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Engineering Leadership Competencies for Entry-Level Civil Engineers

Agha Bedar Bakht
Walden University

Walden University

College of Management and Technology

This is to certify that the doctoral dissertation by

Agha Bedar Bakht

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Dr. Daphne Halkias, Committee Chairperson, Management Faculty
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Chief Academic Officer
Eric Riedel, Ph.D.

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Abstract

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Agha Bedar Bakht

EMBA, Preston University, 2007

BS (Civil Engineering), UET, 1989

Dissertation Submitted in Partial Fulfillment

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Abstract

The general problem is that while technical engineering firms today require entry-level, full-time engineers to possess leadership skills, companies have failed to indicate which leadership competencies are most important in their recruitment and hiring process. This study's contributions could have implications for the long-term career prospects of engineers as well as the future outlook and sustainability of engineering companies. The specific problem is that various disciplines in the engineering profession, such as the construction sector, have yet to clearly define which leadership competencies are most important for the job market in their specific areas. Advancements in this regard are important for both entry-level engineers and engineering companies given the strong competition in local and international markets. The purpose of this qualitative study using a multiple case study design was to explore the views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. The study was framed by three concepts of engineering leadership. The research question was: How do the perceptions of managers in the construction industry establish a basis of leadership competencies most needed in the job market for entry-level civil engineers? Applying the knowledge gained from this inquiry has the potential for positive social impact by driving reforms in educational curricula and professional settings and with industry leaders to further the personal development of early-stage civil engineers, supporting their career success and the success of their companies.

Engineering Leadership Competencies for Entry-Level Civil Engineers: A Multiple Case Study

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Chapter 1: Introduction to the Study

Engineering leadership is essential in today's highly entrepreneurial market for engineers (Elia, Secundo, & Passiante, 2017; Weilerstein & Byers, 2016). According to statistics gathered in 2009, among engineering graduates, 21.4% of the class of 1954, 24.6% of the class of 1959, and 30.1% of the class of 1964 held a leadership role with oversight and decision-making responsibilities for innovation in products or processes and had one of the following titles: owner, managing director, chairman, executive vice-president, or president (Solymossy & Gross, 2015). Additionally, in today's volatile areas of the world where engineers of various disciplines, such as civil engineers in the construction industry (Back, Macdonald, & Grau, 2012; James, 2017), are regularly dispatched, leadership is paramount as a professional skill because the risks are high, time frames for action response are short, disaster management is essential, and resources can be highly limited (El-Sabek & McCabe, 2017; Kotnour, Hoekstra, Reilly, Knight, & Selter, 2014).

In this chapter, I provide insight on the potential impact and the challenges faced by engineers needing leadership and management skills upon entry into the job market, specifically within the construction industry. Firstly, this chapter presents the background literature leading into the need for the problem to be studied. I also present a description of the gap in the scholarly literature. Following is a presentation of a logical alignment between problem, purpose and research question, and conceptual framework of

the study. Finally, in this chapter I present the significance, assumptions, and limitations of the study, along with definitions of key terms used throughout this document.

Background of the Study

Farr, Walesh, and Forsythe's (1997) seminal paper was among the first to emphasize that leadership skills development for engineers was significant for an engineer's professional growth. In addition, the authors reflected on the importance of qualitative research methods to further study leadership development for engineering managers. This early perspective on engineering leadership incorporates perspectives of engineers in industry, human resource professionals, entrepreneurs, politicians, and interns, and it proposed a polyvocal definition of engineering leadership and practical implications for engineering leadership educators (Cox, Cekic, & Adams, 2010). Bergeron (2001) was among the earlier scholars who provided insight on the need to introduce engineering management to all engineering students. Bergeron also summarized research on leadership and management in engineering. Engineering leadership education has become increasingly popular over the past decade in response to national calls for educational change (Rottmann, Sacks, & Reeve, 2015).

Bonasso (2001) described an understanding of and summarized research on engineering leadership, providing insight on engineering, leadership, and an integral pedagogical philosophy for engineering education and engineering leadership. Challenges and opportunities in leadership and the new developments that are needed for engineering leadership can provide insight on the branding of engineering and its

challenges and opportunities (Baranowski, 2011). Bayless (2013) summarized the development of engineering along with the purpose and philosophical approach for developing engineering leadership skills in engineering students. Bayless also discussed the foundational approach to engineering leadership through enhancement of self-awareness and interpersonal communication.

Graham, Crawley, and Mendelsohn (2009) argued for the importance of engineering leadership education. Before and since then, various scholars have addressed international good practice in higher education focused on engineering leadership and its philosophical approach, as well as understandings of the fundamental approach of teaching leadership to engineering students. More specifically as pertaining to civil engineers, Cassin (2003) first suggested that leadership and communication in civil engineering drive innovation, productivity, and purpose for engineering students, and that leadership education needs to be a part of the general engineering curriculum. More research is needed on the perspectives of industry experts on required leadership, change, and synthesis skills among young engineers (Ahn, Cox, London, Cekic, & Zhu, 2014).

Problem Statement

The general problem is that while technical engineering firms today require entry-level, full-time engineers to possess leadership skills, companies have failed to indicate which leadership competencies are most important in their recruitment and hiring process (Hartmann, Stephens, & Jahren, 2016; Itani & Srour, 2016; Schuhmann, Magarian, & Huttner-Loan, 2014). Engineering leadership has been defined by scholars as including

the ability to motivate and equip people by being able to communicate clearly, manage and organize conflicts, foster creativity, display aptitude in technical tasks (Kotnour et al., 2014), have the ability to change, and being able to consider multiple team perspectives (Ahn et al., 2014). A recent study by Hartmann and Jahren (2015) conducted across the Midwestern United States indicated that less than 14% of companies hiring today's entry-level engineers included leadership in the job description, but nearly all indicated they want an employee with leadership skills and soft skills. When human resources departments of these engineering companies were questioned to identify how they define engineering leadership, less than 10% offered a definition on what leadership meant for their workplace (Hartmann & Jahren, 2015).

Engineering leadership is essential in today's highly entrepreneurial market for engineers (Elia et al., 2017; Weilerstein & Byers, 2016). According to statistics gathered in 2009, among engineering graduates, 21.4% of the class of 1954, 24.6% of the class of 1959, and 30.1% of the class of 1964 held a leadership role with oversight and decision-making responsibilities for innovation in products or processes and had one of the following titles: owner, managing director, chairman, executive vice-president, or president (Solymossy & Gross, 2015).

In today's volatile areas of the world where engineers of various disciplines, such as civil engineers in the construction industry (Back et al., 2012; James, 2017), are regularly dispatched, leadership is a paramount professional skill (El-Sabek & McCabe, 2017; Kotnour et al., 2014). While many universities across the United States are offering

leadership courses, minors, and certificate programs, more work is required to define by different engineering disciplines which leadership competencies are most important to companies hiring undergraduates for entry-level, full-time positions (Paul & Falls, 2015). Such contrasts in engineer hiring requirements do not offer engineering programs in higher education a standard set of training requirements in engineering leadership within the profession's various disciplines (MacIntyre, 2016; Schuhmann, 2010). Abdulwahed and Hasna (2017) and Hartmann (2016) reported that a literature gap exists in clearly defining engineering leadership by specific discipline, resulting in an ambiguous connection between theory, academia, and professional practice. The specific problem is that the various disciplines within the engineering profession, such as the construction sector, have yet to clearly define which leadership competencies are most important for the job market within their specific areas (Hartmann et al., 2016; Rottmann et al., 2015; Simmons, Clegorne, & Woods-Wells, 2017).

Purpose of the Study

The purpose of this qualitative study using a multiple-case study design was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. To address this gap and the research problem, I used a multiple-case study design to collect qualitative data from multiple sources, including interviews, peer quality audit, and engineering school curricula (Yin, 2017). I conducted triangulation of data sources to strengthen the

trustworthiness and robustness of the data analysis and findings on the central topic of the study (Guion, Diehl, & McDonald, 2011; Patton, 2014).

Research Question

RQ: How do the perceptions of managers in the construction industry establish a basis of leadership competencies most needed in the job market for entry-level civil engineers?

Conceptual Framework

This study is framed by three concepts of engineering leadership developed hieratically by Mallette (2005), Robledo, Peterson, and Mumford (2012), and Rottmann et al. (2015). Mallette (2005) originated the conceptual framework of engineering leadership, and Robledo et al. (2012) and Rottmann et al. (2015) each further extended the framework by building upon previous studies. The purpose of this qualitative study was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers.

A study by Robledo et al. (2012) considered engineers' work by integrating the five stages of creative projects: scanning, elaboration, development, appraisal, and implementation (Mumford, Scott, Gaddis, & Strange, 2002) into a flow chart. Their model focused on three key vectors where engineers and scientists have an impact: group, work, and organization. Although the model is procedurally dense, it is in effect conceptually weak as it does not define engineering leadership (Rottmann, Reeve, Sacks, & Klassen, 2016). Finally, Rottmann et al. (2015) used qualitative data with engineers to

distinguish three orientations to engineering leadership: technical mastery, collaborative optimization, and organizational innovation. While Rottmann et al.'s (2015) grounded theory conceptualizes leadership from the perspective of engineers, however, this framework leaves a knowledge gap on how to connect engineers' actual roles on the job to definitions of engineering leadership presented in the literature up to now (Rottmann et al., 2016). This study aimed to fill this conceptual gap by gathering data in the field from managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers.

Nature of the Study

The nature of this study was qualitative to address the purpose of the study and provide data for the central question that drove this research drawn on an interpretivist paradigm, based on the assumption that people and groups construct their own social reality (Denzin, 2002). The relativist ontology leads researchers to search for a different perspective on a research question and the subjectivist epistemology presumes that people cannot separate themselves from their own personal knowledge. Interpretivists also assert that perspectives of others are embedded in biographical, organizational, and social contexts that are meaningfully connected from their interpretation of a social phenomenon (Rolfe, 2006).

I used an exploratory multiple case study as the research design for this study given that the study purpose called for a deeper understanding of engineering leadership competencies most needed in the job market for entry-level construction engineers by

exploring the views of managers in the construction industry (Yin, 2017). The research problem and the nature of the study required a qualitative methodology because I needed to explore in a brief manner a problem that is involved in a complex social process (Merriam & Tisdell, 2015). Qualitative research also presents opportunities that describe how to analyze business decisions and how to explore the reasons behind various aspects of behavior within organizations. Qualitative sampling strategies include purposeful sampling, which ensures an in-depth understanding of a case study's collected data (Klenke, 2016).

Qualitative case studies contribute critical knowledge to the field of business research and practice, and they necessarily deal with quantitative data and methods (Klenke, 2016). Case studies are widely used in business to trace efforts and successes of various companies in multiple fields. A multiple case study investigating a social phenomenon can involve individuals living within a social context as separate units of study (Yin, 2017). This design allows for comparing and contrasting data within and between cases (Eisenhardt & Graebner, 2007; Yin, 2017).

Definitions

Civil engineer: A civil engineer is a professional who deals with design, construction, environment, and maintenance, including construction of roads, bridges, canals, dams, and buildings, and who observes organizational context, carries out observations, has concrete experience, has vision of a building project, and can be employed in either the public or private sector (Stevens & Vinson, 2016).

Construction industry: This term refers to a sector of the national economy engaged in reparation of land and construction and alteration and repair of buildings, structures, and other real properties. There are five specific construction trends noted in this industry today, and these are: (a) lack of qualified workers, (b) offsite/modular construction, (c) implementing more technology, (d) a growing economy, and (e) the Internet of things. The construction industry plays an important role in regard to cost saving, worker safety, operational efficiencies, and leadership initiatives in this business sector (Hartmann & Jahren, 2015).

Engineer: This term refers to a person who, regarding the system, material, safety, regulations and cost, invents, designs, analyzes, discovers, and builds the machine. A 4-year degree is required to be called an engineer, with specializations such as civil, electrical, and mechanical.

Engineering leadership: This term refers to the ability to motivate and equip people on an engineering team and to communicate clearly, manage and organize conflicts, and foster creativity and aptitude in technical tasks (Kim, 2014).

Leadership competencies: This term in the engineering field refers to leadership-related attributes that have been correlated with people skills that are important for engineers beyond technical knowledge and decision-making skills. These these are: (a) communication; (b) motivation and negotiation; (c) self-confidence; (d) reliability; (e) maturity and emotional stability; (f) a constructive, positive attitude; and (g) flexibility and tolerance for ambiguity and uncertainty (Abdulwahed & Hasna, 2017).

Soft skills: This term refers to a set of abilities not as quantifiable as technical skills. Soft skills include competency in the areas of communications, conflict resolution and negotiation, problem solving, team building, personal effectiveness, strategic thinking, influence, and so forth. (Hartmann, 2016).

Assumptions

One key assumption in this study was that participants could be interviewed regarding their experiences, knowledge, perceptions, and views on the topic being explored. There was a consideration of the depth and quality of the data taken at the time of the interviews as well as dependent points of view. A second assumption was that participants would respond to the interview questions with honesty and transparency. Another assumption was that I would accurately transcribe each digitally recorded interview and capture the participants' intended meaning and perception of every issue at the time of the research. I used NVivo (Version 10)—a type of computer-assisted qualitative data analysis software—for the analysis and response as well as extracting results of the data, which provided a meaningful framing of the relevant themes that supported the narrative findings and results of this research.

Scope and Delimitations

The scope and delimitations are relevant to the research problem of companies failing to indicate which leadership competencies are most important in their recruitment and hiring process for entry-level civil engineers in the construction industry (Hartmann et al., 2016; Itani & Srour, 2016; Schuhmann et al., 2014). I chose this problem upon

review of the literature and reviewing a study by Hartmann and Jahren (2015) conducted across the Midwestern United States indicating that less than 14% of companies hiring today's entry-level engineers included leadership in the job description but nearly all indicated they want an employee with leadership skills and soft skills. Additionally, less than 10% of human resource departments in these companies offered a definition on what leadership meant for their workplace (Hartmann & Jahren, 2015). Abdulwahed and Hasna (2017) and Hartmann (2016) reported that a literature gap existed in clearly defining engineering leadership by specific discipline, resulting in an ambiguous connection between theory, academia, and professional practice.

I did not interview construction industry managers who had less than 5 years' experience. I established this limit so as to ensure data was collected only from individuals with enough experience, knowledge, and adequately formed insights into the needs of the industry regarding leadership competencies most needed in the job market for entry-level construction engineers. Additionally, I did not pose questions that related to shortcomings in leadership competencies of construction engineers who are not considered entry level. This is because construction engineers who have already been in the industry for some time may have already acquired on-the-job experience, so perceptions of construction industry managers regarding such individuals would not have added to the particular scope of this study's investigation.

I conducted 10 in-depth, face-to-face individual interviews with construction industry managers and explored their views on leadership competencies most needed in

the job market for entry-level civil engineers. I used purposeful criterion and snowball sampling strategies and screened participants with the following inclusion criteria: (a) adults over the age of 18, (b) 5 years' minimum experience in the management of a construction company, and (c) possessing knowledge regarding leadership competencies most needed in the job market for entry-level construction engineers (Patton, 2014).

