Lukac (2013) commented projects contain many tasks, but the number depends on the areas of application and the size of the project executed. Conflicting schedules caused by shareable resources or constraints must be examined and resolved specifically for multi-project scheduling to be practical, realistic, and implementable. Since TOC - which is anything that limits a system's performance - facilitates the utilization of resource allocation and project scheduling to reduce project duration (Johnson et al., 2016). Then, this method can minimize scheduling problems of resource allocation by assessing the constraints and eliminating the project bottleneck.

Project quality. Kikwasi (2011) stated a project's success is more dependent on the people involved than on a piece of equipment, process, or patent. Some projects require skills ranging from specialized professionals to operatives; therefore, there has been a constant need to utilize current skills excessively so that quality is maintained throughout the project. Kikwasi (2011) claimed because of the rapid changes in technology, some sections of the workforce could not cope with these changes, and this has led to some of the works-in-progress and finished-works exhibiting poor quality. New technology requires consistent skill upgrade, and it is the skills of the project team that assure the quality of the project, which means a lack of qualified skills hinder project quality.

The literature revealed several essentials of how the project is impacted due to a qualified personnel shortage. These are critical elements (e.g., costs, schedule and quality), which needs to be carefully monitored to guard against project derailment since they closely intertwine with the human resource aspect of the project, and in this case, the proposed study's problem. Project managers need to consider implementing an appropriate framework such as TOC that can assist in properly monitoring these essential elements that are impacted by the lack of skilled resources.

Factors Influencing Qualified Personnel Shortage

Project managers in research universities who frequently engage in research work possess a background that is either scientific or technical. The activities performed by these individuals are supported through the provision of grants, contracts, or private partnerships. To accomplish the scope of work, many elements are considered, one of which is assigning the appropriate personnel to each project. Project activities require skilled graduate research students, scientists, or individuals who have the proper expertise to execute the project tasks, however accessing these highly skilled individuals may be difficult. According to Liu and Yokoyama (2015), staffing problems can become apparent at both the planning and execution phases of projects. This problem occurs specifically during the execution phase when individuals exit or are unexpectedly absent. Maenhout and Vanhoucke (2016) claimed the project-staffing problem is a personnel-scheduling problem that assumes a project schedule and requires exact mathematical programming techniques that have frequently been proposed to construct a personnel roster. Barreto, Barros, and Werner (2008) offered a different view to staffing problems in that employee selection is usually constrained by project and departmental needs, such as maximum monthly cost and estimated development time. Barreto et al. suggested staffing problems are prevalent across project activities, including those conducted in a four-year research university, which affect the project's successful completion.

Another factor that affects the shortage of qualified individuals to conduct research in university projects is the need for training. In this case, training serves as a precursor for quality output. It is important trained personnel are research-ready to perform these activities, specifically the faculty who in most cases assume the role of project manager. Some of the literature agrees that training is an essential element that guards against the problem of qualified personnel shortage (Hassab-Elnaby, Dobrzykowski, & Tran, 2012). Hassab-Elnaby et al. argued that faculty who are

not academically qualified within the university setting may be problematic. Such individuals are required to conduct research; therefore, faculty members who lack research skills will mainly focus on teaching and most likely will not be involved in research, leading to avoid in this area.

McDermid, Peters, and Jackson (2012) have cited other reasons for the shortage of qualified personnel, pointing to the roles and responsibilities required by the faculty in the academic environment. For example, a nurse academic faculty member, similar to academics from other disciplines such as computing or engineering, is required to conduct research and write successful research grants. These grant opportunities translate into projects that require extensive governance, one of which includes recruitment of personnel to conduct the project activities. McDermid et al. (2012) along with other authors (e.g., Danna et al., 2010; Penn et al., 2008) agreed some new faculty are unfamiliar with the nuances and mores of the academic culture, and this includes those entering research universities for the first time. Consequently, the demand placed on these highly skilled individuals reduces the number of qualified personnel entering the university setting. Moreover, this creates a shortage of research personnel needed to conduct the research work required by project grants. Utilization of the Path-Goal theory to the previous problem will provide these researchers who are new to the research landscape the ability to carve out a feasible trajectory in their research career and handle the load of adjusting to the fact project activities are central the research ecosystem. These individuals are the scientists, analysts, and programmers who make up the project team, are in short supply, and are attracted by other entities, which makes it difficult for project managers in a four-year research university.

Further research in this area has suggested the problem of the qualified personnel shortage in research universities is the result of the low percentage of qualified personnel remaining in research more generally. Ibraev et al. (2015) emphasized by the end of 2013, 673 researchers were awarded PhDs in science, whereas only 223 PhD holders or 33.1% decided to seek scientific

research-oriented careers, according to the Statistics Agency of the Republic of Kazakhstan. This is one example which indicated 66.9% of this total or two-thirds of PhD holders chose other fields of activity unrelated to scientific research in academia. Similarly, in the U.S., there are signs in areas such as biomedical research, where scientists are involved in project activities are seeking employment outside of academic institutions. According to Albertsa, Kirschner, Tilghman, and Varmusd (2014) "not surprisingly, extraordinarily well-trained and successful young scientists are opting out of academic science in greater and greater numbers; not because they find other opportunities so much more attractive, but because they are discouraged by their future life in academia" (p. 5774).

This population represents project managers who are essential to the management and administration of research projects within universities. Coates and Goedegebuure (2012) noted the problem of the shortage of qualified personnel in universities resulted in a growing number of senior faculty who retired fueling this current crisis. This has become a significant concern in research universities worldwide and in countries where the baby boomer generation is retiring, increasing the global competition for academic staff. Research projects will be impacted by this mass foreseeable shortage of qualified individuals.

Graduate research assistants also play a significant role in the project aspect of a four-year research university, meaning the student experience is one of the factors that are necessary for involvement in project progress. According to Zhang, Foskett, Wang, and Qu (2011), research-intensive universities are regarded as the principal touchstones of the higher education system in most countries, and yet they appear to be the most difficult institutions in which to generate enhanced student experience. Consequently, for this kind of university, the fundamental challenge in responding to lower levels of student satisfaction is to establish a balance between teaching and

research. Moreover, because these universities are involved in extensive research projects, it is a concern for project managers.

Barker and Ingram (2011) pointed to an important reason for the skilled worker shortage, which they refer to as *relative scarcity*. Relative scarcity refers to a situation where suitable skilled people exist but do not meet other employment criteria (e.g., they live in different geographical areas). Many researchers that meet the need to staff four-year research university projects in countries such as the U.S. live in countries such as India which produce high volumes of scientific and technical personnel.

Also, the skills that support projects in a four-year research university are from a diverse population. However, there is a concern that women have been underrepresented in academia, which further limits the population of qualified individuals for project employment. Scott-Metcalfe and Padilla González (2013) observed the underrepresentation of women in the academic profession continues to occur in North America even though women are increasingly earning doctoral degrees. Scott-Metcalfe and Padilla-González (2013) argued the proportion of women who have earned a PhD is a partial indicator of the expected proportion of women in the academic pipeline. However, it seems either some of these women do not perceive an academic career as attractive as other job options, which is a matter of personal choice (self-selection); or there are barriers or obstacles women face in entering and advancing within the academic profession, which may be related to social or cultural selection (Scott-Metcalfe & Padilla-González, 2013).

Project Managers' Reaction to the Shortage of Qualified Personnel

The growth of project management requires project managers to address various issues that emerge in the day-to-day operation of the project. Emerging issues such as skilled personnel shortage must be addressed so the project's trajectory stays on the path to success. Maintaining the path to success while controlling the shortage challenge requires a response from the project

manager. Project managers have resorted to external recruitment on a local, national or a global scale. For example, nationally, project managers have been encouraged to seek talents from among minority groups such as Hispanics, African Americans and other underrepresented groups that possess these highly-specialized skills (Toldson, 2013). This is a practice encouraged by U.S. federal agencies for most of its grant programs and strongly encouraged that individuals of underrepresented groups be employed on projects awarded to research universities (NSF, 2017a). Global recruitment is an alternate option used by project managers and their universities to fill these scientific and technical positions. Scott (2007) noted the H-1B visa system in the U.S. have been utilized by many in higher education to recruit highly skilled migrants. Their appointment in a four-year research university includes conducting project research.

In addition, Liu and Yokoyama (2015) believed project managers should understand the skills and experiences of each project individually and then create a mitigation plan in case the need arises to reallocate personnel to other project activities. These authors further believed although this idea might be helpful, skills and experiences can be difficult to evaluate. Moreover, project managers should collect relevant information about each worker by administering surveys during project startup. This information can be used to create a skills inventory matrix and resource calendar. Liu and Yokoyama (2015) admitted although some organizations have considered this practice, it is difficult to manage skills for various and advanced technologies.

Although the preceding information indicated that project managers are in short supply of the qualified resource pool and must be strategic about these limited resources, research has argued there is not a dearth as some have indicated. However, project managers have ample qualified resources at their disposal (Salzman, 2013). Salzman supports her point:

> For the 180,000 or so openings annually, U.S. colleges and universities supply 500,000 graduates. Accepting that STEM field definitions are overly restrictive and that in even

> marginally related occupations there could be a productive use of workers with STEM degrees, these numbers still represent a 50 to 70% greater supply than demand. Engineering has the highest rate at which graduates move into STEM occupations, but even here the supply is over 50% higher than the demand. IT, the industry most vocal about its inability to find enough workers, hires only two-thirds of each year's graduating class of bachelor's degree computer scientists. (p. 60)

Salzman has inferred that U.S. universities are supplying a high volume of qualified graduates, greater than the nation's job demand.

The TOC, which is anything that limits a system's performance, and the TOC review process, which involves identifying constraints, improving the capacity of the constraint, and restructuring the rest of the organization (project) around it, are useful for mitigating the skilled personnel shortage problem and assist the project manager with controlling this problem. One main feature of TOC is based on the premise that any manageable system is limited in achieving more of its goals by a very small number of constraints, and there is always at least one constraint (Tulasi & Rao, 2012). Hence, the TOC process seeks to identify the constraint and restructure the rest of the organization around it (Tulasi & Rao, 2012). The constraint identified in this study is the shortage of project personnel, and project managers who facilitate research projects in a four-year university have the responsibility of reorganizing the project activities around these scarce resources. Tulasi and Rao (2012) believed TOC is vital to the project process particularly in the case of protecting the critical chain of tasks which at times require splitting a worker's time between two or more priority projects to the detriment of the overall schedules.

Another reaction to the shortage challenge by the project manager can be met with the application of the RBV theory which focuses on managing limited resources to generate a competitive advantage; as these resources are tangible assets of the project and the organization.

Assessment of the project and deployment of these resources requires the project manager to be strategic in planning, and with much accuracy of resource utilization during the execution phase. Stakeholders rely on the project manager to deliver results that are valuable, and beneficial as the scarce human resources are critical and therefore determine the outcome of the project.

Strategies to Impact the Qualified Project Personnel Shortage

Resolving the shortage of qualified project personnel in a four-year research university demands multiple strategies. These plans will vary based on the capacity requirement of each project. However, the goal is to attract and retain these skilled individuals.

Developing a strong employer brand: Pinar, Trapp, Girard, and Boyt (2014) claimed firms and organizations in various industries have utilized branding strategies to build stronger brands. In this regard, higher education and universities are no exceptions. Branding differentiates the uniqueness of the organization (Pinar et al., 2014). The brand's power most of the time increase the association, so the stronger the brand, the greater the association (Iqbal, Rasli, & Hassan, 2012). An example is Georgia Tech as a major research university in the southeast has attracted many fortune 500 companies to operate within proximity of its campus. This creates opportunities for these entities to engage the university's pool of qualified researchers and students in project activities that are technologically in nature since the university is known for its cutting-edge technology programs, and project success (e.g., the NASA Rover project; Georgia Tech, 2017b). Therefore, presidents, provosts, and chairs working with project managers should engage in building a brand that attracts qualified researchers and eventually will lead to retaining these individuals. Once qualified researchers are onboard to staff project activities, retaining them can be accomplished through several motivational practices.

Motivation of project workers. Braun, Michel, and Martz (2012) believed the objective of any project manager should be to create an environment that provides personal incentives and

motivation for individuals to cooperate and collaborate with their team members. Patanakul, Pinto, and Pinto (2016) posited some project personnel are routinely assigned to work on multiple, simultaneous projects. This arrangement is typically a result of resource limitation at the project team level. These researchers further claimed this environment could lead to low morale, a decrease in the level of motivation of project personnel, and over time lead to workplace burnout. Moreover, this issue becomes the responsibility of the project manager to implement plans to motivate team members. The needs of team individuals vary, however, McClelland's Theory of Needs points to three areas of motivation project managers might consider when motivating team members.

McClelland's Theory of Needs. McClelland's theory consists of three motivations: the need for achievement, need for affiliation and need for power (McClelland, 1985). Liu and Wohlsdorf Arendt (2016) described the various needs:

> The need for achievement means the drive to excel, to achieve in relation to a set of standards, to strive to succeed. The need for affiliation refers to the desire for friendly and close interpersonal relationships. The need for power denotes the need to make others behave in a way that they would not have behaved otherwise. (p. 3)

Peterson (2007) claimed an individual who is motivated by achievement is self-driven so he or she can perform and function well both alone and within a team. He or she can identify a clear objective and develop a "line of sight" to get there. Project managers need to provide an environment that will give team members the ability to be creative, opportunities that will expand beyond their current position or role, and tasks that are challenging (Peterson, 2007). Peterson claimed individuals who are motivated by affiliation are drawn toward a friendly work atmosphere and will strive for team unity, team success, and commonality of team norms. Motivation through affiliation will steer an individual to assist others while promoting a collective team effort. An

individual who is motivated by affiliation will naturally identify his or her role as a fellow team member willing to assist and support project efforts or decisions. Individuals who are motivated by power are drawn toward the ability to offer input and access into a variety of situations from risk review and competition to a general need for appreciation or personal acknowledgment (Peterson, 2007). Individuals drawn toward power can be given ownership of broad tasks to drive toward collective team agreements, overcome inherent risks, and adhere to specific project objectives.