The scope of transferability of this research, framed by three concepts of engineering leadership developed hieratically by Mallette (2005), Robledo et al. (2012), and Rottmann et al. (2015), was determined where results were comparable or applicable to other similar contexts using the qualitative research design of multiple case study (Merriam & Tisdell, 2015). Transferability refers to the potential for extrapolation and relies on the reasoning that findings can be generalized or transferred to other settings or groups (Lincoln & Guba, 1985). I followed recommendations by Stake (2006) on showing transferability of multiple case study findings to identify the research significance of my results as they contribute to the study's conceptual framework.

Limitations

In this multiple case study, I considered a key limitation to be those participants who could not afford to donate the time to contribute their views on the phenomenon of the study. I did my best to mitigate this effect by managing and accommodating the participants' time limitations in scheduling the interviews (Patton, 2014). In addition, the purposeful sampling approach was applied to counter this bias through the selection of opposing views, but this was a significant limitation in this study. Researcher bias was

mitigated with the use of an audit trail, transcripts of digital recordings, and member checking to strengthen the credibility of the study results. A similar limitation was the relative novelty of the phenomenon under study in terms of the participants' knowledge. This limitation was mitigated by strictly adhering to the participant inclusion and exclusion criteria. Additionally, preinterview questions were asked to ensure as much as possible that participants had in-depth knowledge of the topic under study before the actual interview began (Merriam & Tisdell, 2015).

Finally, as in all qualitative case studies, transferability of results to the general population is always a limitation. To determine transferability, the original context of the research was clearly described in detail so sound judgments could be made about the results (Klenke, 2016). I developed detailed descriptions so that I could make an informed decision about the transferability of the findings to their specific contexts (Lincoln & Guba, 1985; Stake, 2006). To mitigate this limitation as much as possible, I diligently created "thick" descriptions, including accounts of the context, the research methods, and examples of raw data (Stake, 2006). Graneheim, Lindgren, and Lundman (2017) recommended that the multiple case study's audience will decide whether the study findings are transferable to another context.

Significance of the Study

This study was important because it addressed an underresearched area concerning engineering leadership and may offer a deeper understanding of the daily lives and experiences of those engaged in engineering leadership. Baranowski (2011)

described and summarized the challenges and opportunities in leadership and the new developments that are needed for the purpose and philosophical approach. The author also assessed the engineering leadership goals and provided insight on the branding of engineering, and challenges and opportunities. The author also endeavored to highlight what types of challenges and opportunities exist for engineering leadership, which is summarized in the background of the problem statement.

Bayless (2013) discussed the development of engineering leadership skills, positing a fundamental approach to engineering leadership education. Bergeron (2001) discussed the implications for workplace inequities that must be addressed and provided insight into the need to introduce engineering management to all engineering students. Engineering leadership education has become an increasingly popular subject of inquiry over the past decade in response to national calls for educational change (Rottmann et al., 2016).

Significance to Practice

The need for engineers to learn leadership skills has been on the national agenda of the National Academy of Engineering (NAE) in two reports (NAE, 2004, 2005). NAE (2004) stated that entry-level engineers "must understand the principles of leadership and be able to practice them in growing proportions as their careers advance" (p. 56). In the face of such professional pressures on today's engineers, no one definition of engineering leadership exists to guide academic programs in engineering on the nature of course offerings in engineering leadership (Hartmann et al., 2016; Rottmann et al., 2015). This

study has the potential to contribute to practice by filling this knowledge gap and offering recommendations for practice to civil engineers entering the job market as well as their professors and trainers.

Significance to Theory

In an emerging body of theoretical literature, more research cites the need to introduce engineering management and leadership skills to all engineering students. While Rottmann et al.'s (2015) grounded theory study conceptualizes leadership from the perspective of engineers, this framework leaves a theoretical gap on how to connect engineers' actual roles on the job to definitions of engineering leadership presented in the literature to date (Rottmann et al., 2016). This study's research significance was focused on contributing original, qualitative data from managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers, and to that end I used a constructivist lens to fill the theoretical gap identified in Rottmann et al.'s (2016) study.

Significance to Social Change

Social change takes place in any community when there is a compelling need, and this is especially the case with engineering education (Rottmann et al., 2016; Warrington, Kulacki, & Warrington, 2011). By recruiting engineers with leadership qualities in a professional project, a project's stakeholders such as investors, clients, and patients are more likely to feel the positive impact of a successful project. Projects can also progress

more smoothly and efficiently, achieving positive results in less time with competent engineers educated in leadership at the helm (Warrington et al., 2011).

Summary and Transition

In this chapter I provided a description of the alignment of the literature review, the problem, and purpose of the study. The research question was guided by the conceptual framework, followed by the significance, assumptions, and limitations of the study and definition of key terms used throughout this document. This chapter also provided insight on the potential impact and the challenges faced by engineers needing leadership and management skills upon entry into the job market, specifically in the construction industry.

In Chapter 2, I present a detailed literature review that explains the leadership competencies that are most important to companies hiring undergraduates for entry-level, full-time positions (Paul & Falls, 2015). In the literature review I explore topics of engineer hiring requirements and engineering programs in higher education with a leadership emphasis in the profession's various disciplines. The gap in the literature on defining engineering leadership by specific discipline, and the ambiguous connection between theory, academia, and professional practice on this topic, are clearly identified and presented.

Chapter 2: Literature Review

While many universities across the United States are offering leadership courses, minors, and certificate programs, more work is required to define by different engineering disciplines which leadership competencies are most important to companies hiring undergraduates for entry-level, full-time positions (Paul & Falls, 2015). Engineering programs in higher education often do not take into consideration contrasts in engineer hiring requirements when offering a standard set of training requirements in engineering leadership across the profession's various disciplines (MacIntyre, 2016; Schuhmann, 2010). Abdulwahed and Hasna (2017) and Hartmann (2016) reported that a literature gap exists in clearly defining engineering leadership by specific discipline, resulting in an ambiguous connection between theory, academia, and professional practice. The specific problem addressed in this study was that the various disciplines in the engineering profession, such as the construction sector, have yet to clearly define which leadership competencies are most important for the job market in their specific areas (Hartmann et al., 2016; Rottmann et al., 2015; Simmons et al., 2017). The purpose of this qualitative study was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers.

Literature Search Strategy

The purpose of a narrative literature review was to summarize knowledge from previously published research on engineering leadership to provide the reader with a comprehensive overview that helps place that information in perspective (Green,

Johnson, & Adams, 2006). Such an approach allows for a broad perspective to be presented on the topic of engineering leadership. The decision to undertake a narrative approach to the synthesis of knowledge was influenced by the diversity of literature in the area, which resulted in a lack of homogeneity in terms of methodological approaches adopted, theoretical underpinning, context, participants, outcomes, variables, and quality (El-Sabek & McCabe, 2017). In this review of the research, the scholarly literature has been organized to offer a wide perspective on the daily lives and experiences of those engaged in engineering leadership.

The articles and materials used in this research came primarily from scholarly peer-reviewed journals. I used the Walden University research library and other library databases and search engines to conduct the literature search. Databases included ProQuest, Google Scholar, Academic Search Premier, Business Source Complete, LexisNexis Academic, PsycARTICLES, SocINDEX with full text, eBrary e-book collections, Franklin University Library, Net Library, and PsycBOOKS. The literature review focused on the last 5 years to ensure analyses of the most recent articles. The key terms used were: *civil engineer, construction industry, engineer, engineering leadership, leadership competencies,* and *soft skills*. Various key terms were coupled together in a search to see if additional results offered new sources. The combined search terms included *civil engineer and leadership, engineer and leadership competencies, engineer and soft skills,* and *construction industry and leadership*. The search strategy involved using all these terms and the various combinations of terms in all the databases noted

above. This approach returned ample sources of literature to identify peer-reviewed articles on the topic and confirmed the rationale for this study.

A review of engineering leadership literature was very important given that engineering leadership is identified as a significant requirement by recruiters of entry-level engineers (Hartmann, 2016).

Conceptual Framework

This study was framed by three concepts of *engineering leadership* developed by Mallette (2005), Robledo et al. (2012), and Rottmann et al. (2015). Mallette (2005) originated the conceptual framework of engineering leadership, and Robledo et al. (2012) and Rottmann et al. (2015) each further extended the framework by building upon previous studies. The purpose of this qualitative study was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. Baranowski (2011) described the challenges and opportunities in researching leadership and the new developments that are needed for investigating engineering leadership.

Mallette (2005) drew on 30 years' experience in the aerospace industry to construct a leadership style best suited to the management of engineers. He called this style "Theory Pi" and contrasted it with "Theory X" and "Theory Y." Theory Pi grew out of transformational and transactional leadership theories. Theory Pi is built on Mallette's conception of engineers as individuals who are motivated by tasks, respond well to hands-off leaders with expert technical knowledge, resolve conflicts through logical

reasoning, and expect their job performance to be based primarily on the quality of their final products. Mallette's study produced a set of recommendations for managers of engineers rather than a theory of engineering leadership, and he referred to engineers as laissez-faire leaders (Singh & Jampel, 2011).

In the face of numerous and varied professional pressures on today's engineers, no one definition of engineering leadership exists to guide academic programs in engineering on the nature of course offerings in engineering leadership needed to meet job market requirements (Hartmann et al., 2016; Rottmann et al., 2015). Engineering leadership also has implications for workplace inequities that must be addressed to bring about social change in the profession (Bergeron, 2001). In an emerging body of literature, scholars are focusing on the need to introduce engineering management and leadership skills to all engineering students. Engineering leadership education has become increasingly popular over the past decade in response to national calls for another type of social change: educational change in the sciences and technology professions (Rottmann et al., 2016). While Rottmann et al.'s (2015) grounded theory conceptualizes leadership from the perspective of engineers, this framework leaves a knowledge gap in terms of connecting engineers' actual roles on the job to definitions of engineering leadership presented in the literature to date (Rottmann et al., 2016). This study was aimed at filling this conceptual gap by gathering data in the field from managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers.

Literature Review

Varying Definitions of Engineering Leadership

The topic of engineering leadership has become very important in today's highly entrepreneurial market for engineers (Elia et al., 2017; Weilerstein & Byers, 2016). Engineering leadership has also become legitimate in the field of engineering, especially in academic inquiry. Engineering leadership knowledge is in high demand and is categorized into five streams: (a) a call for engineers to accept leadership roles, (b) engineering leadership programs, (c) competency-based depictions of effective engineering leaders, (d) empirical studies of engineering leadership in industry, and (e) conceptual examinations of leadership from an engineering perspective. All streams are linked in undergraduate education, with competencies based on the depictions of effective engineering leaders and research studies of engineering leadership in industry. A survey conducted in 2009 showed that from among engineering graduates, 21.4% of the 1954 class, 24.6% of the 1959 class, and 30.1% of the 1964 class had a leadership position as president, executive vice president, chairman, owner, or managing director, all charged with oversight and decisions related to innovation in products or processes (Solymossy & Gross, 2015).

In the engineering leadership literature, Bergeron (2001) and Kirschenman (2011) described that at the practical level all engineers in industry need to learn how to lead in order to respond to the management challenges that arise from time to time. Engineers need to be prepared for the leadership responsibilities inherent in an increasingly

globalized economy. In engineering leadership, it is of utmost importance that engineers come forward as leaders to realize their full potential for service to society (NAE, 2004; Pierson, 2013; Simpson, Evans, & Reeve, 2012). Additionally, given that engineers of various disciplines (e.g., civil engineers in construction) are often employed in volatile areas across the world (Back et al., 2012; James, 2017), leadership is an essential skill considering high risks, short response times for necessary action, need for disaster management, and constrictions on resources (El-Sabek & McCabe, 2017; Kotnour et al., 2014).

Engineering leadership program descriptions are the most prevalent type of literature on engineering leadership. They are relevant for the different audiences that facilitate the advancement of professional engineers in industry, especially national and state policymakers in higher education and professional engineers who are affiliated with official related associations and regulatory bodies as well as the education sector (Rottmann et al., 2016). In the engineering leadership literature, few researchers have conducted program evaluations across institutional contexts (Froyd, 2005; Graham, 2009; Graham et al., 2009). Much research in the field of engineering leadership offers nonempirical descriptions of program and curricular initiatives in three prominent foci of engineering leadership programs: entrepreneurship and innovation (Hsiao, 2013; Soundarajan, Ramnath, & Weide, 2013), personal and professional growth (Colcleugh & Reeve, 2013), and global citizenship (Ellis & Petersen, 2011; McMartin, 2013). The first

two involve skill building and industry partnerships, while the third concentrates on international mobility and service learning projects in the global south.

For the most part, faculty members, instructors, and industry partners have used a wide range of instructional strategies to engage engineers in leadership education and to assess students' development as leaders, including (a) direct instruction of leadership skills and traits (Bayless, 2013; Passow, 2012), (b) problem-based learning (Cain & Cocco, 2013), (c) case studies (Gheorghe, Hodgson, & Van der Loos, 2013), (d) grand challenges curricula (Kalonji, 2005), (e) reverse engineering (exploring design identity through a "reverse engineer") and improving values elicitation activity (Foster & Sheridan, 2013), (f) experiential education (Osagiede, Cox, & Ahn, 2013), (g) formative peer assessment (Sheridan, Reeve, & Evans, 2012), (h) capstone projects (Bishop, 2013), and (i) team effectiveness inventories (Sheridan, Reeve, & Evans, 2014). The extent to which these strategies support the development of effective engineering leaders has not yet been determined, but the wide range of foci, program structures, institutional locations, and instructional strategies developed by engineering educators has certainly diversified the curricular and noncurricular offerings in many North American institutions of engineering (Rottmann et al., 2016).

In another research stream, literature reviews comprise the competency-based depictions of effective leaders communicated to an audience of engineers. Farr et al. (1997) were the first to outline the leadership qualities important for engineers, including good communication, having a mission that matters, using power wisely, and being a

decision-maker, big thinker, team builder, risk taker, master of change, and ethical and courageous (Farr & Brazil, 2009). More recently, Goodale (2005) proposed a set of traits (courage, influence, sincerity, pride, adaptability, honesty, and competence) and leadership skills (communication, team building, visionary, mentoring, problem solving, delegation, and management) that, albeit generated in a business context, are applicable to engineers in the interest of improved exposure. These two sets of attributes may be linked to effective engineering leadership, but it is not clear how the authors methodologically arrived at their lists or how they factored engineering into their research (Rottmann et al., 2015). Engineers themselves have advanced other lists, keeping engineers in mind, proposing five qualities of engineering leaders relevant to the construction industry and covering integration, innovation, distinguishing between important and trivial matters, intensity, and integrity (Ivey, 2002). In addition, Pitts, Klosterman, and McGonagle (2013) identified 14 leadership capabilities deemed by industry partners to be important for an intensive engineering leadership program: initiative, decision-making, responsibility and urgency to deliver, resourcefulness, ethical actions and integrity, trust and loyalty, courage, vision, realizing the vision, inquiry, interpersonal skills, communicating and advocacy, connecting, and negotiating and compromise.

Engineering leadership literature includes the fewest publications in the leadership field. Rather than accepting leadership standards from other disciplines for engineers, researchers such as Mallette (2005) and Rottmann et al. (2016) studied

leadership from an engineering perspective. Drawing from 30 years' of experience in aerospace, Mallette (2005) advanced "Theory Pi," a leadership style best adapted to the management of engineers. In contrast to "Theory X" and "Theory Y," Mallette developed Theory Pi by building on transformational and transactional leadership theories as well as his perception that engineers are people motivated by tasks, who respond well to hands-off leaders having expert technical knowledge, who use logical reasoning to resolve conflicts, and who expect that job performance be primarily based on the quality of their delivered product. Mallette offered a list of recommendations for those managing engineers, whom he regarded as laissez-faire leaders, as opposed to a theory of engineering leadership (Singh & Jampel, 2011).

Engineers in industry have identified three orientations to engineering leadership, namely technical mastery, collaborative optimization, and organizational innovation (Rottmann et al., 2015). While the grounded theory study by Rottmann et al. (2016) approached leadership from the view of actual engineers, the work still failed to connect the varied roles of engineers with an official engineering leadership definition. There remain unanswered questions in the literature and academic inquiry regarding educational improvement in undergraduate programs focused on engineering (Rottmann et al., 2016).

The Nature of Engineering Leadership

While many universities across the United States offer leadership courses, minors, and certificate programs, more work is required to define by different engineering disciplines which leadership competencies are most important to companies hiring

undergraduates for entry-level, full-time positions (Paul & Falls, 2015). Such contrasts in engineer hiring requirements do not offer engineering programs in higher education a standard set of training requirements in engineering leadership within the profession's various disciplines (MacIntyre, 2016; Schuhmann, 2010). Abdulwahed and Hasna (2017) and Hartmann (2016) reported that a literature gap exists in clearly defining engineering leadership by specific discipline, resulting in an ambiguous connection between theory, academia, and professional practice.

Leadership has been studied since the beginning of civilization, and there are many definitions and theories of leadership that have evolved over time. Engineering leadership programs provide the skills to undergraduate engineering students with formal training and a credential in complementary performance skills necessary for success in today's workplace. Engineering leadership has been defined by scholars as including the ability to motivate and equip people by being able to: (a) communicate clearly, (b) manage and organize conflicts, (c) foster creativity, and (d) have aptitude in technical tasks (Kotnour et al., 2014). There is a need for leadership education to be infused into the undergraduate engineering curriculum and include engineering soft skills within the Gulf Corporation Council (GCC) area demands and Accreditation Board for Engineering and Technology (ABET) requirements (Yaacoub, Husseini, & Choueiki, 2011).

Role of self-awareness and communication in engineering leadership. In engineering leadership there are important points that need to be considered in terms of self-awareness and communication because there is a continuous change in the global

economic landscape as well as in the area of communication. In their research, Itani and Srour (2016) noted that while they found some students believed engineers easily make the shift from a technical to a managerial position, others expressed an awareness of the lack of communication skills among engineers. In these modern-day changes of the 21st century, an engineer needs to follow strategies that enable them to be an individual contributor to engineering programs as well as on engineering projects. In engineering leadership there is mostly need for engineering skill that is very important regarding the engineering business as well as in the competitive engineering market (Itani & Srour, 2016). These researchers found that students were aware that engineers frequently changed jobs in today's market, making several career changes before deciding on a final career path. The results of their study also strongly showed that students do not possess enough confidence especially in regards to entrepreneurial abilities and skills. This underlines the need for universities to more actively provide student engineers with the skills needed to grow beyond employment positions at companies and have the confidence to work toward launching their own professional ventures (Itani & Srour, 2016). In engineering leadership the scope of the professionalism and decision-making skill has a viable role (Zaharim et al., 2010). While there is literature underlining the importance of soft skills for engineering graduates, more is needed on the specific topic of self-awareness beyond awareness of trends in the construction industry relevant to business and hard skills (Yaacoub et al., 2011).

In addition to the engineering leadership literature, an important report by Katz (1993) supported that engineering students should focus on a narrow view in entry-level engineering jobs, which leads them to better engineering leadership as well as enhanced communication with good experience of languages and with proficiency (Ismail, Hassan, Masek, Nordin, & Jalani, 2017). In the ABET criteria, engineering schools need to address issues that are encountered in multidisciplinary teams (Kraisuth & Panjakajornsak, 2017). In engineering leadership, clear and precise communication is very important for managers, peers, presentation, business writing skill, and cultural communication, playing an important role in all areas of engineering leadership as well as relevant program curricula (Rottmann et al., 2016). In addition, communication is very important in global businesses for successful leadership (Kirschenman, 2011). In engineering leadership, management skill is also very important for managers. In many universities engineering leadership skills are improved through training on project management, personal, and organization skills, which always benefits the students toward the scope of a team's work skills, confidence, motivation of transformational and transactional leadership skill in the real engineering business in their future place of employment (Rottmann et al., 2016).

Leadership Practices among Entry-Level Engineers

Engineering leadership in the organizational setting. Engineering leadership is based on the clear theoretical work of Rottmann et al. (2015), stating that engineering leadership is based on grounding leadership theory, especially in engineers in whom

professional identities have been identified. Engineering leadership is influenced by three distinct orientations to leadership: technical mastery, collaborative optimization, and organizational innovation. Building on this, Klassen, Kovalchuk, Reeve, and Sacks (2017) developed a framework that highlights how engineers express these orientations, in varying degrees over the course of their careers, as a result of their personal learning, mobility, and changing roles in their organization. A survey by Reeve, Rottmann, and Sacks (2015) of 175 engineers revealed that the majority of those with up to 2 years of experience had stronger orientation toward collaborative optimization. This contrasted with the Klassen et al. (2017) study that evidenced more focus on technical mastery. The most recent research of Rottmann et al. (2016) on engineering leadership shows how engineering leadership is viewed differently depending on who is perceiving it.

Engineering leadership across organizational locations. An in-depth single-case study by Alvesson and Jonsson (2016) of a middle manager in a large, international manufacturing company presents helpful perspectives on the practice of engineering leadership. Following 10 interviews and 8 observations of the manager in meetings, the authors found evidence challenging dominant perceptions of leadership that are based on "assumptions of coherence, integration, context and direction" (Alvesson & Jonsson, 2016, p. 13). The research revealed fragmentation between the manager's ideas and practice of leadership and striking differences between believed leadership meanings and their real application in practice. While this research deepens understanding of leadership, its focus on an engineer in a leadership position does not offer more regarding

how leadership develops in the early stages of a career (Klassen et al., 2017). Such studies point to which engineering leadership orientations to search for in engineers, support that leadership is not a fixed concept, particularly for engineers, and underline that even one person can have opposing perspectives regarding their own leadership. There is a need to delve deeper than the basic patterns that emerge from such research — e.g., that early-career engineers prefer collaborative optimization behaviors and that interns do not view themselves as leaders — and focus specifically on early-career engineers (Klassen et al., 2017).

Recruiting for and hiring engineering leadership. Another strand of research in the literature on engineering leadership explores hiring and recruitment practices of engineering companies. Based on an analysis of job descriptions and interviews with staff responsible for hiring at engineering companies, Hartmann and Jahren (2015) identified five themes for leadership among early-career engineers: initiative/confidence, communication, interpersonal interactions, teamwork, and engagement. Hartmann and Jahren followed up on their findings and developed an instrument validating the themes in an effort to better understand the industry's needs for entry-level engineering positions in the field of engineering management. Hartmann and Jahren (2015) found that human resources practitioners clearly preferred behaviors falling into the first three themes — i.e., initiative/confidence, communication, and interpersonal interactions. The authors noted that limitations of the study include the small sample size and number of interviews. This restricted their ability to explore more in-depth certain themes that

emerged but were only mentioned by a few study participants. Notwithstanding, the small sample size did make it possible for the researchers to fully explore the information and emerging themes and gain a deeper understanding of the data gathered (Eisenhardt & Graebner, 2007; Yin, 2017).

Handley, Lang, and Erdman (2016) conducted a study that explored the perspectives of on-campus recruiters searching for leadership among final-year engineering students. They found that recruiters were looking for students who were involved in nonclassroom-related activities and who could articulate what they had learned gained from their experiences in these activities. Three engineering leadership themes emerged from this research: communication, connection, and confidence. While the studies of Hartmann and Jahren (2015) and Handley et al. (2016) offer insight to employers' perspectives regarding the leadership qualities and behaviors they look for in entry-level engineers, they do not offer insight into the perspectives of engineering graduates per se. Further, they only consider expected displays of leadership as opposed to real-world practice (Klassen et al., 2017). After their recruitment and hiring, engineers must necessarily adjust to their new professional setting and the demands of both their new position and the organization. There is ample literature on this topic with important insights relevant and applicable to leadership in the construction industry and thus also the leadership competencies most needed in the job market for entry-level civil engineers.

Engineers' adjustment and socialization in the workplace. Some key studies have been conducted on workplace adjustment and socialization of engineers in the early

stage of their careers. Korte (2009) studied the experiences of 30 engineers who were new hires at a large manufacturing organization. Findings revealed that the main driver of socialization and adaptation to the workplace were relationships with colleagues and that the main context for this was the new hires' immediate work group. This is in contrast to some core assumptions held in organizational sociology, which emphasizes organizational structures and the agency of formal line managers. However, Korte's (2009) work aligns with research by Ashforth, Sluss, and Saks (2007), both contributing variables from models of organization socialization, including behaviors such as seeking out information as well as feedback and relationship building. These findings underline the importance of proactive behavior and building relationships for successful workplace transition (Klassen et al., 2017).

A review of studies in the areas of interest discussed in this section highlights the need for more research on the kind of leadership development that takes place among early-career engineers (Klassen et al., 2017). While there are some frameworks and thematic areas that offer good starting ground, Klassen et al. (2017) advanced their own conceptual framework to make sense of the various aspects and dimensions of leadership, taking care not to be overly prescriptive or narrow. Considering Alvesson and Jonsson's (2016) point that even one person's beliefs surrounding leadership can contradict how they actually practice, Klassen et al.'s framework centers on three key perspectives: "an individual's *conception* of leadership, the *opportunities* for them to enact leadership, and the actual leadership *behaviours* they display" (2017, p. 3). The first perspective relates to

the understood definitions or mental models that frame how individual engineers see the world and guide them in their beliefs on what leadership is and is not (Northouse, 2009). Klassen et al. (2017) used Northouse's (2009) definition of leadership as a process in which one person influences other people to realize a common goal. They also used Rottmann et al.'s (2015) three orientations to engineering leadership, which can shed light on both leadership conceptions and behaviors. This approach supported the framework's perspective on leadership behaviors, which are viewed as actions taken by individual engineers that can be observed and which influence change. Early-career engineers may display behaviors that others interpret as leadership but which they themselves may not see as leadership. For coding, Klassen et al. (2017) applied Hartmann and Jahren (2015) and Hartmann et al.'s (2016) five engineering leadership themes, adding to this by coding for the proactive behaviors noted by Ashforth et al. (2007). The third perspective, opportunities, has to do with those roles, situations, and tasks that individuals deem to be relevant contexts for practicing leadership. For this particular perspective, Klassen et al. (2017) built on research by Ibarra (1999, 2015) to investigate ways in which engineers in the early stage of their careers can set up opportunities for themselves. Ibarra's approach supports that leaders are best developed when they first create opportunities to test new behaviors and roles and then work on their identity as a leader. Klassen et al.'s (2017) framework of leadership conceptions, behaviors, and opportunities provides a means of conceptualizing leadership among early-career engineers and the ability to recognize when these individuals may be displaying

leadership behaviors without actually perceiving them as such in accordance with their definition of leadership.

Soft Skills Training in Engineering Programs

While engineers are still considered mainly technical contributors, the nature of their work in today's marketplace calls for skills beyond technical know-how gained through studies and professional experience (Itani & Srour, 2016). To compete in and meet the demands of the postindustrial world, employers require that engineers have soft skills related to management, teamwork, communication, and entrepreneurship. Without such a set of matching nontechnical skills, effectively mental tools, engineers find it hard to make an impact or progress in their profession. However, formal engineer education and training programs are often lacking in this area (Bradford, 2017; Willmot & Colman, 2016).

To address this gap and better meet industry expectations, ABET's most recent update, in 2014, to accreditation criteria for engineering programs includes a set of soft skills to complement traditional technical skills training (Itani & Srour, 2016). The updated criteria address the gap between the skills engineers are taught at university and industry expectations of skills entry-level engineers should have. As a result, universities are increasingly making the move to expose engineering students to soft skills. However, challenges remain in incorporating them in engineering programs as faculty are hard-pressed to balance the various curriculum demands (Siller, Rosales, Haines, & Benally, 2009). As a result, although many recognize the need to align engineering curricula with

ABET criteria, these programs are still characterized by a heavy imbalance between technical and nontechnical skills training (Kaushal, 2016).

Changing dynamics in the global economy and rising demand for communication and collaboration beyond borders has significantly impacted modern engineering practice. Oral communication, business writing, cross-cultural communication, and presentation skills fall under the domain of required communication skills and should be integrated in undergraduate-level engineering programs (Norback, Leeds, & Forehand, 2009). Good communication skills are necessary for successful leadership, and proficiency in a foreign language and cross-cultural awareness and experience are needed for global business activities (Kirschenman, 2011). Yet, students of engineering programs still lack adequate exposure to multidisciplinary teams.

Against this background, Itani and Srour have noted: "Since engineering education is considered to be the main agent of transforming students into practicing engineers, it must keep pace with the requirements of the engineering world and workplace" (2016, p. 2). Yet, insufficient attention on the part of engineering education to the needs of today's business world still largely graduates 21st century engineering students as individual technical contributors rather than team players (Kirschenman, 2011). ABET evaluation reports (Coe, 2006) show this holds even for ABET-accredited institutions. Research has highlighted an important gap between academic perceptions and employability skills or employers' expectations of entry-level engineers (Domal & Trevelyan, 2009).

Zaharim et al. (2010) studied what engineering skills and traits or personal characteristics were required of engineering graduates at accrediting institutions in Australia, the European Union, Japan, the United Kingdom, and the United States. Their findings revealed that many employability skills commonly deemed necessary for engineers comprise nontechnical skills, including teamwork, communication, decision-making, lifelong learning, and professionalism. Yet, research has found that engineering students regard soft skills to be more important for skilled engineers than for newly graduated engineers seeking employment (Lang, Cruse, McVey, & McMasters, 1999).

Recognizing the need for changes in engineering education and necessary inclusion of soft skills training, many universities have made the move to include recommended soft skills in their engineering programs, with some even targeting a major reform (Itani & Srour, 2016). For example, at Purdue University, the Abilities and Qualities pillars of its engineering program comprise mainly nontechnical or professional skills training (Redish & Smith, 2008). Colorado State University also made a move to improve the soft skills of its program through the launch of the Professional Learning Institute (PLI). Among other skills, the PLI places great emphasis on leadership, and in collaboration with industry professionals offers training in time and project management, personal and organizational leadership, and teamwork and conflict resolution (Siller et al., 2009). Beyond the need for soft skills such as communication, leadership, and teamwork, future engineers also need entrepreneurial and intrapreneurial skills. Advancing these competencies will give engineering graduates more confidence and

motivation to capitalize on innovative ideas in their employing organizations or to launch businesses of their own (Menzies & Paradi, 2002; Souitaris, Zerbinati, & Al-Laham, 2007). Recognizing this need for future engineers to possess such entrepreneurial skills, renowned universities such as the Massachusetts Institute of Technology, Pennsylvania State University, and Stanford have established programs or minor degrees in entrepreneurship (Itani & Srour, 2016).