Motivating project workers can be a recruitment and retention strategy for these qualified individuals with various needs. Each project manager may use different motivational tactics to attain dedication and commitment from project workers. This decision depends on what the project manager wants to achieve as it pertains to the project, which should always point to the successful completion of the project. However, the subject of motivation may take various forms.

Other sources of motivation.

Compensation. Lianying and Fe (2014) believed motivating project individuals might commence with compensation that might persuade these highly skilled individuals to commit to the project activities. These writers claimed that in the field to project management, compensation is directly tied to project success, and thus participants must cooperate to maximize individual and project returns. Lianying and Fei (2014) further believed any risk and reward of compensation in project management needs to satisfy all those involved, and should consider the respective contributions of the participants to the project. Moreover, offering compensation as a motivational tool has been used to influence the project team. For example, one university's practice is to provide a compensation match for research projects based on the project manager's ability to successfully commercialize their product (Derrick & Bryant, 2013).

Autonomy. Patanakul et al. (2016) believed there are additional motivational factors besides compensation, such as autonomy which can drive individuals to commit to the project goals. Jones and George (2013) claimed autonomy typically refers to the degree to which a job provides employees with the freedom and discretion needed to schedule their work and determine how it is to be conducted. Gibson, Ivancevich, Donnelly, and Konopaske (2012) posited autonomy can also refer to the right to make a decision. Braun et al. (2012) provided a unique perspective on the concept of autonomy which is strongly linked to the project manager; where an autonomy-supportive project manager might, provide team members with the necessary information and insights while encouraging them to use this information in solving problems or to achieve an objective in their self-directed way. Mak and Sockel (2001) summarized the discussion that in the project management literature, autonomy is considered as an important source of motivation. Therefore, its importance should drive managers to utilize this technique as it can lead to innovation and creativity by project workers who are domicile within a four-year research university who are experiencing qualified personnel shortage.

Project Goals. Patanakul et al. (2016) believed it is crucial for project managers to be clear about conveying project goals to personnel and the degree to which work-related objectives are defined, understood, and mutually agreed-upon by individuals of a workgroup. Since this has long been recognized as a critical antecedent of worker motivation, and goals play a critical role in stimulating the outcomes of a project (Lind, 2015). According to Hong, Nahm, and Doll (2004) having clarity of tasks, goals, and expected outcomes are all shown to significantly impact project success. Moreover, Gällstedt (2003) claimed researchers have found that clear project goals as well as clear understanding of what needs to be accomplished is a source of motivation for project personnel.

Path-Goal Theory. Clarity in project goals is meaningful for both the worker and project success; hence, workers desire leaders to help them progress in attaining their goals, which is a principle of the Path-Goal theory. This theory states the primary goal of leaders is to help subordinates attain their goal effectively by providing necessary support to achieve their own goals (Ag Budin & Wafa, 2015). Leaders should provide direction, support and clarify the path for followers while increasing rewards and removing goal obstacles through adapting their leadership style (as cited in Ag Budin & Wafa, 2015). This may involve engaging project workers. It is a leadership tool which is used to identify, analyze, solve and effectively manage situational issues arising from either unfavorable external factors or follower characteristics (Zabihi & Hashemzehi, 2012).

According to this theory, a leader's behavior is acceptable to subordinates as long as they view it as a source of immediate or future satisfaction. House believed leaders are responsible for assisting their followers in attaining their goals (as cited in Ag Budin & Wafa, 2015). Al Mehrzi and Singh (2016) posited employee engagement is critical for and is an essential element in the success of organizations. Therefore, leaders should strive to make work meaningful, such as ascertaining and endeavoring to resolve any difficulties that employees face. Likewise, project managers must be committed to ensuring that project workers succeed, as this aligns with the project success.

Opportunities for learning. In organizational settings, learning at the individual level is not only crucial to the growth of the employee, but it is also significant for enhancing organizational learning and the development of dynamic capabilities (Antonacopoulou, 2006). Two forms of leaning are experience accumulation - learning by doing and knowledge articulation – learning by reflecting, thinking, discussing and confronting. In respect to project learning both learning mechanisms can occur at the individual level (Zollo & Winter, 2002). The opportunity to

learn and develop new skills is found to be a source of motivation for personnel (Patanakul et al., 2016). McClelland's theory of needs concerning achievement and affiliation points to the relevancy of these motivational approaches toward employees providing them with opportunities to excel while providing a favourable environment for learning can consequentially leading the growth (Liu & Wohlsdorf Arendt, 2016). Additionally, Adams, Cain, Giraud, and Stedman (2012) acknowledged that in higher education teambuilding efforts in cross-disciplinary research become more critical, so does the need to access the leadership behaviors of principal investigators (PIs). The qualities and perceptions that research PIs have regarding leadership, teamwork, and motivation may give insight into how research teams function. Adams et al. (2012) suggested leadership needs to continually encourage research teams and are responsible for removing barriers. This gives the implication that motivation is a vital component to project teams. Therefore, having leadership in higher education and specifically project managers in a four-year research university who need to understand the crucial importance of motivation of qualified project personnel in the context of scarce resources.

This portion of the literature covered several subtopics as it relates to the study's problem. A variety of reasons for the problem stems from project staffing, training, and new research faculty who are not aware or the demands of balancing project management with other academic duties. There is also the issue of a decrease in PhD holders seeking employment outside of academia. Also examined was the project manager's reaction to the project shortage which is resulting in global recruitment in some cases for these skilled personnel, and devising plans for allocating human resources in critical moments of the project. The TOC was incorporated as a solution to this problem. Further examination dealt with plans to impact the problem, such as attracting the right people and then motivating these individuals appropriately. McClelland's theory was

incorporated as a framework for motivating these needed resources to staff the project in order to secure successful completion.

Research Collaboration and the Issue of Qualified Personnel Shortage in Research Universities

Collaborations allow access to a broader range of knowledge for conducting frontier research, and research team members have to work together under explicitly stated common goals and objectives (Chan, 2015). Toma, Toma, and Zait (2013) observed research universities as organizations with a unique role in the development of knowledge-based societies, but also indicated the essential role of these entities is to shape highly qualified human resources, an important asset of a nation. Within the framework of these organizations, collaboration is a central component for enabling productive research outputs (Stanley & Anderson, 2015). This type of relationship is prevalent in a four-year research university. Nadim et al. (2013) posited the collaborative element has different entities working together and is critical for these organizations. Nadim et al. claimed coordination between universities, researchers, and sometimes industries will lead to maximum output from different faculties resulting in the creation of new knowledge, which academics pass to others through publishing their findings for the economic and social welfare of society.

Further research in this area has demonstrated the impact of collaboration between research universities and non-academic entities. For example, in 2014, Drexel and George Mason Universities collaborated with the Cyber Security Research Alliance (CSRA) on several projects. These universities were CSRA's first academic research collaborators aiming to advance cyber-physical system security in transportation vehicles, medical devices, and power grids (Defense & Aerospace Week, 2014). Equally important, the collaboration between these academic organizations and a non-academic entity was rooted in project management. This collaboration

was significant since it was a unique endeavor that involved two research universities and an industry company who were addressing critical research needs in the form of projects. These projects revealed the importance of an industry-university partnership to boost innovation which required qualified personnel from the universities network. Furthermore, a shortage of this type of resource within the universities would have made this collaboration improbable.

Bei and Dongsheng (2014) examined factors associated with project supportability of scientific research in universities. These factors are essential to the project's success with the evaluation of the quality of the project individuals being foremost because the quality of talents affects the project's success. For instance, in Romania, some research university projects are exploratory, so they require highly qualified personnel for the development of the scientific content (Toma et al., 2013). Furthermore, meeting the demands of the research project means the project manager must acquire skilled and capable researchers, which is not always easy.

Recent research surrounding university projects and qualified personnel shortage have provided unique insight into the problem. Koehn (2014) examined the distribution of research projects in relation to the universities' specific location and observed the shortage of qualified research personnel. This difficulty impeded the research in locales where the project was conducted specifically in satellite location. Some universities have devised ways to address the shortage of qualified personnel with the goal of meeting the long-term needs of their research ecosystem. Oishi (2013) cited China as another country that has shown signs of experiencing a shortage of highly skilled professionals in its engineering and technology fields. Subsequently, China formulated a plan and established 100 joint research project teams between Chinese and foreign researchers by inviting over 1,000 researchers from the world's top 100 universities and research institutes (Oishi, 2013). This action aims to assist in meeting future shortages of project

personnel in the research environment specifically for projects linked to engineering and technology.

Importance of Project Teams to Collaborative Research Projects

Stanley and Anderson (2015) claimed collaborative research has become one of the primary objectives of most higher education institutions and running effective research teams is central to achieving this aim. Endacott and Whitehead (2013) described the members of a research team that are involved in this collaboration as ranging in size from several chief researchers, associate researchers, and research students to research assistants. Hickson (2008) indicated the team might also include the funder, sponsor and the organization in which the research is taking place and could be expanded to encompass teams made up of interdisciplinary and multidisciplinary professionals. Lippe and vom Brocke (2016) agreed the research team should comprise of members from different disciplines that might be in different locations with various philosophical roots and diverse views about how the team should be led, managed, or structured. Endacott and Whitehead (2013) suggested the number of members and composition of the collaborative research team depends on the study's scope, methods, and design. These writers believed team members ideally bring a set of collective skills that also complement the study's scope, methods, and design, and the greater the collective experience of the team, the more likely the project is to succeed. Endacott and Whitehead's assessment of the importance of the need for skill diversity among the project team was supported by Andrew and Halcomb (2009). Andrew and Halcomb observed very few researchers are skilled in conducting multiple functions on research projects; for example, conducting qualitative and quantitative methodologies. Moreover, project team collaboration is essential for research approaches that require the use of mixed methods.

A recent study conducted by Brocke and Lippe (2015) examined collaborative research where partners shared a common research interest and provided complementary information, often

inter-disciplinary resources and competencies to fulfill the project goals. Huutoniemi, Klein, Bruun, and Hukkinen (2010) described the core thrust of collaborative research projects which is a temporary, limited, project-based organization based on the paradigms of cross-disciplinary, joint research and those of a single-project environment. Brocke and Lippe (2015) and other researchers admitted collaborative research projects face many challenges relating to successful project management (Calamel, Defélix, Picq, & Retour, 2012; König, Diehl, Tscherning, & Helming, 2013). These writers claimed collaborative research projects are generally associated with high uncertainty and risks as they are comprised of individually oriented project personnel and heterogeneous project partners that are located at different locations, with significant pressure regarding creativity and innovativeness. Still others (Lenfle, 2008; Shore & Cross, 2005) asserted that special project management attention demands adaptations and adjustments to suit the projects' needs and particularities which are critical for the success of collaborative research projects. However, Calamel et al. (2012) and König et al. (2013) claimed relevant knowledge gained in scientific project management literature is fragmented and spread across a variety of disciplines and application areas, which presents a hurdle for its successful application in practice. Applied management methods often fail to satisfy the specific needs of collaborative research projects, and managers follow the “learning by doing” principle and establish a working set of project management principles and tools for each project.

Also, Brocke and Lippe (2013) believed that within the scientific community the nature of collaborative research contributes to project-based research becoming a major form of organizing innovation activity. This development results in increasing attention in project management research. The specific characteristics and challenges of this type of project complicate the application of many existing approaches, so the ability to innovate in project management has become a significant factor of success (Lenfle, 2008). König et al. (2013) believed for a project-

specific management approach to be developed, the needs and requirements of the project type must be well-understood, so most current contributions aim at making the everyday settings and processes of such collaborative research projects explicit and plausible. For example, the tasks, roles, and responsibilities in inter-disciplinary research management. Brocke and Lippe (2013) claimed research projects must be managed without defeating creativity and researchers' motivations by facilitating spontaneity and supporting the desire for change and rule-breaking as regarded as flexibility. However, at the same time, research by Tatikonda and Rosenthal (2000) has also shown these projects benefit from firmness in project execution; suggesting that formality and flexibility are distinct constructs in the approach to project management and should be simultaneously applied for optimal project performance (Brattström, Löfsten, & Richtnér, 2012; Naveh, 2007). Ideally, project managers should understand which tasks are creative or less creative and the characteristics of such tasks and adapt their project management style accordingly.

Collaborative research in project teams has been encouraged by large sponsors. This has been emphasized in the program announcement that requests prospective projects from research universities and other entities (NSF, 2017a). These sponsors believed that synergy of heterogeneous project teams produces broader results the homogeneous teams. This points to an important issue since the homogeneity of the team members fails to bring a variety of skills to the project. Therefore, it may be difficult to obtain the diverse skill-set to the collaborative project research. Some project managers have commented that it is not easy to obtain specific skills when they are needed for a large collaborative project. The downside to this concern is that a partial amount of qualified project individuals do not benefit the project if the full range of qualified individuals are not available to perform the project objectives that will lead to a successful outcome.