Employers as well as educators often highlight the problem of a lack of soft skills among graduates of engineering and science programs, especially in relation to business knowledge, team work, communication, and project management (Schulz, 2008). Yet, while these soft skills are more and more in demand by today's employers (Firth, 2011; Yaacoub et al., 2011), defining soft skills remains a challenging issue. Whitmore and Fry (1974) defined these skills as relatively widespread application of core abilities related to a job and which involve little or no work with hardware. Soft skills augment technical expertise and enhance an employee's professional standing (Sousa & Mouraz, 2014). There are many accrediting bodies worldwide that recognize the importance of this and thus through their accreditation standards emphasize the need for universities to graduate students with soft skills.

American Board for Engineering and Technology (ABET) criteria for engineering program accreditation. ABET criteria reflect the need for graduating engineers to possess soft skills, making this a condition for accreditation of engineering programs. Specifically, for 'Student Outcomes' — criterion number three in its 'Criteria

For Accrediting Engineering Programs' — ABET lists 11 skills that an engineering program should help its students acquire. The first six, listed here, are deemed soft skills:

- an ability to function on multidisciplinary teams;
- an ability to communicate effectively;
- a recognition of the need for, and an ability to engage in life-long learning;
- a knowledge of contemporary issues;
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; and
- an understanding of professional and ethical responsibility (Yaacoub et al., 2011, pp. 90-91).

The first soft skill—ability to function on multidisciplinary teams—required by ABET extends the notion of team work beyond just individuals collaborating under the same capacity to team work among people from different disciplines. Second, ability to communicate effectively involves communicating with different groups (colleagues, supervisors, customers, and the public) and was found by Yaacoub et al. (2011) to be highly demanded by companies, followed by interpersonal skills and eye contact. Recognition of the need for, and an ability to engage in life-long learning, the third soft skill listed by ABET, emphasizes an organization's continuity and longevity. The fourth and fifth soft skills — knowledge of contemporary issues, and broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context, respectively — have to do with awareness and understanding of the

interdependent nature of domains and events (Yaacoub et al., 2011). Understanding of professional and ethical responsibility, the sixth and last soft skill required by ABET, is deemed a process skill and has to do with more than just following rules but also taking appropriate decisions.

Leadership Paradigms for Engineers in the Construction Industry

Engineering leadership is a highly sought-after skill by construction companies in today's high-pressure, entrepreneurial market for engineers (Elia et al., 2017; Weilerstein & Byers, 2016). In volatile areas of the world where engineers of various disciplines, such as civil engineers in the construction industry (Back et al., 2012; James, 2017), are regularly dispatched, leadership is paramount as a professional skill because the risks are high, time frames for action response are short, disaster management is essential, and resources can be highly limited (El-Sabek & McCabe, 2017; Kotnour et al., 2014). The construction industry is a sector of the national economy engaged in reparation of land and construction, building, and alteration and repair of building structures and other real properties. There are five specific construction trends noted within this industry today and these are: lack of qualified workers, offsite/modular construction, implementing more technology, a growing economy, and the Internet of things. The construction industry plays an important role in regard to cost saving, worker safety, operational efficiencies, and leadership initiatives within this business sector (Hartmann & Jahren, 2015).

A study by Simmons et al. (2017) offers insights into how studies on civil engineering and construction education programs as well as on the engineering and

construction professions has framed leadership development. Based on a critical review covering four periods of leadership theory, their research and findings highlight important implications for scholars and industry professionals vested in advancing the means for meeting the industry's demands and needs. From across academia, industry, and professional associations, the engineering and construction communities are responding to the demands of the industry's burgeoning growth and making strong calls for better leadership (Ahn et al., 2014; American Society of Civil Engineers, 2008; Ellis & Petersen, 2011; Froyd & Borrego, 2014; Mohan, Merle, Jackson, Lannin, & Nair, 2010). However, the leadership competencies of engineering students are significantly lacking in comparison to those of students graduating in other disciplines (Stephens & Rosch, 2015). A study by Russell and Stouffer (2005) noted the lack of focus on professional skills such as leadership in US engineering education programs, but more than a decade later the situation is not much changed (Seemiller & Murray, 2013).

Engineering graduates entering the job market have ample opportunities to focus on professional experience and hone their skills in the construction industries. However, organizations do not offer analogous opportunities for developing leadership competencies (Chartered Institute of Building, 2008), even though a study by Mohan et al. (2010) noted that more than half the time professional engineers spend on the job is dedicated to leadership responsibilities and nontechnical professional skills-related activities. Simmons et al. (2017) emphasized this gap between education and practice, noting that the curricula of engineering and construction programs do not align with the

values deemed important by scholars of leadership as well as leaders and associations specific to the industry. Further, the authors supported that the general curricula of these programs do not adequately prepare career entry-level engineers to take full advantage of the future opportunities for leadership development that will be available to them in their profession.

Distinguishing between leader development and leadership development. The differences between leader development and leadership development are an important consideration in engineering leadership (Simmons et al., 2017). This holds for education in engineering and construction at both the undergraduate and graduate level, in addition to longer-term leadership development. Education programs in civil engineering and construction play an important role in engineering leadership, related research, and industry demands, as well for employers engaged in professional engineering activities. The development of leaders is considered important because of the benefits to innovation to be gained from a skilled group of supervisors who hold the technical expertise and drive to progress in their field. In leadership development, however, the goal is to advance a culture of team members who undertake leadership or followership roles as called for by specific contexts. As such, this paradigm targets a shared process that is heavily dependent on context and perspective (Heifetz, Grashow, & Linsky, 2009; Jepson, 2009; Western, 2010). Rather than just creating an elite squad of leaders, such a culture supports better leadership and understanding and team that can more efficiently respond to adverse shifts in context (Robledo et al., 2012). Adopting this approach in

civil engineering and construction will better prepare students about to enter the industry and also support professionals to overcome the lack of effective leadership (Simmons et al., 2017).

Towards a leadership paradigm shift. Simmons et al.'s (2017) critical review of the literature found traditional, leader-centric approaches in the majority of articles on civil engineering and construction and only relatively few instances where contemporary leadership paradigms were presented. This provides evidence that the main focus of the civil engineering and construction industries is on development of leader-centered skills, even in cases calling for a more complex paradigm. Undoubtedly, there are particular personal characteristics and technical skills that predispose certain people to success in leadership roles (Crumpton-Young et al., 2010; Farr & Brazil, 2012; Tuuli, Rowlinson, Fellows, & Liu, 2012; Zaccaro, 2007). However, there are more wide-ranging sets of skills that align with a more modern understanding of leadership and group dynamics for early-career engineers (Heifetz et al., 2009; Northouse, 2009; Western, 2010). To facilitate adopting contemporary conceptualizations of leadership from the most recent leadership studies, Simmons et al. put forward four action steps for engineering education programs as well as the construction industry:

1. Develop a clear, value-, and culture-laden definition of leadership;
2. Embed leadership-development content into existing courses and professional development;

3. Formalize leadership development from co-curricular and extracurricular involvement; and
4. Evaluate leadership competencies using valid and reliable instruments. (Simmons et al., 2017, p. 2)

There is support in the literature that civil engineering and construction industries would benefit from a more holistic approach to leadership. This would give greater weight to emotional intelligence, a crucial skill that has been largely ignored in the civil engineering and construction fields (Zhang & Fan, 2013). Integrating and aligning contemporary leadership paradigms in engineering education will ensure that civil engineering and construction students and professionals remain relevant and competitive in global economies (Simmons et al., 2017).

Assessment of New Construction Engineering Management Graduate Program at University of Colorado Denver

With capabilities generally considered to be fundamentally related to employability in construction-related fields (Torres-Machí, Carrión, Yepes, & Pellicer, 2013), and given that related competencies are acquired and enhanced through higher education, there is empirical evidence supporting the expansion of master's-level construction education (Clevenger, Ozbek, Fanning, & Vonfeldt, 2015). Increasingly, outcomes assessment is an important feature of accreditation for higher education and professional schools (Palomba & Banta, 1999). This process involves identifying learning outcomes for students, assessing themusing various measures, and applying the

information and feedback to inform improvements to programs offered (Wolf, Dunlap, & Stevens, 2012).

The University of Colorado Denver (CU Denver) introduced in 2014 a new interdisciplinary master's program in its Civil Engineering Department: Construction Engineering and Management (CEM). The CEM program aims to provide the next generation of construction engineers with the skills needed to be effective leaders and managers in the construction industry, or as stated on its webpage: "Our goal is to prepare future construction professionals to lead industry, academia, and research" (Colorado.edu, n.d., para. 2, line 1). A small faculty working group developed the program in collaboration with an assessment expert and taking into consideration industry input. The graduate program allows students to enroll in elective courses offered by the College of Engineering, the College of Architecture and Planning, and the Business School. While there were few models or templates on which to base its development and wholly interdisciplinary character, feedback from its early stages has been both positive and encouraging (Clevenger, Brothers, Abdallah, & Wolf, 2017).

Clevenger et al. (2017) documented initial outcomes and assessment of the CEM program's curriculum and highlighted lessons learned during its development. To begin with, a faculty team implemented a program development process, gathered information on peer construction engineering and construction management educational programs, and outlined a structure for the CEM curriculum. Following, and on the basis of faculty experience and learning outcomes identified by external organizations such as accrediting

bodies and the American Society of Civil Engineers (ASCE), the team detailed a list of criteria for course content. Monthly meetings were also held with construction companies to present the program and get feedback. Three courses were identified as fundamental, or 'core': construction methods and materials, construction planning and control, and construction cost estimating. A fourth course — a master's report or academic internship — was also identified to meet the College of Engineering's Master's program requirements. Finally, the team drew up a list of electives available to students in the CEM program. Over another series of meetings, this time weekly, faculty decided on a set of goals, which guided development of the interdisciplinary CEM program. They also developed a set of course-level student learning outcomes, which are at the center of the outcomes assessment process. In regard to these two points, Clevenger et al. (2017) stressed that aligning the objectives and outcomes of both program and course learning is essential for a sound system of outcomes assessment.

Following completion of the first year of the program, faculty assessed student learning with regard to the core curriculum, gathered feedback through interviews with students, and carried out a survey of industry experts. Three assessments were used for each of the three core courses, and these map to three program objectives. For the Construction Materials and Methods course, these were a comprehensive final exam, in-class presentations, and communication category of grading rubric for 10-minute in-class presentations. The three assessments for the Construction Planning and Control course were exams and various assignments, a course project, and presentation of the course

project. For the Construction Cost Estimating course the assessments were midterm and final exams, projects involving quantity takeoffs and cost estimates for concrete and metal; and final project cost-estimate results. Lastly, one assessment was used for the fourth course, master's report or academic internship, which maps to one program objective: oral defense and final written report.

While initial results fell short of expectations, assessment data offer a positive starting point and working benchmark (Clevenger et al., 2017). Further, although there were variations in student performance, faculty members were confident that the main components of a quality outcomes assessment system are in place. In other words, learning outcomes have been identified, outcomes map to courses, learning is measured using direct assessments, and assessment results can be gathered, presented, and reviewed.

At the start of the program's second year faculty actively gathered feedback from industry members with respect to the CEM program's core course and the electives offered. Interestingly, Clevenger et al. (2017) grouped courses that got votes from more than 80% of those surveyed who shared a job title, with the results potentially suggesting that a student's curriculum path should align with intended career path. Again, before the program's second year commenced, faculty also sought out student feedback to gain insight into how students were navigating the curriculum. An analysis of this feedback and examination of the student body make-up affirmed the program's interdisciplinary nature.

The mixed methods research conducted by Clevenger et al. (2017) offers the following main takeaways: diverse, customizable, and interdisciplinary curricula are needed to prepare students for professional practice in the field of construction; to realize this, curriculum and assessment should be developed in parallel; faculty buy-in and commitment are vital to the program; it is critical that there be program- and course-level coordination and iteration. Course content and assessment rubrics have been coordinated and program assessment has been standardized. Feedback from representatives of the industry pointed to the diversity of educational content in relation to teaching the skills and competencies that professionals from various jobs in construction are looking for (Ahn, Pearce, & Kwon, 2012). The study notes that students have started customizing their curriculum paths to find the best fit for their personal interests, backgrounds, and career goals. Finally, comprehensive program assessment will support aligning learning objectives and outcomes to promote and support the CEM program's vision. Clevenger et al.'s (2017) findings and discussion can inform engineering departments looking to develop or enhance interdisciplinary and innovative programs or curricula.

The Literature Gap in Studies on Engineering Leadership Competencies for Entry-Level Civil Engineers

A study by Robledo et al. (2012) considered engineers' work by integrating the five stages of creative projects (scanning, elaboration, development, appraisal, and implementation (Mumford et al., 2002)) into a flow chart. Their model of scientific leadership focuses on three key vectors where engineers and scientists have an impact:

group, work, and organization. Accounting for how leaders in these professions influence operations and people in a sociotechnical context, the model is procedurally dense and designed to guide leaders' creativity in order to make an impact in all three vectors. In this model, leadership of creative efforts is treated as separate from other leadership forms. This facilitates an approach to issues that research to date had not sufficiently addressed — organization/cross-field and multi-level issues, for example. To support leaders of engineers and scientists in the key vectors, Robledo et al. (2012) proposed five interventions: training existing leaders, developing scientists and engineers to become leaders, promoting stakeholder integration, utilizing survey feedback, and modifying management procedures and processes.

The authors recognized that there may be many variations in the creative work carried out in the engineering and scientific fields, and thus supported the need for future research to examine the leadership of engineers and scientists across the different levels, contexts, and types of organizations. Notably, they suggested the potential value of future studies that examine leaders' abilities and performance across rather than within single vectors. Robledo et al. (2012) further noted there would be value in conducting research on multiple leadership, given the complex nature and wide range of skills and expertise required of engineering and scientific leadership. Finally, the authors underlined the need for leadership models to account for the complexity of training engineering and scientific leaders and to thus consider the particular type of leadership for which they are designed.

In an overview of studies in the engineering leadership literature, Rottmann et al. (2016) identified various shortcomings in research to date. They supported that Robledo et al.'s model is conceptually weak as it does not actually define engineering leadership. Further, they noted that while Ahn et al.'s (2014) five leadership categories and Rottmann et al.'s (2015) grounded theory make headway in filling this conceptual gap, both still fail to provide an adequate framework for conceptual explorations of engineering leadership. Rottmann et al. (2016) extended these studies to address this gap, adding for example a society vector to Robledo et al.'s (2012) leadership model. Through their study and narratives from engineers as well as human resource professionals, politicians, student interns, and entrepreneurs, they offer a more comprehensive view of engineering leadership. The authors also underlined the broader implications of leadership research and the need to focus on specific disciplines so as to create a foundation on which to base experientially informed leadership training.