Graduate Students: A Key Constituent of Project Research

Graduate students are a valuable resource to research projects. For example, MacPhee (2015) commented as a graduate student her involvement in a pilot research project was rich and rewarding and she further encouraged other graduate-level students to engage in these activities. The shared experience of MacPhee is proof this level of students can benefit from research done through project activities. However, recruiting these individuals to project-based activities can be challenging since they are attracted to corporate or industry enterprises during their time as graduate students. Many seek internships during the summer semester which further lead to non-academic partnerships. Weert (2011) asserted the doctoral degree candidate is mainly destined for careers in academic and other publicly-funded research institutions. However, these individuals have increasingly looked to the private sector to widen their employment prospects. Pedersen (2016) claimed most PhDs are trained within the academic tradition; therefore, the question is whether there is sufficient encouragement for choosing a career in the private sector as opposed to academia. Pedersen (2016) further claimed a key incentive why prospective PhDs are choosing private sector jobs over academia is based on financial rewards. The opportunities and alternatives available to graduate-level individuals present challenges and further limit the pool of research professionals available for project-based research in four-year universities.

Gemme and Gingras (2012) posited attitudes toward working in industry are shaped by experiences during doctoral studies, and students whose research is associated with non-academic objectives and who collaborate with industry during their studies are also more interested in careers outside academia. Gemme and Gingras (2012) further posited some grants obtained by well-established universities involve collaboration with one or many non-university organization. These partnership exposes graduate-students to a different relationship. Slaughter, Campbell, Holleman, and Morgan (2002) commented graduate students are often the gifts professors exchange with

industry to strengthen new alliances and they are valuable because of their research ability in techno-science fields. Since there is a pull on graduate students to seek non-academic opportunities, then project managers must devise ways in which to foster a passion in graduate students to see academia as a viable option. They are assets for project activities while pursuing graduate studies and beyond. Ultimately, the reliance of project managers in a four-year university on this group of individuals require that a research university ensure there is a pipeline of this academic level type resource, as a shortage can impact partnerships and project success.

Conclusion

The shortage of qualified project personnel is a problem for project managers who have the responsibility of managing and allocating resources to complete the project successfully. This problem prevalent in other industries has emerged within the environment of academia presenting many challenges. Some challenges range from project quality to the assignment of complex tasks to the scarce highly skilled personnel that in some cases provide critical benefits to society, such as the development of a drug. Devising plans to address this problem is a critical aim of the project manager. This may be through collaborative efforts, global recruitment, or working with academic leadership to ensure these qualified personnel used to staff the project are available, such as researchers with specialized knowledge, scientists, statisticians, programmers, software specialists, and graduate students. Also, addressing this problem of scarce resources require approaches such as McClelland's theory, path-goal theory, theory of constraints, and resources-base view theory.

Alternate plans include motivating current project workers to build a strong brand that attracts these competent individuals to the organization. As project managers in academia experience a decline in the volume of skilled personnel, they realize a resolution to this problem calls for immediate attention. Since the results of these project activities in academia impacts

many stakeholders, addressing the challenges within the context of the project framework is critical to the project manager and the project's success.

Transition and Summary

Section 2 provided information specific to the research design that was employed in this study. A qualitative single-site case study was conducted with personalized interviews with project managers from one four-year research university who lead qualified project personnel. The chapter addressed the population, sampling procedures, data collection instruments, and data collection measures. Also discussed were plans on how to adhere to the validity and reliability of the results of the research that derived from the study's questions.

The shortage of qualified project personnel in a four-year research university is an important study in the field of project management. The scholarly information addressed critical topics related to the study's problems in headings such as: (a) defining a project and project management, (b) project management in higher education, (c) qualified project personnel and their importance, and (d) research collaboration and the issue of qualified personnel shortage in research universities. The literature examined showed this topic is at a nascent stage in academia as it relates to the project management field (Austin et al., 2013). The literature showed a crucial gap. Although the shortage of project workers has studied is other industries, it has not been studied in academia. Also, this study intended to contribute to the body of project management literature as it relates to higher education.

Section 2: The Project

In this section, the focus of this applied doctoral research project was on the research methodology, a reiteration of the purpose statement, and discussion of the qualitative research process. Information about the researcher's role in the study was also discussed. The following methodological topics were addressed: participants, research methods and design, population and sampling, data collection, data analysis, reliability, and validity.

Purpose Statement

The purpose of this qualitative single-site case study was to explore the reasons why project managers in a four-year research university in the Southeastern United States are experiencing a shortage of qualified project personnel. Therefore, in this study, the researcher intended to understand project managers' perceptions of the specific business problem and the actions that could be taken by project managers to address the problem.

Role of the Researcher

Stake (2010) posited the qualitative researcher is the primary instrument for data collection and analysis. This means data are mediated through humans, rather than through inventories, questionnaires, or machine. The researcher sought permission for this study through Liberty University's institutional review board (IRB) by submitting all required documents. The researcher also sought approval from the institution where the study was conducted to gain access to the study's population. Contact was made with the qualifying participants through department managers, then interviews were scheduled and conducted using open-ended questions which encouraged participants to provide in-depth answers. These interviews were audio-recorded, then transcribed verbatim while maintaining accuracy and completeness and adherence to the IRB guidelines. The researcher coded the data with the objective of comprehending the entire narrative for analysis. The results of these analysis were verified, and the findings were reported which

informed the work that was being researched. Also, this site was chosen due to accessibility to the study population with specific project manager expertise and since it possessed the context needed to explore the research questions. Additionally, the researcher is currently employed at the university as a financial manager, while supporting the work of project managers from several disciplines on this campus. However, she does not report to any of the participants who were enrolled in this study.

Participants

This qualitative single-site case study included interviews with project managers who possessed a technical or a scientific background from one four-year research university. The researcher worked with managers in the qualifying schools and units and obtained access to their school's mailing lists which enabled contact to these participants from the university. The sample was obtained from the academic institution. These participants were purposely selected from the college of computing and two applied research divisions, as they met the criteria to answer the study's questions. An email invite (Appendix A) was sent to the participants describing the study's requirements; all participants were voluntary, and each received informed consent forms (Appendix B), in line with APA's ethical standards (www.apa.org/ethics/code/index.aspx). Participants who agreed to be included in the study were contacted by the researcher who scheduled interviews which were performed in-person or via telephone. These interviews were performed in private locations and were digitally recorded, with the participants permission, then transcribed and coded (see Table 1) without the participant names, to ensure anonymity and confidentiality.

Table 1

University and Participants Code

University	Participants							
University	A1	B1	C1	D1	E1	F1	G1	H1

Research Method and Design

In determining a research methodology, Creswell (2003) posited that preliminary steps to designing research require assessment of the knowledge claims brought to the study, consideration of the strategy of inquiry that will be used, and identification of the specific method. Creswell further posited in using these three elements a researcher can identify the quantitative, qualitative or mixed method approach to inquiry. To address the research questions of this study, the qualitative method and a case study design were utilized. The various research methods are described below with the rationale for conducting a qualitative study, and the case study as the research design is also provided in this section.

Method

Creswell (2013b) explained three methods of research inquiry which are quantitative, qualitative, and mixed methods.

Quantitative. This is an inquiry into a social or human problem. It is applied during the testing of objective theories by examining the relationship between variables. These variables, in turn, can be measured, typically on instruments, such as questionnaires and tests, so that numbered data can be analyzed using statistical procedures (Creswell, 2013a).

Mixed Methods. This approach involves collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. The core assumption of this form of inquiry is the

combination of quantitative and qualitative approaches provides a more complete understanding of a research problem than either alone (Creswell, 2013b).

Qualitative. This type of research method is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. Creswell (2013a) claimed this research process involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes, with the researcher making interpretations of the meaning of the data.

This study utilized the qualitative methodology, and the following content justifies its appropriation. Stake (2010) believed qualitative study is personalistic, meaning, it is working to understand individual perceptions. It further seeks people's point of view, frames of reference and value commitments. This study intended to understand a project manager's perception and point of view of the problem and what actions can lead to a solution. Snyder (2012) posited qualitative research is based on the view that reality is constructed by individuals interacting with their social worlds. Snyder further posited that qualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world. The researcher of this study intends to explore project managers' experiences in the academic environment in order to better understand their views of the problem they are facing. Instead of designing an experiment that involves manipulation of the variables, qualitative researchers use case studies to study the participants by collecting detail information, using a variety of data collection procedures (Creswell, 2013a). Whereas quantitative research seeks to validate a theory by conducting an experiment and analyzing the results numerically, qualitative research seeks to arrive at a theory that explains the behavior observed. Therefore, it can be perceived that quantitative research is more deductive and qualitative research is more inductive (Rudnick, 2014; McCusker & Gunaydin, 2015). While quantitative research provides a

broad view of a phenomenon that is often generalizable to the population, qualitative research seeks to explain a current situation and only describes that situation for that group (Zikmund, 2001). Qualitative research typically involves empirical study of human beings' experiences and behaviors, as well as related matters that do not involve or reduce to quantified, numerical measure, which are characteristics of quantitative research (Rudnick, 2014). Similarly, George, Kruger, and Tennant (2012) claimed qualitative research does not seek to provide quantified answers to research questions and tends to be a more naturalistic type of research. It can be used to interpret, explore, or obtain a deeper understanding of certain aspects of human beliefs, attitudes, or behavior such as people's personal experiences and perspectives; unlike quantitative research methods that provide quantified information and answers to research problems and are associated with positivistic experimental research. They can be used to establish a cause-effect relationship (George et al., 2012)

In summary, electing to apply the qualitative research method explored the problem that is been experienced by project managers in one four-year research universities and how these participants perceive this challenge in their environment, and what are viable ways to address this issue. Ascertaining these answers would not be obtained through random sampling or statistical techniques which are associated with quantitative designs but through the explanation of the individual's perception of his environment (Creswell, 2003). The qualitative method used included interviews for its research design, while the data's results considered trends, patterns, and themes raised by the participants of the effects of the problem.

Research Design

Several designs fall under the umbrella of the qualitative method, such as ethnography, grounded theory, phenomenological and case studies. The study utilized a case study design. The rational to support usage is provided in this section along with an examination of other designs.

Ethnography. This design of inquiry is rooted in the fields of anthropology and sociology in which the researcher studies the shared patterns of behaviors, language, and actions of an intact cultural group in a natural setting over a prolonged period by collecting, primarily observational data (Creswell, 2003). An ethnographic design was inappropriate for this study, as a salient aspect of the ethnographer is to participate in people's daily lives and study them in an everyday context. Hence, participant observation and relatively informal conversations are usually the main sources of data collection (Sarma, 2012). Creswell (2013a) posited collecting the data will require the researcher observe participant's behaviors during their engagement activities.

This can be a complex process, particularly for large groups (Sarma, 2012). Contrastingly, with the case study, development of detailed, intensive knowledge about a single case, or of a small number of related cases is done at one define point in time (Sarma, 2012). This study applied such technique. Obtaining the data for this study was done through interviews, which is an efficient manner of gathering data for this exploratory study, a feature of case studies (Sarma, 2012). Although the ethnographic design shares similar data gathering techniques as the case study, such as interviews, the design requires interpretation of the group organization or the community's experience in their own world, which makes it unsuitable for this study. This study aimed to explore project manager's perception of the problem of qualified personnel shortage which was best achieved through the case study.

Grounded Theory. In grounded theory, the researcher attempts to derive a general, abstract theory of a process, action or interaction grounded in the views of participants in the study. This process involves using multiples stages of data collection and the refinement and interrelationship of categories of information. This design is rooted in the field of sociology (Creswell, 2003). One of the techniques of the grounded theory approach requires simultaneous and systematic data collection and analysis, while in a case study the data are collected and then

analyzed. The case study's data collection technique is a simpler process for the researcher that can lead to much quicker findings of the study's results, which qualifies its appropriateness. Also, a critical tenet of grounded theory is about theory generation – an explanation for what is happening (Harris, 2015). Harris further explained that in grounded theory, concepts and theory emerge through a process of continually comparing the data, generating questions to explain behavior and testing these with further data collection. This design is in contrast to a case study design that focuses on theory inquiry, which assists in solving the problem, which is a key objective of this study. Exploring project manager's perception relative to the business problem, the researcher believes that this is best achieved through the examination of theories, such as Path-Goal and McClelland's, instead of creating one. Hence, a grounded theory was not considered as the design of choice for this study.

Phenomenological research. This design of inquiry is rooted in the field of philosophy and psychology in which the researcher describes the lived experiences of individuals about a phenomenon as described by participants. This description culminates in the essence of the experiences of several individuals who have all experienced the phenomenon (Creswell, 2003). According to Matua and Van (2015), phenomenological research design comprises of two sub-approaches – descriptive phenomenology: which attempts to discover what it is like to undergo a particular experience. This requires the researcher focus on describing as faithfully as possible the first-hand experience being investigated so that others can see and feel it, without mentioning any of the participant's social, cultural, or political contexts. The second sub approach is interpretive phenomenology: achieving a deeper understanding of the experience, concentrating on unveiling the otherwise hidden meanings in the accounts of the experience and taking into account the various contexts of the participants. Miner-Romanoff (2012) claimed phenomenological data analysis is a complex and unique method of inquiry. It involves cyclical analysis, in which,

through repetition and recurring analysis, the researcher inquires, listens, searches, compares, verifies, composites, confirms and evaluates in endless cycles to ensure fundamentals of knowledge. Although these may be valid reasons for utilization of a phenomenological design for this study, the researcher believes there can be difficulty in describing and interpreting the participants' behavior. This can result in a human error in the area of data collection and can significantly distort or impact the study findings. Therefore, the researcher rejects this as a design of choice.