With engineers currently facing many and wide-ranging professional pressures, there is still no one definition of engineering leadership to guide the development of academic engineering programs in terms of what course offerings are needed in engineering leadership so as to meet the requirements of today's job market (Hartmann et al., 2016; Rottmann et al., 2015). Advances in engineering leadership hold potential for redressing workplace inequities in order to effect positive social change within the industry (Bergeron, 2001). In connecting the diverse insights from and perspectives of the five groups they studied, Rottmann et al. also emphasized the need for change, noting

"we can use our personal points of impact to collectively catalyze dynamic, innovative, and widely meaningful change" (2016, p. 164).

With more research emerging in the engineering leadership literature, scholars are focusing on the importance of increasing the exposure of all engineering students to engineering management and leadership skills. To this point, Rottmann et al. (2016) supported that it is important for engineering leadership education to create greater awareness among students of the alternative career options and different organizational contexts available to engineering graduates. Over the past decade, education in engineering leadership has become increasingly popular in response to national calls for another kind of required social change: educational change within the sciences and technology professions (Rottmann et al., 2016). As such, while Rottmann et al.'s (2015) grounded theory conceptualizes leadership from the perspective of engineers, their framework does not offer the knowledge or means needed to connect the actual roles of engineers to definitions of engineering leadership that have so far been presented in the literature (Rottmann et al., 2016). This study aimed to fill this conceptual gap by gathering data in the field from managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers.

Summary and Conclusions

In an emerging body of theoretical literature, more research cites the need to introduce engineering management and leadership skills to all engineering students. Engineering leadership has been defined by scholars as encompassing the ability to equip

and motivate people by fostering creativity, considering multiple team perspectives, communicating clearly, managing conflict, accepting change, and being apt in technical tasks. In today's engineering market, which is eminently entrepreneurial, effective engineering leadership is vital. As a professional skill, leadership is crucial when engineers of various disciplines, including civil engineers in the construction industry, are routinely dispatched to high-risk, volatile areas, where disaster management is imperative, and engineers may face brief time frames for taking actions, as well highly limited resources.

While many universities across the United States offer certificate programs, leadership courses, and minors, more research is needed to define which leadership competencies are most essential to companies in numerous engineering disciplines hiring undergraduates for entry-level, full-time positions. Engineering programs in higher education do not have a standard set of training requirements in engineering leadership as it applies to the field's many disciplines, due to these differences in engineer hiring requirements. A gap in the literature exists in clearly defining engineering leadership according to specific engineering disciplines, leading to an obscure connection between professional practice, theory, and academia.

In Chapter 3, the research method for qualitative, multiple-case study research is discussed. Following, procedures for recruitment, participation, and data collection are presented and applied to the present study's research strategy. The data analysis plan is also addressed, as are issues of trustworthiness in this qualitative study.

Chapter 3: Research Method

The purpose of this qualitative study utilizing a multiple case study design was to explore the views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. To address this gap in the literature and remain consistent with the qualitative paradigm, I used a multiple case study methodology to meet the purpose of the study and collect data from multiple sources. This study is important because it addresses an underresearched area concerning engineering leadership and may offer a deeper understanding of the daily lives and experiences of those engaged in engineering leadership. This study's research goal was to contribute original, qualitative data from managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. I used a constructivist lens to fill the theoretical gap identified in Rottmann et al.'s (2016) study.

In this chapter, I provide detailed information on the research method and rationale for conducting an exploratory multiple case study and also on the central research question guiding this empirical investigation. This chapter presents a foundational rationale for the participant selection strategy, data collection strategies and data analysis, the role of the researcher, ethical considerations, and a summary on main points of the research method.

Research Design and Rationale

Browne and Keeley (2014) recommended that a researcher ask the right questions in qualitative research to address the purpose of their study and drive the research strategy. Consistent with the purpose of this study, the research question (RQ) was as follows:

> RQ: How do the perceptions of managers in the construction industry establish a basis of leadership competencies most needed in the job market for entry-level civil engineers?

In today's volatile areas of the world where engineers of various disciplines, such as civil engineers in the construction industry (Back et al., 2012; James, 2017), are regularly dispatched, leadership is paramount as a professional skill because the risks are high, time frames for action response are short, disaster management is essential, and resources can be highly limited (El-Sabek & McCabe, 2017; Kotnour et al., 2014).

More research is needed on the perspectives of industry experts on necessary leadership, change, and synthesis skills among young engineers (Ahn et al., 2014). In today's complex society, there is an increasing call to offer a wider set of human dynamics skills training in engineering curricula, especially leadership skills (McConville, Rauch, Helgegren, & Kain, 2017). Engineering experts in industry and academia highlight constructs in engineering leadership, ability to manage change, and ability to synthesize business and social perspectives as critical job skills in their industry (Cox, Cekic, Ahn, & Zhu, 2012). Industry expert views should also be considered in

moves to improve engineering leadership education. Furthermore, a new area of discussion must be opened related to curriculum development for civil engineers encompassing leadership, change, and synthesis abilities demanded by employers in today's job market (Klassen et al., 2017).

The nature of this study was qualitative to address the purpose of the study and provide data for the central question that guided this research, which was drawn from an interpretivist paradigm based on the assumption that people and groups construct their own social reality (Denzin, 2002). Interpretivists also assert that perspectives of others are embedded in biographical, organizational, and social contexts that are meaningfully connected from their interpretation of a social phenomenon (Rolfe, 2006). I used an exploratory multiple case study as the research design for this study given that the study's purpose called for a deeper understanding of engineering leadership competencies most needed in the job market for entry-level construction engineers by exploring the views of managers in the construction industry (see Yin, 2017). Qualitative research offers scholars opportunities that describe how to analyze business decisions and how to explore the reasons behind various aspects of behavior within organizations. Qualitative sampling strategies include purposeful sampling, which ensures an in-depth understanding of a case study's collected data (Klenke, 2016).

In choosing the case study research design, I considered other qualitative designs such as phenomenology and narrative inquiry, yet I deemed they would be ineffective to answer the RQ due to the methodological limitations of uncritical personal storytelling

(Ritchie, Lewis, Nicholls, & Ormston, 2013). Case study methodology offers several strategies to provide data for phenomena-driven RQs and offers the option to extend a theoretical proposition.

Norlyk and Harder stated that "conflicting philosophies about data analysis can raise inconsistencies to methodological clarity" (2010, p. 425). Yin's (2017) recommendation on this issue also states that "the case study method is pertinent when your research addresses either a descriptive question (what happened?), or an explanatory question (how or why did something happen?)" (p. 112).

Qualitative case studies contribute critical knowledge to the field of business research and practice, and they necessarily deal with quantitative data and methods. Case studies are widely used in business to trace efforts and successes of various companies in multiple fields. According to Eriksson and Kovalainen (2015), case studies are excellent for generating holistic and contextual in-depth knowledge using multiple sources of data. Reviewing different types of evidence and outlining the research findings while using a qualitative approach enables researchers to assess a particular case from various perspectives, relying on the data available. Researchers using a multiple case study to investigate a social phenomenon can involve individuals living within that social context as separate units of study (Yin, 2017).

Role of the Researcher

It was my responsibility as the researcher of this study to maintain rigor and credibility in all aspects of the research. My ethical research relationship with the

participants was critical for the successful completion of the study. Recruitment procedures were clearly spelled out to the Walden Institutional Review Board (IRB) and I began recruitment after IRB approval was granted, using purposeful and criterion sampling. I addressed any issues of research bias by first using validated instruments for the data collection and ethical procedures for data processing and analysis.

Qualitative research is by nature exploratory, fluid, flexible, driven by data, and sensitive to context (Reiter, Stewart, & Bruce, 2011). It is therefore important to consider the role of the researcher as their expertise and skills influence the study's credibility, dependability, and transferability. I also acknowledge that in qualitative research, the researcher may make errors that threaten the validity, reliability, credibility, and utility of the study.

Interviews conducted for multiple-case study research are conversations between the researcher and the study participants that can provide a lot of useful information. This data is gathered through participants' responses to the researcher's questions relating to beliefs and facts as well as perspectives regarding facts, behaviors, feelings, motives, and reasoning behind particular actions or thoughts (Leedy & Ormrod, 2010). As such, I recognized the potential risk of confirmation bias, whereby a researcher introduces an idea about the study and the topic from the literature review or their personal knowledge and hopes for predetermined results from the study. Together with human distractibility, all these factors can distort what the researcher hears, especially when they are analyzing data and seeing what they are disposed to see. In order to guard against biases during the

interviews, I avoided posing leading questions to participants; I used terms that were easily understandable, and I avoided questions that could elicit strong feelings, either positive or negative.

When explaining the study to potential participants I took care not to introduce bias through implicit or explicit expectations, and I ensured that the interviews were conducted properly and according to the design. As an observer, the role of the researcher includes selecting appropriate artifacts and images, note-taking, handling, analyzing, and interpreting the data as per the study design, and making appropriate field observations. Finally, I ensured all participant information, including their real names and identities, would remain confidential.

Methodology

Stake (2013) established that the multiple case study methodology does not fit all research purposes but is mainly for those wishing to advance theory generation. When the data focus is only on individuals in a multiple-case study design, the study's central phenomenon—in this case the views of managers in the construction industry—is the context and not the target of study (Eisenhardt & Graebner, 2007; Yin, 2017). For this study, the unit of analysis, which in a case study may be a person, event, entity, or other unit of analysis (Noor, 2008), was the construction industry manager. The multiple-case study design allows for comparing and contrasting data within and between cases (Yin, 2017). Additionally, Stake (2013) wrote that multiple cases notably lead to studies with

methodological rigor due to using inductive theory and adhering to recommendations from the methodological literature.

Purposeful sampling is widely used in qualitative research for the identification and selection of information-rich cases that are related to the phenomenon of interest. Although there are various purposeful sampling strategies, criterion sampling should be used in the most common implementation research (Palinkas et al., 2015). I recruited participants for this case study using purposeful criterion and snowball sampling strategies, screened with the following inclusion criteria: adults over the age of 18, 5 years' minimum experience in the management of a construction company, and possessing knowledge regarding leadership competencies most needed in the job market for entry-level construction engineers (see Patton, 2014). The criterion of 5 years' minimum experience in engineering management is consistent with that used in similar qualitative studies (Hartmann et al., 2016; Serrador & Pinto, 2015). Snowball sampling is the most common form of purposeful sampling and works by asking a few key participants who already meet the criteria for the study to refer others who may also meet the criteria (Merriam & Tisdell, 2015). I conducted 10 in-depth face-to-face individual interviews with construction industry managers. Patton (2014) recommended a range of 5–10 participants for a qualitative study, stating that a larger sample size may weaken a deep investigation of the phenomena under study.

This multiple case study used Yin's (2017) concept of replication logic in identifying and recruiting participants for the study. The concept of replication logic

states that each case in a multiple case study is treated as a distinct experiment and as a unit of analysis (Eisenhardt & Graebner, 2007). Because case studies do not involve experimental controls or manipulation, the method is suitable for this study in order to gain a deeper understanding of views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. To address this gap in the literature and the research problem, qualitative data was also collected from multiple sources, including interviews, peer quality audit, and engineering school curricula (Yin, 2017). Once the data collection was completed, the cross-case synthesis data analysis technique was utilized, as recommended when analyzing data in a multiple case study, to strengthen the trustworthiness of data (Merriam & Tisdell, 2015; Yin, 2017). Finally, triangulation of data sources was conducted to strengthen the trustworthiness and robustness of the data analysis and findings on the central topic of the study (Guion et al., 2011; Patton, 2014). The data collection process is launched by developing an appropriate participant selection logic.

Participant Selection Logic

Population. Given that the study purpose calls for a deeper understanding of engineering leadership competencies most needed in the job market for entry-level construction engineers, the population from which this study's participants were selected was all managers in the construction industry in the United States who were presently listed on the LinkedIn online professional network. As of January 12, 2018, there were approximately 376,470 professionals listing "construction manager" as their respective

current job title. Construction managers are an integral part of the building process; they plan, coordinate, budget, and supervise construction projects from start to finish (U.S. Bureau of Labor Statistics, 2018). A total of 10 participants were recruited from this population as the purposeful sample for this multiple case study. This number of participants falls within the recommended range of 5–10 participants for a qualitative study (Patton, 2014). A larger sample size could weaken deep investigation of the phenomena under study, while the upper limit of 10 participants ensures reaching saturation quicker (Fusch & Ness, 2015).

Sampling strategy. To identify and recruit participants for this multiple case study I used Yin's (2017) concept of replication logic, which states that each case in a multiple case study is treated as a distinct experiment and as a unit of analysis (Eisenhardt & Graebner, 2007). Since case studies do not involve experimental controls or manipulation, this method was suitable for the purpose of this study to gain a deeper understanding of construction industry managers' views on leadership competencies most needed in the job market for entry-level civil engineers. Participants for this case study were recruited using purposeful criterion and snowball sampling strategies. The most common form of purposeful sampling, snowball sampling works by asking a few key participants who already fulfill the criteria for the study to refer others who also potentially meet the criteria (Merriam & Tisdell, 2015).

Sampling criteria. The construction industry managers eligible to participate in the study were adults above 18 years of age, they had a minimum of 5 years' experience

in construction management, and they possessed knowledge regarding leadership competencies most needed in the job market for entry-level construction engineers (Patton, 2014). The specific participant selection logic ensured that all potential participants met the minimum requirements for recruitment and subsequent participation in the study through in-depth interviews.

Sampling selection. The proposed process for identifying and selecting participants in order to gather through interviews information on their views, attitudes, and opinions regarding leadership competencies most needed in the job market for entry-level civil engineers enabled in-depth investigation of the phenomenon (Rowley, 2012). I actively worked to select participants through criterion and network sampling who would potentially provide the richest data, and I started to establish rapport once I was assured of their full understanding of the phenomenon and ability to provide in-depth data for analysis and interpretation (Rowley, 2012). The focus of the chosen sampling strategy was to ensure a participant pool that could contribute to a sound understanding of the central study topic and not just generalizations (Baxter & Jack, 2008).

Sample size and saturation. A small sample of up to 10 participants was chosen for this multiple case study to increase chances of reaching saturation faster and also to ensure a trustworthy study of high quality and with validity (Fusch & Ness, 2015). The number of participants chosen for this study on construction industry managers' views on leadership competencies most needed in the job market for entry-level civil engineers provided a thick and rich data pool for the study.

Initially, I identified construction industry managers who fulfilled my sample inclusion criteria through the LinkedIn online professional network, which served as my recruitment tool. I posted a notice on this online professional network platform to attract candidate participants, and asked them to contact me via personal message or via the e-mail address included in the specific post. When the participants had been recruited for the study and had signed their Informed Consent forms, I arranged for interviews to be conducted via Skype or telephone (Redlich-Amirav & Higginbottom, 2014). Skype enables the interview interaction to avoid contextual information from influencing the researcher and to maintain an unbiased atmosphere (Deakin & Wakefield, 2014). The study participants shared their views on and experiences regarding necessary leadership competencies for entry-level civil engineers, thus supporting and enriching the gathered data.