Case studies. In a case study the researcher develops an in-depth analysis of a case, often a program, event, activity, process of one, or more individuals. Cases are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period. Also, they are used to gain in-depth understanding replete with meaning for the subject. The focus is on the depth of an individual case, not a whole population (Kisely & Kendall, 2011).

Utilization of the case study as the design of choice permitted the researcher to conduct an exploratory approach of the problem to gain an in-depth understanding of this situation (Taylor & Thomas-Gregory, 2015). Case studies can explore, describe, and/or explain the case of interest, and enable in-depth, meaningful and context-constituted knowledge and understanding about real-life events (as cited in Taylor & Thomas-Gregory, 2015). Baxter and Jack (2008) claimed there are two key approaches that guide a case study methodology. One proposed by Stake (1995) and the other by Yin (2003), where each seek to ensure the topic of interest is well explored and the essence of the phenomenon is revealed, but the method they each employ are entirely different. Baxter and Jack (2008) explained both Stake and Yin base their approach to a case study on a constructivist paradigm. Constructivists claim that truth is relative and it is dependent on one's perspective. This paradigm recognizes the importance of the subjective human creation of

meaning but does not reject outright some notion of objectivity. Constructivism is built upon the premise of a social construction of reality (as cited in Baxter & Jack, 2008). One of the considerations purported by Yin (2003) for the use of a case study design is when the focus of the study is to answer "how" and "why" questions, as in the case of this study - Why are four-year research university project managers experiencing a shortage of qualified project personnel? Based on the previous scholar's explanation of the legitimacy of the use of the case study in exploring specific knowledge, then, the study's questions relative to project managers' perception can be best examined through the case study.

Another important aspect as to the use of the case study research is the way in which rigor is assured (Taylor & Thomas-Gregory, 2015). Taylor and Thomas-Gregory claimed rigor refers to the way in which the researcher demonstrates the study is high quality, and provided several ways in which rigor can be demonstrated (e.g., rigor can be demonstrated through accuracy check that allows the researcher to return to the participants to verify information, such as the accuracy of transcripts from interviews). Also, participants have the option to listen to their answers, which can verify the accuracy of the content. Another way of verifying rigor is through the allowance of an audit trail of documentation (e.g., transcripts of interviews the researcher will be using as part of the analytical process; Taylor & Thomas-Gregory, 2015). These approaches to rigor allowed the researcher to demonstrate the research is credible, and the user can have confidence in the quality of the research and its findings. Case study research is not generalizable, and Merriam (1998) considered the case study can be defined by its unique features, which are not mutually exclusive, and which include particularistic and descriptive features. The particularistic feature, which focuses on the uniqueness of the case, may focus on a specific event or situation.

Population and Sampling

Population

Asiamah, Mensah, and Oteng-Abayie (2017) referred to the population as the group of individuals having one or more characteristics of interest. In this study, the population was project managers, with a technical or scientific background from all races, ages 18-65 years, and from one four-year research university. The study sample was recruited from this population.

Sampling Method

According to Gentles, Charles, Ploeg, and McKibbon (2015) sampling is defined as the act, process, or technique of selecting a representative part of a population to determine parameters or characteristics of the whole population. The **s**ampling technique for this study was purposeful sampling. Palinkas et al. (2015) posited purposeful sampling is a technique widely used in qualitative research for the identification and selection of information-rich cases for the most effective use of limited resources. This involves identifying and selecting individuals or groups of individuals who are exceptionally knowledgeable about or experienced with a phenomenon of interest. The researcher plans to learn a great deal about issues of central importance to the purpose of the inquiry (Gentles et al., 2015). A purposeful sample comprising of 8 project managers was used. Other sampling techniques which are not suitable for this study such as homogeneity, snowball, convenience and typical case which are defined below by Palinkas et al. (2015).

Homogeneity. To describe a particular subgroup in depth, to reduce variation, simplify analysis and facilitate group interviewing. Contrastingly, personalize interviews were conducted to gain understanding of the problem from individuals, hence this technique was not considered.

Snowball. To identify cases of interest from sampling people who know people that have similar characteristics who know people, also with similar characteristics. Accessibility to the population was not difficult. Therefore this technique was not utilized.

Convenience. To collect information from participants easily accessible to the researcher. This is usually used in quantitative research and was excluded as this was a qualitative study.

Typical case. To illustrate or highlight what is typical, normal or average. The study aims to explore project managers' perception of a problem; hence, this technique was not considered.

Of the stated sampling techniques examined, homogeneous sampling was considered as a possible choice. However, homogeneous sampling is best considered for group interviews, so it was ruled out as a possible choice. Participants in this study were engaged in personalized interviews for reasons of confidentiality, anonymity, and without regard of trepidation of other participants. This enabled in-depth answers that provided rich content of information for analysis.

Sample Size

Marshall, Cardon, Poddar, and Fontenot (2013) claimed in addition to selecting a research topic and an appropriate research design, no other research task is more fundamental to creating credible research than obtaining an adequate sample. They further claimed ensuring there is enough data is a precursor to credible analysis and reporting. While Kemparaj and Chavan (2013) concluded there are no established rules for sample size, they claimed in qualitative research the sample size is usually determined based on informational needs. Hence, a guiding principle in sampling is data saturation, which is sampling to a point at which no new information is obtained and redundancy is achieved. In this case study, a purposeful random sample size of eight project managers was selected from the population. The rationale for this sample size is based on Saunders' research. Saunders (2012) claimed that a range of four to 12 participants is likely to be

sufficient when chosen from populations considered homogeneous, and 12−30 participants, when chosen from populations considered heterogeneous.

Eligibility Criteria and Relevance

The below criteria specify the characteristics that people in the population must possess to be involved in the study. The eligibility criteria for this study required the participants to:

- Be a project manager with a technical or scientific background.
- Be from a school or college of science, engineering, computing or an applied unit in a four-year research university

Selecting these participants with similar background and knowledge allowed for in-depth information to answer the research questions. With a high level of homogeneity among the population, a sample size of 8-12 interviews may be sufficient to enable development of important themes and useful interpretations (Mason, 2010).

Data Collection

Data collection is critical to the research, and it is the first stage in the research process (Rimando et al., 2015). Stake (2010) claimed qualitative researchers seek data that represent personal experience in particular situations. Creswell (2003) believed the data collection should follow several steps: (a) setting the boundaries for the study, (b) collecting information for the study, and (c) establishing the protocol for recording information.

Instrument

The qualitative researcher is the primary instrument for data collection and analysis (Stake, 2010). The researcher was the primary instrument for data collection and analysis. Personal assumptions and bias were minimized through the use of interview protocol and an audit trail. Participants were recruited from colleges, schools, and research units through direct email (Appendix A) and were allowed to withdraw from the study based on the instructions provided

through the consent document (Appendix B). The researcher developed 17 open-ended questions related to the field of project management, designed exclusively for the qualifying participants to achieve the study's aim (Appendix C). These questions were informed by the work of other investigators. Interviews were conducted in a private location, in-person and through telephone conversations. These interviews were recoded for transcription, coding, and analysis. Also, the data were handled carefully so the participants were assured of anonymization of this sensitive information.

Data Collection Technique

Barratt, Choi, and Li (2011) noted there are several data gathering sources (e.g., structured or semi-structured interviews, observations, and archival sources). As the researcher contemplates which mechanism to use for data gathering, one seminal scholar offers strong support for involving the appropriate individuals when conducting interviews. Creswell (1994) posited the idea of qualitative research is to purposefully select informants that will best answer the research question. Kemparaj and Chavan (2013) explained that within the framework of the data collection approach, as it pertains to interviews, participants are encouraged to talk in depth about their perspectives on a research topic. This allowed the researcher the opportunity to collect meaningful information from the participant to be analyzed. Zohrabi (2013) pointed out some strengths in conducting interviews: good for measuring attitudes and most other content of interest; can provide in-depth information; allow good interpretative validity; moderately high measurement validity for well-constructed and well-tested interview protocols; relatively high response rates often attainable, and useful for exploration and confirmation. This study employed interviews as the primary method for gathering data.

Interviews. A total of eight project managers from a single site of this case study was interviewed using seventeen open-ended (Appendix C) questions to explore their perceptions and

responses to the qualified personnel shortage problem. According to Stuckey (2017), interviewing is a primary way of collecting data in qualitative research to direct the participant in responding to a specific research question. For example, some questions will include "What do you believe your school's leadership is doing about this qualified shortage" or "How long have you been a project manager? The development of these questions was informed by the work of several investigators (Amadi, 2015; Ferreira, 2013; Spears, 2014). The interviews were conducted in a semi-structured manner, in-person and through telephone conversations.

Prospective participants were invited to take part in the study through direct email. The email provided a description of the study, the study's guidelines, and reference to the consent form (Appendix B). Willing participants took part in personalized and phone interviews lasting about 30-40 minutes. The interviews were audio-recorded and transcribed for further analysis. Creswell (1994) stated researchers to record information from interviews by using note taking or audiotapes. Each response was assigned an alpha-numeric code, (e.g., see Table 1). Also, the researcher provided each participant with a copy of the in-person and phone interview transcripts, for review to ensure, accuracy and reliability of the content.

Data Organization Techniques

The data were stored on the investigator's personal laptop which was password protected. It was coded in the NVIVO software which was password protected during the entire research process. After the study completed, the data have been stored on a universal serial bus (USB) flash drive in a secure location. This location is known only to the researcher, and the data have been deleted from the researcher's laptop. Taking these steps has assisted in protecting the confidentiality of the participants.

Data Analysis Techniques

Houghton et al. (2015) claimed there are no systematic rules for analyzing qualitative data. However, the aim is to rigorously and creatively organize, find patterns in, and elicit themes from data. The aim is to gather enough data to be able to write a complete, detailed, coherent, and rich description (as cited in Houghton et al., 2015).

The personalized recorded interviews were promptly transcribed, coded and then analyzed for this case study. Creswell (1994) posited that data collection and data analysis must be a simultaneous process in qualitative research. The transcripts were coded with the aid of the NVIVO software where the algorithmic design of the software looked for themes, patterns and various style of reasoning concepts from the participants. Burnard, Gill, Stewart, Treasure, and Chadwick (2008) explained regardless of whether data are analyzed by hand or using computer software, the process of thematic content analysis is essentially the same, in that it involves identifying themes and categories that emerge from the data. This involves discovering themes in the interview transcripts and attempting to verify, confirm and qualify them by searching through the data and repeating the process to identify further themes and categories (Burnard et al., 2008). NVIVO supports coding thereby contributing to its transformation into a dis-embedded standard technique of qualitative data analysis (Gläser & Laudel, 2013). The design of this software supported pattern coding - explanatory, inferential codes to create more meaningful analysis (Houghton et al., 2015). Also, analysis of the coded data involved, examining, categorizing, tabulating and testing of the content, through pattern matching (Yin, 2003).

Pattern Matching. Pattern matching are conceived in case-study approaches as an arrangement of occurrences, incidents, behavioral actions, or the outcomes of interventions that are apparent in the raw data (Wiebe, Durepos, & Mills, 2009). In addition, Yin (2003) posited that

good analysis must attend to all of the evidence, address all significant rival interpretations, and use the researcher's own prior expert knowledge.

Reliability and Validity

Kisely and Kendall (2011) suggested in qualitative research, reliability and validity are assessed by establishing the trustworthiness of the data. Noble and Smith (2015) claimed research quality and credibility are essential if findings are to be utilized in practice. Therefore, assessing the reliability and validity of study findings requires researchers to make judgments about the soundness of the research about the application and appropriateness of the methods undertaken and the integrity of the final conclusions.

Reliability

Reliability is broadly described as the dependability, consistency, and repeatability of a project's data collection, interpretation, and analysis. It is the ability to obtain the same results if the study were to be repeated (Morse, 2015). Zohrabi (2013) argued that in qualitative approaches achieving identical results are demanding and difficult. It is because the data are in narrative form and subjective. However, it is important to point out that instead of obtaining the same results, it is better to think about the dependability and consistency of the data (Zohrabi, 2013). Mirriam (1998) posited one way to ensure reliability is through audit trail.

Audit trail. The researcher described in detailed how the data were collected, how they were analyzed, how different themes derived, and how the results were obtained. Therefore, this detailed information can help to replicate the research and contribute to its reliability. In addition to maintaining the audit trail, conducting personalized interviews strengthened the data's reliability. These interviews revealed existing knowledge in a way that can be expressed in the form of answers and so become accessible to interpretation. It is expressed that open-ended questions may generate richer and more spontaneous information in questionnaires administered

by interviewers. This allows the investigator to get an answer that is valuable (Noble & Smith, 2015). This study applied these techniques during the data collection process accounting for the study's reliability.

Validity

Validity or internal validity is usually defined as the degree to which inferences made in a study are accurate and well-founded (as cited in Morse, 2015). Validity is further defined it as the goodness or soundness of a study (as cited in Morse, 2015). Additionally, Zohrabi (2013) posited validity is concerned with whether our research is believable and true and whether it is evaluating what it is supposed or purports to evaluate. The researcher applied member checking as one of the internal validity to boost the research data and instruments (Mirriam, 1998). Through member checks, the results and interpretations are taken back to the participants to be confirmed and validated. Therefore, the results and interpretations of interviews might be handed over to the interviewees to confirm the content of what they have stated during the interview encounter. In this way, the plausibility and truthfulness of the information can be recognized and supported Zohrabi (2013). Zohrabi described external validity as concerned with the applicability of the findings in other settings or with other subjects. It looks at the research design such that whether one can generalize beyond the subjects under investigation to a broader population. The population for this study was eight project managers from one four-year research university possessing a technical and a scientific background. This study can be duplicated in other similar cases which can result in increased external validity.