Instrumentation

This study's interview guide (Appendix) consisted of open-ended questions on the topic of exploring views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. It was designed and validated by Hartmann (2016) in research conducted at Iowa State University on engineering leadership and explored important themes identified by recruiters of entry-level engineers in the construction industry within Iowa, USA. The interview protocol is available as an open-access document and therefore permission to

utilize on further research was not required. Given that the interview protocol questions were validated by Hartmann (2016), no pilot study was required to repeat this process.

Content validity in qualitative research surveys is aimed at ensuring that the instrument of measurement has captured the concept it sets out to measure by including an adequate representation of items that operationalize the concept (content validity), differentiating items on an adequate criterion (criterion-related validity), and ensuring that the measure used fits around the theories for which the test is created (construct validity) (Sekaran & Bougie, 2013), though validation is not a necessity in qualitative research as concepts already reflect the world of the object of study (Jacob & Furgerson, 2012). One way to ensure that validity is achieved in any research is to conduct a pilot study of research instruments (Patton, 2014). Such a pilot study was carried out on this study's interview protocol by Hartmann (2016). Each interview question was grounded in theoretical literature, the authors' knowledge, and Hartman's (2016) understanding of the engineering leadership literature. The interview validation process was conducted by Hartmann (2016) and her team as follows. Two college recruiters were contacted to assist with improving the survey instrument. A project manager from a large heavy-construction contractor and a project engineer from a national building contractor agreed to perform cognitive interviews. The project manager and project engineer had, respectively, over 10 years and 5 years of experience as recruiters for their respective companies. The participants agreed to be audio-taped and each completed a "think-aloud" interview while taking the survey in the online survey tool, Qualtrics. These cognitive

interviews are recommended as best practices in survey and interview protocol development (Abdel Latif, 2018; Bolarinwa, 2015; Groves et al., 2004). Upon completion of the first interview and prior to the second interview, Hartmann (2016) made updates to and revised the items/questions. Both participants verbalized their thoughts and each interviewee was observed during their 30- to 40-minute interview. The first reviewer focused on verbal feedback, facial expressions, and other nonverbal cues to identify questions that were problematic. During this process, improvements and appropriate changes were made to create a more stringent interview protocol to meet the purpose of the study and to gather trustworthy data in response to the study's research questions (Hartmann, 2016).

Given that Hartman's original 2016 study was a local one interviewing only construction industry managers working in Iowa, USA, the current research followed recommendations (Hartmann, 2016) to further extend the original study for generalizability and transferability, by adding variance to the sample in terms of location. By opening the participant pool to managers in the construction industry across the USA through recruitment on the LinkedIn professional platform, more detail could be discovered on hiring desires for entry-level civil engineers in the area of leadership, and thus strengthened transferability of results. The open-ended interview method is intended to enhance the researcher's ability to understand a phenomenon or phenomena though the subject's point of view (Kvale, 1995). Hence, in the case of this study, using validated,

open-ended interviews was valuable in gaining an in-depth understanding of the phenomenon under investigation and gaining each individual participant's viewpoint

The validity of this study's instrumentation and using it for adept collection and to extend theory depended on the matter of transferability. Transferability is similar to external validity, as both notions are involved with the degree to which the outcomes of one study can be useful to other settings (Merriam & Tisdell, 2015). This poses a challenge for many qualitative studies as findings are usually limited to specific settings and individuals (Shenton, 2004), and, as a result, it is plausible that the outcomes from this multiple-case study research will be applicable to individuals beyond the participant group (Stake, 2013).

Procedures for Recruitment, Participation, and Data Collection

For size and saturation purposes, the number of participants recruited for this qualitative multiple case study was 10. Recruiting a group of up to 10 construction industry managers for in-depth interviews regarding leadership competencies most needed in the job market for entry-level civil engineers was deemed adequate to attain data saturation (Fusch & Ness, 2015). A study achieves saturation point when further data collection ceases to yield new themes or information (Glaser & Strauss, 1967; Mason, 2010; Yin, 2017).

To recruit participants for this case study, I used LinkedIn to connect with 10–15 managers in the construction industry in the United States, and those who responded positively were invited to participate in the study through a recruitment letter advertised

on a LinkedIn post. Those who accepted the invitation were asked to provide their e-mail address, telephone number, and Skype ID for communication purposes. Following approval by the Walden IRB, I e-mailed each potential participant a recruitment letter to invite them to take part in the study. Additionally, I e-mailed them a consent form that included the following: explanation of what the study entails, the option to withdraw, the procedure, possible risk or discomfort associated with participation, the time limit, a statement of voluntary participation and no consequences for refusal, rights to confidentiality, and the benefit of this study for the engineering community in the United States in particular and society in general.

The main purpose of the qualitative method is to gain in-depth understanding of the knowledge and experiences of the study's participants (construction industry managers). I was mainly engaged in the production of data relevant to the interviewees' experiences regarding the issue under investigation. The study's participants — construction industry managers — were identified and selected from all managers in the construction industry in the United States who were presently listed on the LinkedIn online professional network. Access to construction industry managers was obtained through other construction industry managers recruited through criterion and network sampling and residing in the United States, which is also this researcher's permanent residence. Participants selected for this qualitative multiple case study were experienced construction industry managers who were above 18 years of age, had 5 years' minimum experience in the management of a construction company, and possessed knowledge

regarding leadership competencies most needed in the job market for entry-level construction engineers (Patton, 2014). In the event that recruitment resulted in too few participants, I was prepared to seek out more construction industry managers through LinkedIn until I had a group of at least 10 willing potential participants.

The methods used for data collection in this study were a review and content analysis of the extant literature, peer quality audit, engineering school curricula, a demographic questionnaire, a semistructured interview, and field notes and observation. The purpose of this qualitative multiple case study was to gain a deeper understanding of construction industry managers' views on leadership competencies most needed in the job market for entry-level civil engineers (Yin, 2017). The interview guide included open-ended questions that aligned with the issue under investigation. The questions were presented to capture the study participants' backgrounds and ideas, thoughts, opinions, values, and behaviors regarding leadership competencies most needed by civil engineers entering the job market (Patton, 2014; Yin, 2017). Each participant's responses during their respective interviews were recorded and transcribed. The semistructured interview was designed to probe the views of these managers on leadership competencies most needed by career entry-level engineers. The interview questions targeted detailed information regarding each interviewee's background and disposition, allowing me to investigate participants' views, values, and behaviors (Patton, 2014; Yin, 2017).

The Walden University IRB granted approval prior to the commencement of data collection, which I personally carried out via Skype or telephone call. Data collection

took place on a daily basis until 10 in-depth interviews had been conducted. The duration of data collection events lasted between 30 and 60 minutes, with data being recorded on a digital audio recorder, and responses and reflective handwritten notes recorded on an observer note sheet (Katz, 2014; Neuman, 2011). I used Microsoft Word software to transcribe interviewees' responses, and then Microsoft Excel software to electronically record, document, analyze, and categorize the data collected from each interview. Microsoft Excel is appropriate for documenting interview schedules, storing collected data, recording research themes, and classifying information through numbering.

At the end of each Skype interview, I thanked the interviewee and informed them that they might be contacted again in the event that clarification of responses was necessary. I assured each interviewee that their personal information and any other materials produced in relation to the data collected during their interview for this research would remain confidential. Access to the research data is protected by requiring a pass code to retrieve from the computer. I e-mailed each participant a transcription of their responses.

Data Analysis Plan

In case study research, the researcher selects an appropriate sample size after determining the focus of the study. This is done to ensure there will be adequate data from the detailed qualitative study so as to authenticate themes and trends that emerge from among the interviewees' responses (Zainal, 2007). Construction industry managers above 18 years of age, with at least 5 years' experience managing a construction

company, and who possessed knowledge regarding leadership competencies most needed in the job market for entry-level construction engineers made up the participants for this study. This approach helped make a link with theoretical propositions, an approach that can effectively guide "how" or "why" questions in case study analyses (Yin, 2017). To achieve this, interview questions were shaped in semistructured arrangements (see Appendix) for collecting interviewees' responses. I also used appropriate prompts to facilitate conversation regarding the interview questions. The collected data was categorized with further information beyond the semistructured questions and responses. In addition, I grouped the findings to support analysis of the data provided by the interviewees regarding leadership competencies most needed in the job market for entry-level civil engineers (Patton, 2014).

I utilized cross-case synthesis in this study to process and analyze the contents of the interviews and documented data (Merriam, 2014; Yin, 2017). This analytic procedure is recommended for analyzing data in a multiple case study in order to enhance external validity and trustworthiness of the data and to establish the research as more vigorous (Merriam & Tisdell, 2015). In developing a case study database, the themes that were identified as well as the important words, views, and/or analyses in the documented data are reliable, referred to, and attributable (Yin, 2017). The organization and analysis of documented interviews through content analysis and cross-case synthesis helped to develop themes and models based on the data (Hatch, 2002; Yin, 2017). I conducted a specific evaluation of each case and synthesized the data across the many cases. The

strength, validity, and reliability of this study were enhanced through a series of proofs (Yin, 2017). Further, content analysis helped to gauge the breadth or exclusion of emphasis of an analytical segment or alignment with theoretical suppositions (Yin, 2017). Observational field notes was one of the data sources utilized in triangulation (Katz, 2014), and I also conducted quality audits, via SME scrutiny and review of the data (Patton, 2014). These enhanced the triangulation of proof from the multiple sources and increased the reliability and validity of the study (Yin, 2017).

I scrutinized the research results to identify recurring themes emerging from the interviews, which were then used to assess similarities and dissimilarities among cases so as to answer the study's research question centered on the views of construction industry managers on leadership competencies most needed in the job market by entry-level civil engineers. Once the data was coded by interview question, I linked the themes that emerged to other coded classifications to assess connections between reviewed cases (Patton, 2014). To consolidate and enhance comprehension of the findings of the research and to improve the quality of the study, triangulation of the multiple data sources was performed — that is, the in-depth, face-to-face interviews, interview transcriptions, observational field notes, and SME appraisals (Patton, 2014). Methodological and data triangulation can be utilized to corroborate the evidence and enhance the strength and reliability of the research (Yin, 2017). I kept handwritten notes during the interview process, noting for example attitudes, feelings, or views of the interviewees that could be omitted from the interview transcripts (Patton, 2014). Scrutiny and appraisal of the data

by SMEs are other methods that can be utilized in compiling proof and interpreting the results of the research. Interviewees received their respective transcripts and were asked to respond to their accuracy and efficacy through the member checking process (Merriam & Tisdell, 2015).

Cross-case synthesis of the face-to-face interviews conducted via Skype provided substantial evidence of what construction industry managers believe to be the most important leadership competencies needed by civil engineers entering the job market. Utilizing this data analysis method, I was able to gather clear, unbiased, and credible arguments based on the data (Yin, 2017). All this information may be used to inform the design and improvement of engineering curricula at universities.

Issues of Trustworthiness

Credibility

A study achieves credibility when there is confidence in the findings of the research (Anney, 2014). That is, the results represent information that is believable and trustful as a result of the researcher dedicating quality time to understanding and interpreting the perspectives of the study's participants along with efforts to avoid researcher bias (Billups, 2014). The goal of qualitative research is to understand the phenomenon under investigation from the points of view of the participants, which in the case of this study were construction industry managers' views on leadership competencies most needed in the job market for entry-level civil engineers. Only they could make a legitimate judgment of the credibility regarding the results. I conducted

individual interviews of between 30 and 60 minutes via Skype or telephone. I explained to each participant that they could withdraw from the interview at any time. I also wrote down as well as electronically recorded their answers, and every participant received a copy of their transcribed responses. In this way, triangulation and member checking helped to prevent any reflexivity on my part and to verify the accuracy and the interpretation of the collected interview data (Billups, 2014). The issue of saturation is also important for the quality and validity of the study (Fusch & Ness, 2015). Thus, I stopped conducting interviews when participants' responses to the research questions began to show a similar pattern after 10 interviews.

Transferability

Transferability has to do with the degree to which the results of the qualitative study can be generalized to other situations, settings, groups, or applications (Anney, 2014). To achieve this, the researcher must provide a thick, deep, and rich description of the findings, derived through NVivo coding of themes, and purposeful sampling through a focus on assumptions that are key to the research. I described in detail the study's original context — context accounts, research methodology, findings, and data samples — so that readers can decide on the transferability of this study's results to their particular context (Houghton, Casey, Shaw, & Murphy, 2013).

Dependability

Dependability is the ability to determine if the study's findings have consistent themes when the same methods of research and data collection are utilized (Billups,

2014). Dependability is achieved through use of an audit trail and examination of the inquiry process and the product used to validate the collected data, on the basis of the research decisions made by the researcher to illustrate how they collected, recorded, and analyzed the data (Houghton et al., 2013). To ensure dependability, participants' transcribed responses must be accurate before coding them with NVivo software. If a different researcher conducts a separate analysis of the study's data and has the same outcome when comparing the results, the study has dependability (Cohen, Manion, & Morrison, 2011).

Confirmability

A study has confirmability when its results are accurate, neutral, and free from bias or reflexivity on the part of the researcher (Billups, 2014). It is the degree to which other researchers can confirm or corroborate the results of a study (Anney, 2014). To obtain responses from participants that were accurate and factual, I ensured that they were comfortable and could speak freely. Confirmability is vital for a qualitative study, with the results reflecting the truthfulness of participants' responses regarding the phenomenon being studied, which in this case was construction industry managers' views on leadership competencies most needed in the job market for entry-level civil engineers. To this end, each participant received transcriptions of their respective interviews for verification (i.e., member checking) and thus offset any reflexivity on my part as the researcher. This is a valid technique for the purpose of establishing a qualitative study's confirmability and trustworthiness (Kornbluh, 2015).

Ethical Procedures

Qualitative research on humans raises concerns for researchers to be careful in avoiding approaches that could place undue burden on study participants or overburden them with long interviews or group discussions, and through such thorough examination of topics cause participants to feel pressured, address emotive and distressing topics, and be unduly intrusive research (Kendall & Halliday, 2014). Walden University requires all students who plan to conduct research on humans to obtain approval from the University's IRB. The IRB application and approval is usually referenced by a number, and used in order to gain access to study participants. The IRB helps to ensure the researcher adheres to aspects of ethical research, including informed consent, minimal harm, undue burden on participants, privacy, confidentiality, and that such risks to study participants are minimized (Jacob & Furgerson, 2012; Kendall & Halliday, 2014).

The researcher and participants interact at different stages of the study; their interactions can be ethically challenging and may include anonymity, confidentiality, informed consent, and the potential impact of the researcher on the participants and vice versa (Kendall & Halliday, 2014). I did not commence data collection until approval was granted by Walden University's IRB. Participants were reminded that they were free to withdraw from the study at any stage and that in such an event they would not incur any penalty or risk for such a decision. Each subject had a chance to pose questions as well as express apprehension regarding each aspect of the research development (Patton, 2014). Private information of each participating subject such as names was secured and stayed

confidential and undisclosed through the whole study as well as subsequently. Records of data and materials collected from the questionnaire were arranged in such way that each subject had a chance to examine them and I was able to attain valuations, observations, critique, and assessments from the subjects. Such a method gave me the opportunity to make certain that research was factual and that the nature of the research is approved and assured (Patton, 2014). To safeguard against violation of participants' privacy and confidentiality, I carefully stored all research materials and processes as well as responses to the interview research questions in a private and secure place. I ensured that participants were aware that their responses would be private and confidential. I am the only person with access to the data, which will remain anonymous and kept for 7 years, after which period it will be destroyed.