Transition and Summary

This section dealt with the research design that was followed in this study. The section also covered the researcher's role and methodological topics such as participants, research methods and design, population and sampling, data collection, data analysis techniques, reliability, and validity.

Section 3 presented details relating to the analysis, along with discussions from conducting the semi-structured interviews with the 8-12 project manager participants. Section 3 ended with the study's findings, biblical application, and application to the problem and to the field of project management. It recommended areas for actions, further research, while detailing the investigator's reflections. Moreover, it culminated with the project's conclusions.

Section 3: Application to Professional Practice and Implications for Change

The objective of this section is to present the findings, applications, and recommendations based on the analysis of the data gathered from the qualitative single-site case study. The section commences with an overview of the study that examines a shortage of qualified project personnel in a four-year research university. The overview includes discussions of the study's rationale for reviewing business practice, a review of the questions being addressed, and a summary of the findings. The section also includes a comprehensive interpretation and presentation of the findings, conclusions addressing the research questions, and their relationship to the theories, Path-Goal Theory, McClelland's Theory, Theory of Constraints (TOC), and the Resource-Based View (RBV). This section also includes discussions of applicability of the findings regarding the professional practice of project management and presentation of a biblical worldview, followed by recommendations. Discussed are recommendations about useful action steps for those affected by the findings, and study of topics that need closer examination. This is followed by a reflection on the researcher's experience with the research process including possible personal biases, effects on the participants, changes in thinking, and examination of the associated biblical principles. This section concludes with a summary of the most salient points and a brief discussion of how the research closed a gap in the literature.

Overview of Study

This single-site qualitative case study explored reasons one four-year research university's project managers are experiencing a shortage of qualified project personnel, and what actions could be taken by the project managers to address the qualified project personnel shortage. Studies have revealed the problem's existence and have examined it in industries where project management is prevalent such as in construction, healthcare, manufacturing, and information technology (Xu, Ming, Song, He, & Li, 2014; Windapo, 2016; Ho, 2016). These studies have further investigated

various responding strategies to the problem. The topic is important to a four-year research university, as the individuals needed by such an organization must be competent, skilled, and must display intellectual agility to perform the complexities of project work (Harlow, 2017). Having access to these qualified resources can ensure that research projects are completed successfully. Besides, project managers need these qualified personnel to contribute their technical and scientific knowledge to the project; and notably, a research university is an important contributor of innovation, effective in technology transfer, the proceeding of which are built on research effectiveness (Harlow, 2017). Hence, project managers must be concerned with any research project skills gap problem as this would affect project success and is worth examination.

Exploring the project manager's perception of the problem determined reasons for the shortage and the actions to be taken by these individuals to mitigate or resolve the problem. The intent of pursuing this problem was to inform and communicate to academic stakeholders – professors, chairs, deans, provosts – of the existing challenge faced by project managers within this organization, so strategic and definitive measures can be taken by these leaders to address their university's qualified personnel shortage. It was also intended to add to the project management body of knowledge.

This study commenced with an in-depth review of the relevant and scholarly literature to evaluate and understand the nature of the problem being studied. This further assisted the researcher to develop the conceptual framework of the study through the incorporation of relevant theories - Path-Goal Theory, McClelland's Theory, Theory of Constraints (TOC), and the Resource-Based View (RBV). These theories were the underpinning of the study as the problem examined scarce human resources in a four-year research university. The literature reviewed covered multiple aspects linked to the problem, such as the project manager's role, their reactions about the problem in the university setting, impact of the problem on a project, the importance of

qualified individuals, and their relevance to project research. New information was collected by discussions with project managers from a four-year research university in the southeast. These individuals possessed a technical or scientific background from the college of computing and two applied research units. A qualitative method and a single-site case study design was utilized. This consisted of personalized interviews, notes, and distribution of the printed transcripts to the respective participants for content verification. The triangulation decision provided support for accuracy, reliability, and validity of the study.

The study's findings addressed the two research questions: Why are four-year research university project managers experiencing a shortage of qualified project personnel? What actions could be taken by project managers to address a qualified project personnel shortage? The findings resulted from data collected from the semi-structured – face to face/phone - participant interviews, as the researcher purposefully selected these individuals. Marginal notes were written during some of the personalized interviews to reiterate critical information shared by the participants. The data were coded aided by the NVIVO software, which allowed the researcher to compile the participants' responses by themes and patterns through nodes for an in-depth analysis. These nodes also allowed quicker groupings of the themes based on the seventeen interview questions, designed for in-depth discussion of the relationship relating to the problem. Overall, the findings revealed project managers facilitating projects in a four-year university pointed to a shortage of qualified project personnel which impacts successful delivery. This was the consensus from the participants, although a small sample referred to this problem as more of a supply and demand issue, which is fundamentally a shortage problem.

The data disclosed the reasons for a qualified personnel shortage varied according to the projects and the needs of the project manager, such as whether the PM needs graduate research students, postdoctoral fellows, or those with unique skills such as a software developers or

programmers. Also, the shortage is mostly seen in technical projects, versus those that are scientific. For example, a project manager (PM) leading a technical project is involved with building a gadget, designing an app or writing a complex program; these skills were not readily available. The PM would need to look outside of academia to industry to recruit this individual, which can be difficult for the PM, since the compensation offered from industry is higher than academia, so this presents a challenge for the PM. Several project managers encounter this problem. Contrastingly, scientific projects usually require a pre-determined team at the proposal phase of the project, which is usually a requirement of the sponsor. Occasionally, the project manager runs into a skill gap situation, as people relocate, students graduate, scientists are engaged in other research project work and cannot commit to the project objectives as planned. Project managers raised a pressing concern and admitted the university's leadership is not aware of the shortage problem, so nothing is being done on that level. They believed the lack of involvement of leadership impacts the academic pipeline of qualified personnel needed for research projects.

The findings, themes and patterns derived from the interviews were: (a) project managers conveyed factors for the shortage, (b) project managers discussed impact on their research, (c) project managers shared their experience in finding qualified personnel, (d) project managers discussed leadership involvement, (e) project managers expressed concern about the academic pipeline, (f) project managers revealed plans to address the shortage, (g) project managers obtained project funding and its relationship to project personnel, and (h) project managers revealed further plans for the shortage. Also, several findings from the data collected concurred with information from the literature review. For example, most scientific research projects are funded by the federal government, while industry sponsors fund those that are more technical and occasionally the government. Also, the literature pointed to past results from the US-based Project Management Institute's (PMI) report, showing the underrepresentation of women in project management

(Henderson et al., 2013). Participant C1 observed this similarity, project manager participant interviewed on September 19, 2017. Reference was made about innovation and creativity in government-funded projects, compared to projects sponsored by industry that are defined with strict timelines, which was also addressed in the literature (Brocke & Lippe, 2013). Participants mentioned project workers in academia are limited by the salary offerings to project workers compared to what industry offers these skilled individuals, which is a major obstacle and a factor of the academic skills gap.

In summary, this study added new information to the field relative to the problem. For example, academia is not a field where a project management certification or training is required for project managers leading projects. For the most part, this is an industry requirement for individuals facilitating their projects. Of the participants interviewed, only one expressed as ever receiving project management training. The others had no training or no project management designation. Project managers network to obtain suitable individuals to staff projects. They have devised unique ways to address the problem, such as advising project personnel to develop multiple skills as a resolution to the shortage. Project managers have expressed there is always the fear of not having the talent to adequately staff projects. Lastly, the consensus among the project managers is there is a qualified shortage problem. However, this contradicts with a recent article by Salzman who argued there is not a dearth of highly qualified personnel as some have indicated (Salman, 2013).

Presentation of the Findings

The interpretations and conclusions of the findings of the qualitative analysis are addressed regarding the research questions and associated literature. These explanations derived from the data collected from the single site case study at one four-year research university. Interviews were conducted with eight project managers with a technical or scientific background employed in the

college of computing and applied research units at a four-year research university in the southeast. The interviews were transcribed and returned to each participant to establish accuracy. The transcripts were then imported into the NVIVO software and coded by themes and patterns, while carefully examining relationships in the data. Each participant was assigned a unique identifier (see Table 1), with the interview days ranging from September 12 to October 23, with the longest interview lasting approximately 35 minutes.

The themes, patterns, and relationships of the findings were explored within the context of the conceptual framework: Path-Goal Theory, where leaders assist subordinates to attain their goals by providing the support and removing obstacles and barriers (Ag Budin & Wafa, 2015); McClelland's Theory, which suggests individuals have specific physical and psychological needs, and these needs are satisfied through achievement, affiliation and power (Neagu et al., 2013; Panda et al., 2014). Themes and categories linked to the project manager's actions for resolving and mitigating the shortage dilemma were explained through the framework of Theory of Constraints (TOC) and Resource Based View (RBV).

The Theory of Constraints (TOC) is anything that limits a system's performance and requires a review process that involves identifying constraints, improving the capacity of the constraint, and restructuring the rest of the organization (project) around it (Lin et al., 2009; Johnson et al., 2016). This theory is used to explain the project managers actions as they attempt to resolve the problem. The Resource-Based View is the ability to manage limited resources to generate a competitive advantage (Cullen & Parker, 2015). Explanation of the findings through the lens of the process based theories provided results of the actions of project managers relating to the second research question.

Five themes emerged from the interviews with project managers relating to the first research question: Why are four-year research university project managers experiencing a shortage

of qualified project personnel? These themes were (a) project managers conveyed factors for the shortage, (b) project managers discussed impact on their research, (c) project managers shared their experience in finding qualified personnel, (d) project managers discussed leadership involvement, (e) project managers are concerned about the academic pipeline, and (f) project managers conveyed additional factors for the shortage. Findings are listed in order of importance.

Theme 1: Project Managers Conveyed Factors for the Shortage

Participants discussed several reasons why project managers are experiencing a shortage of qualified project personnel. These were the most common explanations shared by project managers and are discussed in order of priority. They were: (a) task matching, (b) compensation, (c) project worker time limit, and (d) other shortage factors (lack of multiskilled workers and industry offering)**.**

Task matching. Project managers pointed to the difficulty of appropriately matching qualified workers to project tasks as the most prevalent reason why there is a shortage. According to participant C1 “sometimes it’s hard to put the project together with the person who can do the work; the better workers are always in demand which makes it difficult to locate the appropriate individual for my project” (personal communication, September 19, 2017). Participant B1 claimed that finding the right match to the project task is a problem (personal communication, September 14, 2017). Respondent D1 shared “I think it's usually because there's not a good match between a student's technical background and goals of a project” (personal communication, September 21, 2017).

Matching the task to the individual is a staffing problem which the literature indicated can become apparent in both the planning and execution phases of projects (Liu & Yokoyama, 2015). Barreto et al. (2008) suggested staffing problems are prevalent across project activities. Hence, organizational hiring practices must accommodate the project manager’s staffing needs and ensure

the right individuals are onboard timely for the project activities. This problem is best understood through the Resource-Based View theory. The RBV focuses on managing limited resources to generate a competitive advantage (Cullen & Parker, 2015). As managers are aware of limited worker time, his or her ability to be strategic in scheduling workers to specific task is paramount. This can result in a competitive advantage for the project being delivered timely as project have been delayed for reasons due to lack of the project manager's inability to schedule critical task appropriately (Pfeifer, Barker, Ramirez-Marquez, & Morshedlou, 2015).

Compensation. Project managers viewed compensation as an alternate reason for the shortage of qualified project personnel. Participant A1 remarked, "We are limited in terms of how much we can pay them [qualified workers] as compared to industry" (personal communication, September 12, 2017). Also, participant H1 noted industry pays significantly higher than academia, so this draws qualified individuals away from the academic work environment (personal communication, October 23, 2017). McClelland's Theory of Needs suggested that individuals have specific physical and psychological needs they attempt to satisfy. Moreover, compensation is a physical need and can be used as a motivational tool to attract suitable project workers. Lianying and Fe (2014) posited motivating project individuals might commence with compensation that might persuade these highly skilled individuals to commit to the project activities. Managers use motivation tools such as compensation as an effective instrument in inspiring the workforce (Panda et al., 2014).

Project worker time limit. The limited amount of time some qualified individuals, such as graduate research students, are available for work is not conducive for the project manager to meet projects goals. This was also regarded as a critical reason for the qualified shortage. A1 commented "due to the limitation of the time you have qualified personnel on a task contributes to the shortage, as they have other commitments such as their school work" (personal

communication, September 12, 2017). G1 similarly observed that graduate students have their academic career to focus on, so it is hard for them to commit to project goals (personal communication, October 11, 2017). Addressing the time constraint problem requires the effective and efficient skills of the project manager. The literature stated, "the project manager needs to identify project requirements; balancing the competing demands for quality, scope, time and cost; and managing projects in response to uncertainty" (Ahsan et al., 2013). Limited graduate student time would be considered an uncertainty to the project. Proper planning is required, and utilization of the Theory of Constraint review process that will require the project manager to identify constraints relating to personnel time limit, improve the capacity of the constraint, and restructure the rest of the project around the problem (Johnson et al., 2016). Additionally, the literature indicated that graduate research students are vital contributors to project work in a research university (MacPhee, 2015).

Project Managers Conveyed Additional Factors for the Shortage

Lack of multi-skilled workers. Project managers explained there are instances when they are in need of multi-skilled personnel for the project. A lack of these indiviuals lead to the shortage. For example, participant D1 claimed there were times when the project needed someone with multiple skills. "that was difficult to find" (personal communication, September 21 2017). Since multiskilled workers have knowledged in more than one expertise they can be utilized in multiple areas of the project and this can lead to a decrease project costs. This can be a disadvantage projects with constrained resources and to the project manager who is unable to located such individuals.

Industry offering. Further explanation for the shortage was that industry is more appealing to qualified graduates said participant E1 (personal communication, October 10, 2017). This can have several meanings. Industry has more incentives for their workers as a for-profit

organization than a university that is a not-for-profit. Industry has more flexibility in their operation towards their employees than a state-run organization, such as a university. The literature supports this finding and indicated that in the U.S. well-trained and successful young scientists are leaving academic science in greater and greater numbers because they are discouraged by their future life in academia (Albertsa et al., 2014).

These factors are perilous to the project in general as they can cause delays, increase costs, and affect quality. The project manager must assess and monitor each factor as they all serve as impediment to the project's success. Project managers must adequately plan before execution, and work through the hurdles that seemingly will emerge and obstruct project completion, specifically as they are aware of these factors.

Theme 2: Project Managers Discussed Impact on Their Research

Research projects are a core part of a four-year research university's mission (Georgia Tech, 2017a). Project managers possess firsthand knowledge of the shortage impact on their work. Project managers explained how the shortage have impacted their project. This impact involves: (a) project delays, (b) extreme shortage, and (c) additional expense.

Project delays. Project managers informed the qualified shortage delayed projects. Participant G1 stated, "It can sometimes delay delivery of results on a research project or an industrial sponsored project because we do not have enough people in our unit to task with working on a project" (personal communication, October 11, 2017). Project manager H1 also mentioned "They were cases when projects were several months behind schedule, and that was a detriment to the relationship with the partnering organization and the sponsor" (personal communication, October 23, 2017). The project manager H1 emphasized that very often the team was unable to complete projects within the timelines that were originally proposed because of the

frequency of being under-staffed. These project delays can consequentially affect collaboration that is vital to project work in a four-year research university.

Extreme shortage (Software personnel). Also, project managers felt the shortage had impact on some areas of their research than others. For example, participant C1 said research that involved app programmers were severely impacted. C1 said such individuals were hard to find versus someone who understood biomedical projects in general (personal communication, September 19, 2017). Participant H1 acknowledged finding software developers is always a problem (personal communication, October 23, 2017). Therefore, having this knowledge of the extreme scarcity in some fields should cause project managers to either secure these individuals early for project work, or inform the sponsor of a potential project extension due to such project member shortage.

Additional expense. Clearly, the impact of the shortage problem had additional effects on the project manager's work that resulted in them taking some type of action. Respondent A1 disclosed how a big shortage resulted in frustration which led to utilization of external sourcing companies to obtain suitable workers to get project successfully completed (personal communication, September 12, 2017). Also, E1 said that securing personal for one project entailed several rounds of advertising (personal communication, October 1, 2017).

Ultimately the project manager must apply procedures that would mitigate delays, make provisions for extreme shortage situation, and plan for additional expenses. These problems impact the project in some way. For example, contracting the work of talent management is an expense to the organization and is likely to be passed on to the project as indirect costs. Maghareh and Mohammadzadeh (2013) emphasized the success of the project depend highly on the effectiveness of the project manager. Before project execution, the planning phase must take all possible consideration, even those that threaten the project.

Theme 3: Project Managers Shared Their Experience in Finding Qualified Personnel

The job of finding qualified project personnel is one that requires the project manager to have specific knowledge on how to recruit these individuals. However, the findings revealed the difficulty of ascertaining qualified project personnel. Project managers discussed their experience as it is relevant to why the shortage problem exists. This may involve situations such as (a) networking experience and (b) project manager's struggle.

Networking experience. Project managers claimed specific information was critical during the challenge. For example, Participant B1 advised these individuals are located through networking (personal communication, September 14, 2017). This participant claimed networking is good because individuals are known. However, this type of recruitment does not produce a diverse pool of candidates, especially in the technical space. Therefore, working with HR to recruit technical talents for the project is another option. Respondent F1 said that it is important to connect with other departments and utilize networking (personal communication, October 10, 2017). Participant A1 viewed finding qualified personnel as time-consuming when attempting to seek project workers internally, so the alternate option is utilizing external assistance (personal communication, September 12, 2017).

Evidently, there are difficulties experienced by project managers as they engaged in finding project workers. It is a time-consuming process and searching within the organization was unproductive sometimes, so project managers sought external help. The process of networking with others became important to project managers so that ascertaining these individuals was possible.

Project manager's struggle. Project managers acknowledged that in some cases it was problematic to locate these qualified individuals during the shortage. For example, participant E1 commented, "It's hard to find people who are qualified enough for these kind of positions"

(personal communication, October 1, 2017). This is a difficult situation for the project manager, so he or she must make a strong case to these individuals to commit to the team once they are recruited. Project managers will need to use various forms of motivation, as explained in McClelland's need for motivation, to retain these individuals. This may be in areas such as autonomy, or opportunities for learning. Autonomy can drive individuals to commit to the project goals (Patanakul et al., 2016). In reference to opportunities for learning; learning at the individual level is not only important to the growth of the employee, it is also significant for enhancing organizational learning and the development of dynamic capabilities (Antonacopoulou, 2006). These sources of motivation are mentioned in McClelland's theory of needs (Liu & Wohlsdorf Arendt, 2016). Also, motivating project workers can be a recruitment and retention strategy for these qualified individuals with various needs. McClelland's needs theory explains that workers have other needs such as affiliation, achievement, and power, so allowing project workers to see there are essential elements to committing to a project other than compensation works to the benefit of the project manager and the project's success.

Another project manager also spoke to the difficulty of recruiting these individuals. For instance, H1 explained:

> It has been very difficult finding qualified individuals even within the organization. Sometimes I would settle for a highly skilled student and even then, it can be difficult, since students that are exceptionally technical have very lucrative job opportunities elsewhere (personal communication, October 23, 2017).

Another project manager's difficulty pointed to the limitation of the organization's ability to recruit these individuals quickly. This impacts short-term projects. Participant G1 shared the problem is with the size of the internal resource which is not large enough to recruit from (personal communication, October 11, 2017). The participant further commented although there are other

resources available, assembling ad hoc teams especially for industrial projects that often have a shorter timeline, or a client who has to have some deliverable done on a set schedule is problematic.

Project managers experienced problems finding potential workers who were highly skilled as these individuals were able to secure better opportunities. Also, when there were immediate needs, due to the shortage, it was difficult to assemble teams in an impromptu manner, so this would have delayed projects. Also, knowing how to network was helpful to lessen the shortage. Overall, these difficulties are present as project managers work through the shortage predicaments.

Theme 4: Project Managers Discussed Leadership Involvement

Project managers needed to know that leaders are concerned with pressing issues of the organization. Leaders need to support project managers, particularly in a complex environment, such as a four-year research university. It is critical leaders are aware of immediate problems that impacts project managers work, such as reasons for a qualified shortage. Adams et al. (2012) suggested leadership needs to continually encourage research teams and are responsible for removing barriers. One common reason was leadership support.

Leadership support. Project managers shared their views concerning the role of leadership as they experience the shortage. Participant A1 remarked “They're aware of this and they've been supportive” (personal communication, September 12, 2017). As there is partnership with sponsor and project manager, there should also be partnership with organization leaders. The Path-Goal theory is a proponent of leadership support, which stated the main goal of leaders is to help subordinates attain their goal effectively by providing necessary support to achieve their own goals (Ag Budin & Wafa, 2015). In this instance, the employees are the project managers who need top-level organizational managers to assist them in resolving the qualified shortage problem, to achieve their goals, meet project objectives in a timely manner, and deliver a successful project.

Responded D1 claimed leadership is trying to use different techniques to recruit the best possible students early, at the admission stage, so that individuals are identified who will eventually join projects (personal communication, September 21, 2017). Also, participant G1, who is in a leadership position stated "one thing we're doing is cultivating relationships and trying to make new connections" (personal communication, October 11, 2017). As with any challenge there are pros and cons. One project manager viewed leadership's as being uninvolved in the problem. For example, participant D1 stated "I'm not aware that they [leadership] are doing anything" (personal communication, October 10, 2017).

Leadership support or input is important for success in project completion. They are influential in the organization and is capable of impacting change. Some project managers have experienced this first hand. Project managers recognize leadership's role in securing solutions. Additionally, the literature pointed to the importance of leadership involvement, as these individuals need to encourage research project teams, and the perceptions that project managers have about leadership may give insight into how these teams function (Adams et al., 2012). A leader's involvement gives credence they are onboard with project managers and are willing to come next to them to resolve any problems.

Theme 5: Project Managers Expressed Concern about the Academic Pipeline

Project research is a continuous activity in a four-year research university, therefore, a pipeline of qualified individuals is needed for this work. Project managers viewed the pipeline of students as a vital component to the shortage problem. Hence, academic stakeholders need to act now to respond to future shortages. A common reason was (a) pipeline: a vital constituent, and (b) pipeline flaws.

Pipeline: a vital constituent. Several participants feel the organization is ensuring that qualified individuals are available for future project employment. This constituent is vital as

project managers contemplate reasons for the shortage. An example given by participant C1 claimed one advantage is students sometimes have the opportunity of conducting research, sometimes leading their own projects (personal communication, Sept. 19, 2017). Having a pipeline of qualified project personnel is beneficial for the project, project manager, and the organization. It is prudent this organization is investing in its students to fill the qualified skills gap. This is contributing to project research continuity.

Participant G1 acknowledged there is reason to believe the organization is ensuring students will be available to staff future projects. The participant remarked "The research scientists and engineers in my unit, we were all students of this organization. So, obviously, it did a pretty good job of training us to be research scientists and, eventually, project managers, more senior people." "So, I think that's just sort of self-evident that the organization is doing a good job" (personal communication, Oct. 11, 2017). The consensus among project managers interviewed is the university has done a good job in preparing them to perform project research that has contributed to the project pipeline.

Pipeline flaws. Project managers are divided on whether the pipeline is being sustained. Some believe that enough is still not being done as it relates to sustaining the pipeline. This subject was dominant as project managers consider the reasons for the shortage. Respondent D1 is clear the shortage problem stems from the pipeline which is occurring earlier than many are aware. This responded [D1], stated academia overall is limited in how it can solve the pipeline problem (personal communication on, Sept. 21, 2017). Participant H1 pointed out flaws with the qualified individuals within the pipeline. This participant claimed individuals in the pipeline need practical skills which are hard to teach in school. The participant said the institution should emphasize the importance of learning practical skills in areas such as software development, which could be very beneficial to the CS pipeline (personal communication on, Oct. 23, 2017).

Project managers are divided on the organization's ability to sustain the pipeline of qualified personnel. It has been acknowledged by project manages a shortage exists, which means not enough qualified individuals are available to staff projects. Possible solutions include the university needs to be engaging students very early, and encouraging them to pursue graduate education that will adequately prepare them to conduct project research. The conclusion seems to be in the difference in the project manager perceptions, which stems from their individual experience in their ability to promptly recruit qualified personnel.

Resolving the shortage problem will require input from organizational stakeholders which involve the project manager. Several themes emerged from the interview responses relating to the second question: What actions could be taken by project managers to address a qualified project personnel shortage? These themes were: (a) project managers revealed plans to address the shortage, (b) project managers obtained project funding, and (c) project managers revealed further plans for resolving the shortage.

Table 2

Project Manager Data

	Participants								
Project related data	A1	B1	C1	D1	E1	F1	G1	H1	Average
Length of time as a project manager	6	12	17	10	8	20	20	18	14
Led projects in other industries	Yes	No	Yes	No	No	No	No	No	N/A
Holder of PMP/related project certification	No	No	No/T	No	No	No	No	No	N/A
Largest team led	40	30	18	12	15	5	8	35	20
Size of department	M	M	M	L	M	S	S	S	N/A

Table 2 captured data collected from the eight project manager participants which is important to the research. These values provide information on questions 1-5 relating to the second research question. Several inferences can be drawn about each individual or summarized based on the overall data. This information revealed the participants' years as a project manager ranged from 6 to 20 years, with an average time of 16 years. Although the literature does not express a project manager needs to be facilitating projects for a specific number of years in order to achieve project success, it stated the individual's knowledge and competency are essential to achieving project success, and their contribution is extremely valable to ensuring the project concludes successfully (Saadé et al., 2015; Blaskovics, 2016).

The data gathered also revealed that a small number of project managers have led projects in other industries. Surprisingly, none of these project managers possessed any project management related certification, though, C1 has received project management training. However, much of their training related to project management is basically what one would refer to as being "on the job." Saadé et al. (2015) said project managers should receive training. Mangematin et al. (2014) emphasized through training and experience these individuals are discipline grounded. Project managers in academia perform tasks as traditional project managers from defining a project

to closing; however, they possess highly specialized skills such as statistics, coding and programming, and software development (Mangematin et al., 2014). Also, participant D1 observed as it relates to this subject matter and stated "No. They do not train you to do anything, they just hire you and then it's like, 'Good luck'" (personal communication, Sept. 21, 2017). Also, the project manager participants have managed teams of various sizes, with the average size being 20 individuals, and most project managers work in a small or medium size department. The researcher defined the project manager's department size based on the following markers: 1- 20 (Small); 21 – 40 (Medium); 41- greater (large).