All participants for this research signed the Informed Consent Form prior to gathering any data or materials for the study, and their rights in regard to social status, age, gender, or race were and will not be violated or shown prejudice against (Walliman, 2017). The participants' engagement in this research was informed strictly by the research methods, and the purpose of the research was met by respecting all the subjects' transparency and thoughtfulness throughout the research process (Wallace & Sheldon, 2015). Ethical examination and exploration of deeds helped to distinguish and establish assurance that professional associates did not falsify research findings and outcomes that were gathered and acknowledged from the latest evaluation of data (Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National

Academy of Engineering, and Institute of Medicine, 2009). Finally, outstanding completion and conclusion of the current research was reliant on ethical aspects that have been determined and antecedent (Walliman, 2017).

Summary

The purpose of this qualitative multiple case study was to gain a deeper understanding of engineering leadership competencies most needed in the job market for entry-level construction engineers by exploring the views of managers in the construction industry. I utilized purposeful criterion and snowball sampling strategies to recruit participants. The concept of replication logic was applied to identify and recruit participants for the study, who met the following inclusion criteria: adults over the age of 18, 5 years' minimum experience in the management of a construction company, and possessing knowledge regarding leadership competencies most needed in the job market for entry-level construction engineers.

Qualitative data was collected from multiple sources, including interviews, peer quality audit, and engineering school curricula. I followed an interview protocol to conduct 10 in-depth, face-to-face individual interviews with construction industry managers. Ethical standards for conducting research on humans were adhered to in order to have access to participants. The cross-case synthesis data analysis technique was utilized to analyze the collected data and to strengthen its trustworthiness. I also performed member checks and triangulation of data sources to ensure reliability and

validity of the data, to reduce bias, and to strengthen the robustness of the data analysis and findings on the central topic of the study.

The views of construction industry managers provided insights into how engineering leadership education can be improved in order to meet the demands of employers in the construction industry in today's job market. Chapter 4 contains information on the sample's demographics, and results of the data collection. It presents the results of the study, data analysis, and the themes that emerged from this qualitative multiple case study.

Chapter 4: Results

The purpose of this qualitative, multiple case study was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. In this theory-generating multiple case study research, I developed a central research question to provide answers in the context of the empirical setting (Ketokivi & Choi, 2014). By answering the central research question and analyzing the views of managers in the construction industry, I have been able to explore and offer insight into what leadership competencies are viewed as most important for civil engineers entering the job market. The RQ guiding this study was as follows:

> RQ: How do the perceptions of managers in the construction industry establish a basis of leadership competencies most needed in the job market for entry-level civil engineers?

This RQ was developed following an exhaustive review of available literature to identify gaps in knowledge on what leadership competencies are most important in the recruitment and hiring process of construction companies (Hartmann et al., 2016; Itani & Srour, 2016; Schuhmann et al., 2014). I also identified a literature gap regarding how to connect engineers' actual roles on the job to definitions of engineering leadership presented in the literature to date (Rottmann et al., 2016). This research could help to establish a clearer definition of what leadership competencies are most important for the job market in specific areas of the engineering profession (Hartmann et al., 2016;

Rottmann et al., 2015; Simmons et al., 2017). This would in turn help to better inform engineering programs in higher education and establish a standard set of training requirements in engineering leadership (MacIntyre, 2016; Schuhmann, 2010).

The research design and approach were grounded in the study's conceptual framework, built on three key concepts of engineering leadership developed hieratically by Mallette (2005), Robledo et al. (2012), and Rottmann et al. (2015). Mallette (2005) originated the conceptual framework of engineering leadership, and Robledo et al. (2012) and Rottmann et al. (2015) further extended the framework by building upon previous studies. Baranowski (2011) described the challenges and opportunities in researching leadership and the new developments that are needed for investigating engineering leadership. Engineering leadership education has become increasingly popular over the past decade in response to calls for educational change in the sciences and technology professions (Rottmann et al., 2016). While Rottmann et al.'s (2015) grounded theory conceptualizes leadership from the perspective of engineers, this framework leaves a knowledge gap in terms of connecting engineers' actual roles on the job to existing definitions of engineering leadership as presented in the extant literature (Rottmann et al., 2016). The findings of this study are aimed at closing this conceptual gap by contributing original qualitative data to the study's conceptual framework and enhancing understanding of the leadership competencies most needed in the job market for entry-level civil engineers.

In this chapter, I provide a description of the results of the multiple case study divided into two main sections. The first is a thematic analysis of the collected data based on the study's multiple sources, as recommended by Yin (2017). This includes: (a) a semistructured interview protocol (Appendix) the items in which have been designed and standardized by previous researchers, (b) reflective handwritten notes (see Merriam & Tisdell, 2015) kept by me throughout the data collection process, and (c) seminal literature relevant to the study as reviewed in detail in Chapter 2. The second involves a cross-case analysis in which the findings of the initial thematic analysis of data are synthesized so as to answer the RQ. Boyatzis (1998) supported that a variety of approaches to thematic analysis can be used and essentially realize the same rigor. The scholar also argued that all approaches have something to offer qualitative data analysis: "Thematic analysis is flexible and what researchers do with the themes once they uncover them differs based on the intentions of the research and the process of analysis" (Boyatzis, 1998, p. 63).

The unit of analysis, which in a case study may be a person, event, entity, or other unit of analysis (Noor, 2008), was the construction industry manager. The multiple case study design allows for comparing and contrasting data within and between cases, and evidence created in this way is considered robust and reliable (Yin, 2017). Eisenhardt (1989) advised that multiple cases should follow a replication rather than a sampling logic, which is characteristic to survey research, but also that the number of cases should

be limited to the point where the incremental contribution of additional cases is only marginal (e.g. four to 10 cases).

When the data focus is only on individuals in a multiple case study design, each unit of analysis becomes a case study in and of itself (Eisenhardt & Graebner, 2007; Yin, 2017). The multiple case study is aimed at producing reliable results to answer the RQ by using data collection methods that support the phenomenon being studied (Shenton, 2004). This method has been proven to add rigor and contribute credible results that can be replicated by other researchers (Yin, 2017). The main patterns and recurrent themes that emerged are described in detail throughout this chapter and supported also by participant quotes. Two tables are also presented that summarize the demographics of this study's sample population, the coding categories and themes, and a cross-case synthesis of themes (Yin, 2017).

Research Setting

Data for this multiple case study was collected through semistructured interviews with 10 construction industry managers via the Skype telecommunication platform, by telephone, or in person. The participants were recruited using the LinkedIn networking platform. After potential participants were identified, contact was made with each one individually via e-mail. After they acknowledged consent to participate, an interview time was arranged via e-mail. The criteria for selection required participants to be (a) adults over the age of 18, (b) have 5 years' minimum experience in the management of a construction company, (c) possess knowledge regarding leadership competencies most

needed in the job market for entry-level construction engineers, and (d) be willing and able to participate in a 30–60-minute interview. The one-on-one interviews were conducted in private settings chosen by the participants and with minimal interruptions. The semistructured format allowed each participant to be engaged throughout the interview. The participants were fully aware of their rights to confidentiality, and they appeared to express themselves openly.

Demographics

I recorded all interviews on a digital audio recorder, and I kept reflective handwritten notes on an observer note sheet (see Katz, 2014; see Neuman, 2011). The interviews ranged from 15 minutes up to 60 minutes. Ten participants took part in the study, all construction industry managers. The participants had a vast range of experience spanning from 10 to 36 years in managerial positions. All managers were responsible for direct-report employees ranging from a minimum of 10 up to a maximum of 40 employees. The participants had high levels of education, with all holding a 4-year professional civil engineering bachelor's degree; four also had a master's degree in the area of specialization, and two held a doctoral graduate degree with experience of nearly 30 years each.

In this study I considered participants' gender, age, ethnicity, and educational and marital status as these demographic issues were pertinent variables in the defining conceptual framework. The given pseudonyms are in an XY format in such a way that X

is presented by the generic letter P standing for "participant" and Y is the number identifier assigned to each participant. The full demographics follow in Table 1.

Table 1

Participants' Demographics and Characteristics

Participant	Age	Ethnicity	Number of yrs. in management	Number of employees	Marital status	Education level
Participant 1	58	American	35	25	Married	PhD
Participant 2	52	American	25	25	Married	BSc
Participant 3	66	American	35	10	Married	MSc
Participant 4	50	American	20	20	Married	MSc
Participant 5	52	American	30	30	Married	MSc
Participant 6	65	American–Indian	35	35	Married	BSc
Participant 7	58	American	36	36	Married	PhD
Participant 8	45	American	28	25	Married	MSc
Participant 9	44	American	22	25	Married	BSc
Participant 10	43	American	21	20	Married	BSc

Data Collection

The data collection process commenced on June 23, 2018, following IRB approval from Walden University (IRB approval number 05-31-18-0136458). The data collection phase concluded on July 16, 2018, when data analysis of interviews and reflective field notes ceased to bring forth any new themes, leading me to conclude that saturation had been reached. Evidence of saturation within the set of raw data manifested itself in themes that included: (a) exceptional technical knowledge in engineering applications, (b) effective written and spoken communication, (c) ability to share and

execute goals with a team, (d) strong work-related experience in a leadership position, (e) ability to overcome obstacles, (f) ability to work effectively under pressure, (g) strong mentoring skills, and (h) ability to manage in a rapidly changing environment. Seminal literature also revealed evidence of saturation in these areas based on statistical data and testimonial accounts (Beckwith, Carter, & Peters, 2016; Crites, Dickson, & Lorenz, 2015). Triangulation of the multiple resources as a data analysis strategy was useful in revealing common assertions among the participants, combined with my familiarity of the topic under investigation (Denzin & Lincoln, 2011; Yazan, 2015). Details of the saturation process and what emerged are discussed thoroughly in the Results section of this chapter.

Over a period of 30 days, I coordinated five tasks: (a) recruitment of participants, (b) scheduling and conducting interviews, (c) recording reflective field notes, (d) reviewing seminal literature, and (e) member checking by the study's participants. The data collection process included a built-in audit trail to establish rigor.

Data collection consisted of 10 in-depth one-on-one interviews that I conducted using the Skype telecommunication platform and telephone, and by e-mails. The interviews were conducted over a period of 3 weeks with an average of two interviews conducted each week beginning June 23, 2018, and concluding July 16, 2018. The interviews were scheduled after participants provided consent, and interview times were arranged according to each participant's preferences. Skype or telephone interviews were

conducted in private settings, which included participants' homes or offices, and I was located in an office.

I recorded and maintained reflective field notes from the time of IRB approval by Walden University on May 31, 2018, to record my thoughts, emotions, and reflections during the process of data collection. I recorded experiences and reactions to both formal and informal aspects of the data collection process, including participant responses to recruitment and receipt of consent forms.

Beyond some typical scheduling conflicts and some delayed responses, interview scheduling progressed as expected. Delayed responses to recruitment e-mails sent via LinkedIn may be attributable to sporadic log-in periods by individuals identified as potential participants. In some interviews there were instances where the connection was bad or even lost as a result of poor network service at the participant's location. Use of a handheld back-up audio recorder ensured I did not miss any responses.

In each interview, participants described their experiences as construction industry managers overseeing civil engineers employed at their organizations. During each interview, a definition of engineering leadership was provided for each participant, to ensure all participants had a similar interpretation of the concept. The interview questions were designed to elicit these managers' views on leadership competencies most needed in the job market for entry-level civil engineers.

Initial Contact

I initiated contact on June 23, 2018, using a criterion search to recruit potential participants via the LinkedIn online professional network. The parameters were (a) above 18 years of age, and (b) minimum of 5 years' experience in construction management. The final participant formally consented to an interview on July 20, 2018, at which point in time I ended outreach for new participants. I followed the data collection plan as noted and established in Chapter 3. Messages were sent to several hundred individuals who described themselves as construction industry managers on their LinkedIn profiles.

Several responded and followed up immediately, providing me with an e-mail address to send them the consent form for participation in the study. Several others who responded to the initial contact were not as quick to submit the necessary information for me to provide a consent form. Still others who responded to the initial contact and expressed interest in participating in the study ultimately did not send any information necessary for taking part in the study. Individuals who formally agreed to participate in the study were encouraged to contact others who they believed fit the criteria. Although several construction industry managers were mentioned during purposeful snowball sampling, just one responded to a recruitment solicitation. Although this individual expressed an interest to participate, I declined as by then I had already recruited the number of participants required.

Interviews

Most of the identified potential participants responded to the initial contact and provided formal consent promptly. Once an interview had been scheduled, most participants were easily located on Skype or by telephone. For Skype interviews, I provided my username to the respective participants so they knew who to expect a connection request from.

Each participant agreed to be recorded via Skype. I also used a handheld recorder as back-up in all interviews, which proved useful when experiencing technical difficulties. Participants were located in California. Skype enabled me to interview participants in far off locations, which aided in replication (Yin, 2017).

I encouraged all interviewees to respond freely to the questions. The confidential, semistructured interview design allowed the interviews to be conversational in nature (Leedy & Ormrod, 2010), and helped me capture the essence of the participants' knowledge of and views on leadership competencies most needed in the job market for entry-level construction engineers. This format also enabled me to observe nonverbal cues in a less formal interview setting. In combination with reflective field notes, this approach improved construct validity via triangulation (Guion et al., 2011).

Reflective Field Notes and Journaling

I began recording reflective field notes from the time of IRB approval on May 31, 2018. I made notes about my feelings and emotions at the beginning of the data collection process as well as my thoughts during the recruitment process, while waiting to obtain

formal consent, and during the scheduling of interviews. I also made notes on the process of selecting what tools I would use to ensure accurate data collection as well as personal reflections to ensure minimal personal bias and expectations. In my role as interviewer, I was interested in listening to each interviewee discuss their views and experiences as they wanted to convey them. I analyzed nonverbal communication as well as the tone and attitude of each interviewee. My field notes and transcript reviews offered participants the opportunity to reflect on their responses in a private setting (Bolger, Davis, & Rafaeli, 2003).

I did not note down many impactful observations during the interviews themselves, but reflected afterwards and, when necessary, I played the relevant recordings for inference (Patton, 2014). This aided in establishing patterns and themes as the interview process progressed. Hand-written notes provided valuable information, and enabled each interviewee to affirm their responses.

Thematic analysis was guided by a systemic process of hand coding the data from the interviews and also participants' views which revealed a theme (Vaismoradi, Jones, Turunen, & Snelgrove, 2016). Triangulation of data as well as word coding also allowed a broader recognition of patterns and enhanced dependability by highlighting common relationships across multiple cases (Patton, 2014; Yin, 2017).

Member Checking

Upon completion of the interview transcriptions, each participant received their transcript via e-mail for review and verification. Such back and forth exchange between

each participant and myself ensured accuracy and offered participants the opportunity to clarify any points they felt may not have been adequately expressed. This process improves credibility and reduces concern regarding the accuracy of the data (Merriam & Tisdell, 2015). Overall, very few changes to interview transcriptions were necessary.