Theme 6: Project Managers Revealed Plans to Address the Shortage

The consensus from project managers is that a shortage exists. Hence, addressing the shortage would require some type of action from the organization, particularly project managers. The participants revealed several ways in which they addressed the research problem. Actions related to addressing the problem include: (a) addressing the pipeline, (b) building collaboration, and (c) team member cross-training.

Addressing the pipeline. The most prominent way project managers addressed the qualified worker shortage is by taking action with regards to the pipeline. For instance, participant D1 plans to impact the pipeline by inspiring students to pursue research or to at least consider going to graduate school and getting involved in project work (personal communication, September 21, 2017). Participant A1's main objective is to create opportunities for students to continue to feed the pipeline (personal communication, September 12, 2017). Project managers should always look for viable solutions to mitigate the shortage problem. Ensuring that appropriate resources are available to deliver the project on time and on budget is vital for all stakeholders. To accomplish this requires that he or she devises viable solutions to address the problem especially when he or she faces impediments to the project's success.

Building collaboration. A knowledgeable and skilled project manager knows the value of the team collaboration. This allows for undertaking of large project scope. Another way project managers addressed the question was to note the need to build collaboration. Participant C1 explained it is important to stay current on-campus research events so collaborators can be identified, both internal and external (personal communication, September 19, 2017). H1 stated, "Build relationships with other groups on campus to create a pool of talent that we could collectively draw from (personal communication, October 23, 2017). The literature state, collaborations effectively allow access to a broader range of knowledge for conducting frontier research, and research team members must work together under explicitly stated common goals and objectives (Chan, 2015). Also, within the framework of these organizations, such as a four-year research university, collaboration is a central component for enabling productive research outputs (Stanley & Anderson, 2015).

Team member cross-training. Another way to resolve the shortage is to address the need for cross-training. One project manager expressed, "We have always tried to encourage people to cross train or, at least, be aware of everyone's talents and, also, cross train on different talents." "Having a broad range of skills is useful in many capacities" (G1 personal communication, October 11, 2017). This action provides project managers with team members that are multi-skilled, and can reduce project cost because of a single worker having multiple skills that are applicable in other areas of the project. Also, the principles of the Path-Goal theory explain leaders are responsible for assisting their followers in attaining their goals (as cited in Ag Budin & Wafa, 2015). Team members need to be trained so they can be effective in their jobs, which increases their competency level.

Project managers discussed ways to resolve the shortage problem by using different approaches. Whether it is to focus on addressing the pipeline, collaborate, or encourage cross

training, these actions can serve to remedy the qualified skills gap. In any case, it requires action on the part of the project manager.

Theme 7: Project Managers Obtained Project Funding

The role of funding emerged as another theme to address the research question, and the participants revealed it is critical to the entire project. Taking action to ensure that funding is available to cover the team members effort is crucial. Project manager can use funding as a tool that attracts individuals to project work to lessen the effects of the shortage, such as (a) a tool to commit, and secure workers, and (b) further funding actions by project managers

Funding: tool to commit and secure workers. It is important that team members are committed to the project goals. Project managers use funding as a commitment and to secure that dedication in response to the shortage. For example, "when funding is available individuals tend to commit more to the project" (B1, personal communication, September 14, 2017). Participant A1 said having available funding allows workers security knowing they will have project work for a specific time (personal communication, September 12, 2017)

Funding is crucial to project activities and this is always a concern for the project manager and other stakeholders. Funding is used as a driver by the project manager to attract prospective project personnel. The topic of funding is being examined by project sponsors such as the federal government. The literature stated that research projects will experience a decline in funding. Qualified researchers, such as project managers who are the engine that contributes to project success, will be impacted by newly formulated NIH funding guidelines (NIH, 2017b). This federal change will drastically impact projects in research universities, since these entities rely on the feds to fund their projects.

Funding: Further actions by project managers. Further funding actions by project managers require them to seek funding with other potential sponsors as this helps to pay team

members, while navigating funding issues in their unit as helps to minimize the shortage. For example, G1 claimed having more stable long-term funding would lessen the problem in many ways, such as always having to shuffle around money, shuffle around schedule, and personnel (personal communication, October 11, 2017). Project manager H1 commented hiring would be easier if more long-term, well-funded projects spanning across multiple years was available (personal communication, October 23, 2017). Participant H1 shared because many projects are on much shorter cycles, this poses a greater risk in making permanent hires. Also, other limitations, such as salary structures at the institute, makes it hard to be competitive for individuals other than those who are recent graduates (personal communication, Oct. 23, 2017).

Project managers should consider including the principles of Theory of Constraints, such as, anything that limits a system's performance, and provide a guide to facilitate the utilization of resource allocation. This can be accomplished by the review process which involves identifying constraints, improving the capacity of the constraint and restructuring the rest of the organization (project) around it (Tulasi & Rao, 2012).

Theme 8: Project Managers Revealed Further Plans for Resolving the Shortage

Several findings were important although they were not related to any specific theme, but are relavent to the research. Responding to the shortage problem may require project managers to take other actions to lessen the shortage is areas such as, allowing more females into technical and scientific roles to work and lead project. Addressing such issues entails: (a) inclusion of women in technical fields, (b) proper planning, (c) project management training, and (d) engaging students, are key solutions to the shortage.

Inclusion of women in technical fields. Including women in technical and scientific fields can assist in resolving the shortage, and also create diversity on project teams. Participant C1 believed the organization needs to encourage females to pursue degrees in technical and scientific

fields, as their knowledge and skills can lessen the shortage problem. C1 said the environment was not conducive for females over a decade ago, so any difference in offering education and encouragement is needed. “I think that giving students the introduction to research early is important and they do that more now, too.” “Also, we need to resolve the gender pay issue, which is still not resolved” (personal communication, Sept. 19, 2017).

As it relates to females entering the field of project management, the literature stated women working in the profession of project management are not breaking into the significant role of project manager (Henderson et al., 2013). Since research shows the low number of females becoming project managers, then there needs to be further investigation as to the reason for the low female representation. Surprisingly, the topic of gender pay is still a problem, even in the field of project management, which is one more challenge for project managers and leaders to address.

Planning. Project managers need to engage in proper project planing so the project is adequately staffed, so that it supports timely delivery. This approach can assist in resolving the shortage. For example, Participant B1 remarked, “I think it is just thinking and planning ahead, then, identifying those risks and mitigating those risk.” “Sometimes it is having to go further with the resources you have, or talking to the sponsor to modify the scope so that expectations are set appropriately” (personal communication, Sept. 14, 2017). Participant B1 also shared the strategy is also to think ahead and know what the project needs are, and devise a process to get the right match (personal communication, September 14, 2017).

Planning may require having additional resources on reserve. Having access to inter-institutional resources can help in meeting the scope requirements averting shortage challenges. These findings show the job of the project manager is difficult. He is responsible for overseeing the entire operation from start to finish and addressing all activities related to the project

(Maghareh & Mohammadzadeh, 2013). Therefore, he or she needs to be able to think tactically and be skilled in allocating the project's scarce resource.

Project management training and student engagement. Further significant findings were relating to project management training and student engagement. The literature stated delivering project quality may require that training is incorporated, as training serves as a precursor for quality output (Hassab-Elnaby et al., 2012). Training produces skilled and competent worker needed for complex work so project managers should recommend training for project workers as this serve to mitigate the shortage problem. Participant G1 posited it would be worthwhile to get some formal training in project management, for one thing, if the organization offers it (personal communication, October 11, 2017). Also, participant C1 feels strongly the focus should be to engage as many students as possible, as they work on pilot projects (personal communication, Sept. 19, 2017). Allowing students, the opportunity to work on projects addresses project readiness and assists with future project shortage.

Summary of the Findings

The findings discussed the themes that resulted from the two research questions: Why are four-year research university project managers experiencing a shortage of qualified project personnel? What actions could be taken by project managers to address a qualified project personnel shortage? The literature supported some of the findings, in areas such as the prevalence of staffing problems in project activities, the low entrant of females in the field of project management, and the importance of collaboration. Also supported was the role of leadership in project activities, training for team members and project managers, the need for proper planning, and the shift of qualified workers from academia to industry. In addition to the literature supporting these findings, the conceptual theories were incorporated to explain various aspects of the findings relative to the various themes. The findings revealed the criticalness of qualified

workers to the project's objective, and how the results of the shortage affected other processes such as scope, quality, and timeliness resulting in delivery delays to the sponsor.

The findings answered both research questions with rich and in-depth discussions by providing reasons for the shortage based on the project managers perception, and further explained other elements relevant to the first question. The second research question was also answered; however, the project manager's actions were limited in contrast to a more comprehensive explanation for reasons for the shortage. Also, although project managers conveyed there is a shortage of qualified personnel and actions needed to be taken, their views are in contrast to Salman who claimed project managers have ample qualified resources at their disposal (Salzman, 2013).

There were surprises in the findings. One, regarding the low number of females entering the project management field, although there is a push for females to take on leadership roles in many fields. The other was related to the pipeline, and the fact that project managers are concerned there is a need to sustain the pipeline to prevent further shortage long-term. It was alarming that none of the participants, excluding one, had any formal project management training. With project managers leading large projects, formal project management training is beneficial when managing scarce resources. Also, the need to sustain the pipeline and the need for multi-skilled workers has generated knowledge that can inform the field of project management. Also, some explanations produced diverse perspectives while others produced similarity, which showed saturation was attained in those areas. Overall the participants provided in-depth, rich and at times surprising information about the research problem. Moreover, the participants had nothing further to add; however, they were candid and honest about their views. Finally, the information provided by the project manager participants will benefit our understanding of project management as a practice.

Applications to Professional Practice

This sub-section will discuss the applicability of the findings regarding the professional practice of project management, as the literature showed this field is a novel approach to academia (Austin et al., 2013). Nevertheless, project managers in a four-year research university have encountered challenges relating to the shortage of qualified, project personnel. The study revealed there is a lack of multi-skilled project workers for projects in a four-year research university. Academia and business in general can benefit from this information by encouraging project workers to gain multiple competencies in more than one fields. Project workers with multiple competences are more valuable than those who possess a single competency, thus reducing project expenses linked to cost overrun. These talented individuals can be utilized on multiple project tasks, which helps to mitigate the skills gap shortage, and resolve a current project management problem.

New knowledge gained from this study involved the importance of sustaining the pipeline for future project needs. The findings revealed a shortage exists for technical and scientific personal in general. Therefore, academic stakeholders and the research community need to devise plans that will assess, analyze, and consider the scope of the pipeline problem and provide suitable solutions where necessary.

Also, the study's findings pointed to the shortage affecting the project scope which would then require modification of specific project tasks, thereby affecting the project outcome and the sponsor's expectations. Hence, project managers needed to thoroughly assess the scope by considering the amount of personnel required for each project so the project is successfully carried out. This also includes the product delivered is one of quality. Additionally, project managers need to diligently plan prior to implementing project activities, as this would have allowed them to possess insights into prevalent problems such as, difficulty of matching workers with tasks and

worker time limit on the project. This knowledge is critical to the field of project management as businesses encountering the above challenges need to engage in decisive planning prior to execution.

The findings revealed most of the project managers in academia have no formal project management training. Project managers with formal project management training possess tools and techniques critical to competently resolve emerging issues related to scarce resource that has impact on the project scope which is important in the practice of business. According to Alotaibi, Sutrisna, and Chong (2016), project management is an essential process which contributes to project success. This involves the project manager's utilization of various tools and possessing the basic project management skills for effectiveness and efficiency (Desmond, 2014).

Project quality is critical for both the project and stakeholders. It is contingent on the type of individuals who are recruited to the project. Hence, the pipeline of qualified personnel must be adequately prepared, and available, as mentioned on several occasions by project manager participant. This will enable project managers to readily have access to these resources to meet the quality set forth by project stakeholders, mainly the sponsor. Delivering quality may require that some type of training is incorporated, as training serves as a precursor for quality output (Hassab-Elnaby et al., 2012). As employees are trained they need project managers to provide direction, support and to clarify the path while increasing rewards and removing goal obstacles which is a key principle of the Path-goal Theory. As was expressed in the findings, retaining these qualified individuals can be difficult as there are other lucrative options available to them, so offering training can be a means for retention for project managers.

Biblical Framework Implication

Although project management is a nascent field on the academic timetable, the origins date back to biblical times. Many project managers existed in biblical times and experienced the issues

of scarce resources. Two of the well-known project managers who have dealt with such challenges are Nehemiah and Joseph -son of Jacob. Nehemiah was an exiled Hebrew who was cupbearer to the king of Persia and a godly project manager who experienced the challenge of managing scarce resources (Nehemiah 1:11). He lacked building resources; however, he appealed to the king who instructed governors in the region to provide the building resources that was needed for his project. This was his approach to networking to fill those building needs. Most of the project managers interviewed discussed the importance of networking to meet the skills gap. Nehemiah's second order of business was to assess the damage which was one of the key activities of his planning strategy (Neh. 2:12). This mission allowed him to know the extent of the building project. As he was tasked with rebuilding the wall of Jerusalem, the enormity of the work in comparison to the builders was overwhelming. Nehemiah's work strategy involved individuals who would build the portion of the wall in close proximity of their residence. The challenge arrived when opposition came from the enemy, which meant it was difficult to gather an ad hoc army and recruit builders. This was problematic as these were the remnant of escapees from the Babylonian invasion (Nehemiah 1:3). His tactic was for a portion of the men to build, while others kept watch with the sword. Also, those who were builders would be prepared with his sword attached to him to fight the enemy who was an imminent threat. Like Nehemiah, the project managers interviewed mentioned the importance of planning to gain knowledge of the resources needed for task execution. Project managers stated their desire for individuals who were multi-skilled, in some cases this was necessary since the project required such individuals. The rebuilding of the wall required individuals who had multiple skill-set which include individuals who were able to be combative against an attack.

The findings revealed there is the need for project management training as the data showed this was an area of need among the participants interviewed. Training in the field of project

management techniques can assist with the project manager's application of the techniques efficiently and effectively while managing these scarce resources. Likewise, there is a biblical application regarding the need for training. For example, Christians are God's project managers and need to be trained in his ways to effectively manage the projects we are assigned. Joseph was a project manager who received training in an unconventional manner that would later assist in his role as a leader to manage scare resource. He was in charge in Potiphar's house managing all of his master's projects (Gen 39: 1-4). He was framed, then thrown into prison. While there he received training, as he was assigned many responsibilities. He was later released through divine intervention, then was given the responsibility to plan, then later allocate scarce resources throughout Egypt. His lifelong training which some might attribute to a series of misfortunes was divinely navigated that allowed him to be known as a successful project manager.

Project managers gave their input concerning the importance of the pipeline of qualified individuals to staff future projects. They believed leaders should be concerned about this issue, since their support and input is critical to addressing the scarce resources. As this paradigm is essential to academia, it is just as important in Christendom with church leadership at the forefront of this subject. The Christian pipeline is about spiritual reproduction which involves discipleship of old and new believers. Jesus too was concerned about the pipeline as he remarked: "the harvest truly is great, but the laborers are few; pray ye, therefore, the Lord of the harvest, that he would send forth laborers into his harvest" (Luke 10:2). This is indeed a pipeline issue where there is an urgent call to the problem, which must start from the church leadership. Adding to the pipeline can be accomplished, one believer or one project at a time.

Recommendations for Action

Project managers need to ensure they possess the required number of qualified team members thereby averting a shortage, and achieving successful project completion. Hence, it is

critical to develop strategies which would assist these individuals in a four-year research university. These institutions are experiencing a shortage of qualified project personnel such as researchers, scientists, statisticians, engineers and analysts who contribute to the project's objectives (Hunter, 2012). Project managers who have experienced the effects of this shortage were interviewed for this research. Therefore, managers and academic leaders (e.g., chairs, deans, provosts, presidents) may benefit from these findings. Also, this study will be beneficial to other researchers, project managers, professional practitioners, and the community at large. The following actions are being recommended based on this study:

- Organizational leaders should offer project management training to expand the knowledge of project managers to effectively and efficiently manage project activities, specifically scarce resources.
- Devise programs geared to attract and encourage a more diverse pool of candidates, including females, to pursue degrees that are scientific and technical in focus, as research projects may benefit from these skilled individuals.
- Organizational leaders should offer compensation and benefits to attract and retain qualified individuals that are desperately needed to staff research projects; these qualified individuals are being drawn to other sectors, such as industry for higher compensation.
- Build an internal, but secure repository of scientific and technical personnel within the organization, available to project managers, which will be a helpful tool in solving the matching issue on projects.
- Expose students early to research, while encouraging them to pursue graduate education as these are antecedents for research project readiness.

- Hiring practices for qualified project personnel need to be less complex so the most suitable candidates may be identified sooner.
- Encourage project managers to collaborate on projects of various sizes and with diverse stakeholders, as this provides experiential knowledge that can be applied in multiple ways.
- Develop a mentoring program where a senior project manager offers guidance to lesser experienced managers, to avoid pitfalls, thereby increasing the success of project completion and delivery.
- Organizational leaders can use these findings to better prepare for research projects where teams are needed to be formed in an ad hoc manner when there are emergencies, for example, finding a cure for the zika virus. This is key as various sectors (e.g., government reach out to universities that have personnel with specific specialties when there are national emergencies). It will be the responsibility of these entities to secure the necessary personnel for the project.

Dissemination of research findings is an important part of the research process (University of Australia, 2014). Research activities supported by public funding are rarely considered complete until the results have been made widely available (University of Australia, 2014). The researcher plans to disseminate the study's findings, its applications and recommendations through the publication of journal entries, and through other modes of communication, including conferences, and public speaking.

Recommendations for Further Study

Research on worker shortage exists for other fields – aviation, healthcare, construction, and several areas of education; however, research about project managers experiencing a shortage of qualified project personnel in a four-year research university is scarce. The literature revealed

project management is not as pervasive in higher education. This is significant since research initiatives within universities are the basis from which many projects evolve. Hence qualified personnel employed on research projects are essential to the project within the university environment. Project managers in academia require workers who possess highly specialized skills critical for project research and meaningful for communities. The findings have revealed the shortage of these qualified individuals places the project in jeopardy of not being completed successfully. Therefore, continued study would be to perform a multi-case study in four-year research universities in other geographic regions. This would enable a broader perspective relating to the problem of qualified shortage. Moreover, multiple research methods could be performed to expand the existing findings and improve validity that could add further insight to the problem of shortage of qualified project personnel. The limitations of this were the geographical location and limited to one four-year research university in the southeast.

Another opportunity for study regarding the qualified project personnel shortage relates to specific specialized skills within research universities (e.g., individuals in computer science or biomedical research). Further studies to determine a set of strategies regarding recruitment and retention by project managers would be beneficial for informing on how to attract recent graduates with scientific and technical expertise to project research. The proposed topic for additional research may assist leaders to focus on factors that impact recruitment and retention of these specialized individuals.

Reflections

The DBA process was a rigorous and sometimes frustrating process, and at times it was overwhelming. It required discipline that led the researcher to this stage. This research topic was of interest to the researcher as she had limited insight into some of the challenges faced by project managers during their governance of research projects. The researcher believed having the

opportunity to interview these individuals would assist in increased knowledge and a deeper understanding of the problem. After studying about researcher bias, the researcher took mitigating steps to limit the impact of any bias. The participants' response showed ease and comfort with the interview process and they spoke candidly about their views. The research findings aligned with some of the literature's evidence regarding challenges experienced by project managers as it relates to qualified personnel shortage. Establishing accuracy of these findings included audio recorded interviews, transcripts, marginal notes, and the return of transcripts to all interviewees to determine accuracy. The validity of the research was established as the findings supported that qualified shortage of project personnel is a problem and it impacts project success.

The biblical principles relating to the handling of scarce resources is emphasized in the story about the widow at Zarephath (I Kings 17). This woman of unknown origin utilized these resources effectively by giving to the prophet who was able to multiply those resources perpetually. Project managers need to wisely consider the usage of scarce resources, then apply principles and tools for efficient utilization. This will result in the success of project completion and delivery to stakeholders.

Summary and Study Conclusions

Presented in this section were the findings, applications, and recommendations associated to the qualitative analysis of the data collected from the single-site case study about the shortage of qualified project personnel in a four-year research university. The findings addressed the two research questions: Why are four-year research university project managers experiencing a shortage of qualified project personnel? What actions could be taken by project managers to address a qualified project personnel shortage? Data were collected from project managers in a four-year research university who shared their views on the effects of the problem in their workplace and on their project activities. Examination of the data included audio-recorded

interviews, marginal notes, and transcripts that were returned to all interviewees to determine accuracy.

Employing triangulation in the examination of this single-site case study improved the reliability and validity of the study that led to recommendations and conclusions. One important conclusion of this study is the quality of the project is contingent on the type of individuals who are recruited to the project, since project managers pointed to having difficulty matching these individuals to tasks. In this situation, project managers may need to use McClelland's Theory of Needs, by focusing on the motivational aspect, as a means of attracting and retention of the suitable personnel. As was expressed in the findings, retaining these qualified individuals can be difficult as there are other lucrative options available to them. Another conclusion was academic leadership involvement is important in supporting project manager as they navigate these challenges, as leaders are key stakeholders to resolving this problem. The Path-Goal Theory, which is a leadership tool, is used to identify, analyze, solve, and effectively manage situational issues arising from either unfavorable external factor or follower characteristic. Conducting discussions to effectively solve these issues for project managers aids in the success of project completion. These were two of the theories which provided a conceptual framework that supported this study.

In summary, as this study revealed reasons why project managers are experiencing a shortage of qualified project personnel, it closes a gap in the professional practice related to worker shortage on projects, specifically in a four-year research university. The findings revealed that project workers are a critical means of accomplishing the project's objective. Therefore, having the suitable candidate for the specific project task will satisfy both the project and the project manager, and meet the sponsor's expectations. Hence, the result can aid in the delivery of a successful project.

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Appendix A: Participant Recruitment Email

Dear Project Managers,

As a graduate student in the School of Business at Liberty University, I am conducting interviews as part of my Applied Doctoral Research Project to explore the reasons why project managers in 4-year research universities in the Southeastern United States are experiencing a shortage of qualified project personnel such as researchers, scientists, statisticians, engineers, and analysts who contribute to a project's objectives, and I am writing to invite you to participate in my study. As a project manager with a scientific or technical background, you are an ideal candidate to provide firsthand information from your own perspective.

It you choose to participate, you will be asked to take part in a semi-structured in-person or telephone interview. Your responses to the questions will be kept confidential. The interview will take no longer than 30-40 minutes and will be conducted in an informal manner. Each interview will be assigned an alphabetical code (A1, B1 etc.) so that no personal identification is revealed during the analysis and detailing of findings. There is no compensation for participating in this study; however, your participation will be valuable to the research, and findings could lead to an understanding of the problem and add to the body of knowledge in the practice of business, specifically project management.

If you would like to participate in this study, please contact me at 404-385-7451 or francine.lyken@ipat.gatech.edu to suggest a date and time that is favorable to your schedule. Also, please sign the attached consent document and either email, mail to the address below, or present at the beginning of the interview. Thanks in advance for your willingness to participate.

Thank You,

Francine Lyken

Liberty University Doctoral Student
4103 Enclave Trail
Stockbridge, GA 30281

Appendix B: Participant Consent Form

Exploring a Project Management Dilemma: A Case Study Examining the Shortage of Qualified Project Personnel in 4-Year Research Universities

Francine Lyken
Liberty University
School of Business

You are invited to be in a research study that explores the perception of project managers who are employed in 4-year research universities and have to address the issue of a shortage of qualified project personnel. You were selected as a possible participant because you have been identified as a project manager with a technical and/or scientific background who has managed and worked with research project personnel. Please read this form and ask any questions you may have before agreeing to be in the study.

Francine Lyken, a doctoral candidate in the School of Business at Liberty University, is conducting this study.

Background Information: The purpose of this study is to explore the reasons why project managers in 4-year research universities in the Southeastern United States are experiencing a shortage of qualified project personnel such as researchers, scientists, statisticians, engineers and analysts who contribute to the project's objectives. This study will seek to understand project managers' perception about the specific business problem and the actions that could be taken by project managers to address the problem.

Procedures: If you agree to be in this study, I would ask you to do the following things:
1. Participate in a 30-40 minute semi-structured interview with open-ended questions designed to obtain information about your qualified project personnel shortage experience. Your responses will be kept confidential and findings will not reveal your identity.

Risks and Benefits of Participation: The risks involved in this study are minimal, which means they are equal to the risks encountered when going about one's daily activities. Participants should not expect to receive a direct benefit simply from participating in this interview.

Benefits to society include informing the work that is being conducted concerning the shortage of qualified project personnel in the research university setting.

Compensation: Participants will not be compensated for participating in this study.

Confidentiality: The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

- I will conduct the interviews in a location where others will not overhear the conversation. Some of the interviews will be conducted via phone conversation in a private location
- Interviews will be recorded on a digital device; this will be followed by the coding of the subject identifier. Consent forms will be locked in a desk that only the researcher has access to. The interviews will be erased from device, after a period of three years.

Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University, Georgia Tech, or Emory University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

How to Withdraw from the Study: If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you will be destroyed immediately and will not be included in this study.

Contacts and Questions: The researcher conducting this study is Francine Lyken. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at 678-895-2421 or fnlyken@liberty.edu. You may also contact the researcher's faculty advisor, Dave Duby, at dduby@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 1887, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please notify the researcher if you would like a copy of this information for your records.

Statement of Consent: I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS IRB APPROVAL INFORMATION WITH CURRENT DATES HAS BEEN ADDED TO THIS DOCUMENT.)

☐ The researcher has my permission to audio-record me as part of my participation in this study.

_____

Signature of Participant Date

_____

Signature of Investigator Date

Appendix C: Personal Interview Questions

1. Why are 4-year research university project managers experiencing a shortage of qualified project personnel?

a. What do you perceive are factors for the shortage of these qualified individuals?

b. Describe the severity of this problem on your research?

c. What has been your experience in finding qualified project personnel for your research?

d. What do you believe your school's leadership is doing about this qualified shortage?

e. How has academia contributed to ensuring that there is a pipeline of qualified researchers to lessen this shortage and to meet the needs of research projects?

2. What actions could be taken by project managers to address a qualified project personnel shortage?

a. How long have you been a project manager?

b. Have you led projects in other industries?

c. Do you hold a PMP or any other related project certification?

d. What is the largest team you have led?

e. How big is your department?

f. How do you perceive your role in addressing this challenge?

g. Have other project managers in your department/school expressed this problem to you? How are they addressing the problem?

h. Describe how funding affects this problem?

i. Are there plans that you are aware of in your school or on campus that seek to address this problem?

j. What do you think are some obstacles to resolving this problem?

k. What more could you do as a project manager to ensure you have this type of resource available to ensure that your projects are completed successfully?

l. Do you have any other comments that you would like to add?