Responses to my request for participants to review their interview transcripts and affirm accuracy or make changes took longer than expected. Most participants responded within 48 hours, but some took longer. This could be attributed to participants' busy schedules as well as their confidence in the ability of the recording to register their words clearly and accurately. After reminders where necessary, participants affirmed the accuracy of their transcriptions and the data was used for coding. Hand coding was carried out with the final approved transcripts, and participants' edited and approved files were stored in accordance with the data collection design noted in Chapter 3.

Data Analysis

Coding is at the core of data collection in qualitative, exploratory studies. In this multiple case study, each case analysis contributed to emerging themes of what characterized the views of construction industry managers on leadership competencies most needed in the job market by entry-level civil engineers. As multiple case studies take place in natural settings so as to better understand an underexamined topic, the researcher can start exploring the phenomenon as soon as data collection begins and this continues through the data analysis process (Eisenhardt, 1989; Stake, 2013). The multiple-case study design also allows the researcher to compare and contrast data within

and between cases, and evidence created in this way is considered robust and reliable (Yin, 2017). This research design is relevant for replication and supported my exploration of this topic when comparing results between and among the study's 10 cases. As part of the multiple-case study strategy, I used an inductive research approach to enable themes to emerge from the data, and in this way allow the data and construction industry managers' perspectives to drive data analysis and recommendations for further research (Yin, 2017).

Classified under qualitative descriptive design, thematic analysis relies on techniques for analyzing textual data and derive and develop themes that during data analysis can be used to answer the study's central research question. Thematic analysis is guided by the systematic process of coding raw data from the interviews, to examine the views of study participants through the creation of themes (Vaismoradi et al., 2016). I developed the database for this study by recording and grouping similar thoughts according to key words, views, and deep-seated sentiments (Yin, 2017). After completing member checking, I hand-coded the interview notes on Excel to enter the participants' transcribed answers to interview questions. Following, I highlighted key comments and phrases important to the questions. I carried out thematic analysis using pattern recognition on the basis of discussions during the interviews. Patterns and themes emerged during the sense-making effort associated with the content analysis. Further coding analysis of interview responses led to categorizing various themes on the basis of common relationships across multiple cases (Patton, 2014).

The multiple case study's finalized categories and themes, together with pertinent examples of participant responses (Table 2), illustrate the coding that took place for each category and theme. In this study, four categories that enclose a total of eight themes were identified. The four categories are (a) technical knowledge, (b) communication, (c) experience, and (d) management skills. The eight themes are: exceptional technical knowledge in engineering applications, effective written and spoken communication, ability to share and execute goals with a team, strong work-related experience in a leadership position, ability to overcome obstacles, ability to work effectively under pressure, strong mentoring skills, and ability to manage in a rapidly changing environment.

Table 2

Coding and Theme Examples

Participant	Interview excerpt	Category	Theme
Participant 1	"I expect them to have a good communication and problem-solving skills, ability to overcome obstacles, ability to develop and maintain good partnerships with both internal and external project stakeholders."	Communication; Management skills	1) effective written and spoken communication; 2) ability to overcome obstacles; 3) ability to work effectively under pressure
Participant 2	"I expect them to have … good technical knowledge in engineering applications and CADD."	Technical knowledge	exceptional technical knowledge in engineering applications

(table continues)

Participant	Interview excerpt	Category	Theme
Participant 3	[Applicants:] "Preferably with experience or internship so they understand an office environment."	Experience	strong work-related experience in a leadership position
Participant 4	"… an employee should be proactive; take initiative to lead and enable the process of change and transition while helping others to deal with their effects."	Management skills	ability to share and execute goals with a team
Participant 5	"Leadership is about inspiring and empowering others to successfully complete the tasks at hand. … Leadership is to be a role model …"	Management skills	1) ability to share and execute goals with a team; 2) strong mentoring skills
Participant 6	"Communication abilities — i.e. written, verbal, etc. … Open communication with staff."	Communication	1) effective written and spoken communication; 2) ability to share and execute goals with a team
Participant 7	"Ability to inspire others by commitment and passion."	Management skills	strong mentoring skills
Participant 8	"… adapt to the possible changing work environment, and be willing to work cooperatively with the team."	Management skills	1) ability to manage in a rapidly changing environment; 2) ability to share and execute goals with a team
Participant 9	"Work-related experience — i.e., managerial, clerical, customer service, etc. — leadership experience/qualities …"	Experience	strong work-related experience in a leadership position

Participant 10	"Basic technical competence in engineering, have a basic understanding of our business."	Technical knowledge	exceptional technical knowledge in engineering applications

The themes varied in frequency of occurrence, with some presenting more often than others. These themes are discussed in more detail in this chapter's Cross-Case Synthesis and Analysis section. A brief description of each of the eight themes follows.

Exceptional technical knowledge in engineering applications. This theme describes the technical knowledge that industry construction managers believe entry-level civil engineers and those in leadership positions should have.

Effective written and spoken communication. This theme describes the expectation of construction industry managers that entry-level civil engineers and those in positions of leadership have the ability to communicate effectively.

Ability to share and execute goals with a team. This theme describes the capacity for team work that construction industry managers require on the part of entry-level civil engineers and those in leadership positions.

Strong work-related experience in a leadership position. This theme describes the necessary work experience that construction industry managers expect new recruits to have.

Ability to overcome obstacles. This theme describes construction industry managers' requirement that entry-level civil engineers and those in leadership positions have the ability to overcome obstacles and problems that arise in relation to their work.

Ability to work effectively under pressure. This theme describes the requirement of construction industry managers that entry-level civil engineers and those in leadership positions are able to perform efficiently under the pressure and demands of the profession.

Strong mentoring skills. This theme describes the expectation of construction industry managers that entry-level civil engineers and those in leadership positions have the capacity to mentor staff as role models and motivators.

Ability to manage in a rapidly changing environment. This theme describes the need expressed by construction industry managers for entry-level civil engineers and those in leadership positions to be able to adapt to changes in the work environment.

Evidence of Trustworthiness

Evidence of trustworthiness contributes value to a qualitative study such as this (Lincoln & Guba, 1985). A researcher must carefully follow the processes that seminal case study and qualitative methodologists have recommended so as to strengthen the trustworthiness of the data gathered in a multiple case study (Eisenhardt, 1989; Stake, 2013; Yin, 2017). In this section I present evidence of trustworthiness on the basis of credibility, transferability, dependability, and confirmability. This adds rigor to the data analysis results and confirms that the study has been conducted according to qualitative methodology protocols as required.

Credibility

Credibility has to do with implementing appropriate strategies in a study to support trustworthiness of the data (Merriam & Tisdell, 2015). I was able to achieve credibility through use of the member checking technique, utilized to address concerns or questions regarding credibility of the data (Merriam & Tisdell, 2015). Each participant selected the location for their interview, allowing for comfortability and openness in their responses. I also ensured them of confidentiality and their freedom to not answer any questions or to end the interview at any time. Triangulation pays attention to and observation of participatory research saturation, and cross-case analysis supported the data analysis (Cooper & White, 2012; Morse, 2015; Patton, 2014; Yin, 2017). Sampling of participants representing typical members of the targeted population adds to this study's credibility (Shenton, 2004; Yin, 2017). Finally, interviews were conducted via Skype or in person, allowing me to carefully observe each participant and capture nuances in nonverbal communication, which also adds credibility to the study.

Transferability

Transferability refers to the evidence made available and that makes transferability judgments possible for others who want to apply a study's findings in other populations, contexts, or locations (Lincoln & Guba, 1985). The use of an online professional network such as LinkedIn to sample study candidates enhances transferability, which also relies on rich and descriptive data provided by participants in their responses to interview questions (Yin, 2017). The carefully and purposefully

selected sample of construction industry managers working in the United States increases transferability as it added to a deeper understanding of the study context. Interviews conducted via Skype enabled me to gather data from participants in geographic locations other than my own, which aids replication. The nature of the interviews ensured interactions took place in an unbiased atmosphere, thus avoiding the influence of contextual information and any associated personal reflexivity on my part as the researcher (Deakin & Wakefield, 2014; Hanna, 2012).

Dependability

Dependability refers to the researcher's activities and determination of the extent to which the techniques employed to ensure credibility and transferability meet the research standards in an independent audit (Houghton et al., 2013). I carefully analyzed the process of participant selection for dependability, and based recruitment on a purposeful sample obtained through a criterion-based search on LinkedIn. Participants received the criteria for study participation via e-mail and were required to confirm if they met them. Those expressing interest received a consent form that also reiterated the participation criteria. Materials examined by this individual include audio and video tapes from the interviews, field and observation notes, transcripts verified by the participants (member checking), and published materials evidencing findings that resonate with the seminal literature (Patton, 2014).

Confirmability

Confirmability has to do with the implementation of measures that establish the rationale that findings are based on evidence and are free from researcher bias or reflexivity (Billups, 2014; Shenton, 2004). It is the degree to which other researchers can confirm or corroborate a study's results (Anney, 2014). The methodology expert of my Dissertation Committee audited this study with respect to the alignment of my data collection, analysis, findings, interpretations, and also recommendations (Lincoln & Guba, 1985). Tools for collecting data, including triangulation (Shenton, 2004; Yin, 2017), the purposely selected sample (Merriam, 2014; Morse, 2015), and the audit trail (Denzin & Lincoln, 2011) also contribute to an assertion of confirmability (Stake, 2013; Yazan, 2015). Field notes maintained throughout the study reduced researcher bias by heightening self-awareness before, during, and following data collection as well as during data analysis (Affleck, Zautra, Tennen, & Armeli, 1999).

Study Results

In this theory-generating multiple case research, a particular research question guided the study (Ketokivi & Choi, 2014). By recording the views of construction industry managers, I was able to answer the following central research question: How do the perceptions of managers in the construction industry establish a basis of leadership competencies most needed in the job market for entry-level civil engineers? This multiple case study revealed construction industry managers' views on this topic, and patterns and themes emerged from the raw data gathered from the interviews and subsequent data

analysis. The identification of these patterns and themes took place across two phases: thematic analysis of the textual data, and cross-case synthesis analysis.

The data analysis considers all data gathered, including interviews, field notes, member-checked transcriptions, auditor reflections, and findings presented in the seminal literature (Patton, 2014). I classified emerging themes and cross-referenced findings, which laid the foundation for cross-case analysis, which increases a researcher's ability to generalize the findings of their study (Eisenhardt, 1989; Yin, 2017).

First Phase: Thematic Analysis of the Textual Data

While there is no step-by-step process in the literature or suggestions on how to carry out a rigorous and relevant thematic analysis, the write-up of a thematic analysis should provide "a concise, coherent, logical, nonrepetitive, and interesting account of the data within and across themes" (Nowell, Norris, White, & Moules, 2017; p. 1). The thematic analysis conducted for this study followed King's (2004) suggestion to include direct quotes from participants as an essential component of the final report. Supported by key insights from the 10 in-depth interviews, in the remainder of this section the eight themes that emerged are analyzed and presented in relation to the central research question.

Exceptional technical knowledge in engineering applications. This theme describes the technical knowledge that industry construction managers believe entry-level civil engineers and those in leadership positions should have. Study participants themselves all had a 4-year professional civil engineering bachelor's degree; four also

had a master's degree in the area of specialization, and two held a doctoral graduate degree with great experience. Out of the 10 participants, 2 referred to technical knowledge and experience when asked what they look for when recruiting entry-level civil engineers. Participant 3 in particular noted the following: "I assume all who apply have the basic technical qualifications." Participant 6 listed: "Educational level — i.e., BS, MSE, PhD [and] licensure — i.e., EIT, PE, SE, etc."

Four participants referred to technical knowledge being one of the specific skills/competencies they expect applicants to possess. In this regard, Participant 2 said: "I expect them to have … good technical knowledge in engineering applications and CADD." In response to the same question, Participant 10 stated: "Basic technical competence in engineering."

Effective written and spoken communication. This theme describes the expectation of construction industry managers that entry-level civil engineers and those in positions of leadership have the ability to communicate effectively. All 10 study participants noted the importance of communication skills. Participant 2 commented in relation to leadership that an employee should "encourage others to discuss and share their vision; and communicate effectively with all project stakeholders." Similar sentiments were expressed by Participants 4, 5, 6, 7, 8. Participant 3 emphasized: "I want good communicators and self-starters. These are the persons who will grow into future leaders." Later during the interview he made this point again, saying that applicants should "be able to communicate effectively in writing and speaking."

Ability to share and execute goals with a team. This theme describes the capacity for team work that construction industry managers require on the part of entry-level civil engineers and those in leadership positions. Nine of the 10 participants discussed the importance of team work. Participant 6 stressed "Work transparency with fellow employees; works well with OTHERS; team player." Participant 3 elaborated:

> That person will direct the activities of others in a project team, be proactive, provide direction to people, take care of details and take responsibility for delivering/completing assignments that may include work needed by others as well as their own.

Participant 5 summed it up as follows:

> Specifically, we look for hiring applicants that, besides their education and experience, demonstrate to be team players and are eager to learn, and commit to producing excellent results, while adhering to organization and industry high standards of conduct and ethical excellence.

Strong work-related experience in a leadership position. This theme describes the necessary work experience that construction industry managers expect new recruits to have. Seven of the 10 participants referred to experience as being one of the criteria they want applicants to fulfill. This is especially desired for positions of leadership, regarding which interview question Participant 1 said: "Work-related experience matters, [and] personality, ethical, analytical experience."

Participant 7 emphasized experience at all levels: “Relevant internship or volunteer experience . . . Basic knowledge of civil engineering principals, demonstrated by appropriate college-level course work and/or apprentice level experience.” Participant 9 also mentioned experience in relation to recruiting entry-level civil engineers, listing the following requirements: “Work-related experience — i.e., managerial, clerical, customer service, etc. — leadership experience/qualities, [and] analytical experience/qualities.”

Responding to the question “What specific skills/competencies would you expect applicants to possess?”, Participant 10 offered an overall picture: “Basic technical competence in engineering, have a basic understanding of our business, be able to communicate effectively in writing and speaking, be positive and self-motivated.”

Ability to overcome obstacles. This theme describes construction industry managers’ requirement that entry-level civil engineers and those in leadership positions have the ability to overcome obstacles and problems that arise in relation to their work. Several participants noted the importance of being able to overcome obstacles or solve problems. Participant 1 commented on this in relation to new applicants: “I expect them to have a good communication and problem-solving skills, ability to overcome obstacles.” Participants 2 and 8 simply stated that new applicants should have the “ability to overcome obstacles,” and Participant 7 underlined “good problem-solving skills.”

Ability to work effectively under pressure. This theme describes the requirement of construction industry managers that entry-level civil engineers and those

in leadership positions are able to perform efficiently under the pressure and demands of the profession. Four participants specifically referred to the necessity of being able to work under pressure. Participant 4 placed this ability in the context of leadership too, noting: “an employee should be proactive; take initiative to lead and enable the process of change and transition while helping others to deal with their effects.” Participant 8 elaborated: “When recruiting entry-level civil engineers, I expect them to be able to perform efficiently under pressure.”

Strong mentoring skills. This theme describes the expectation of construction industry managers that entry-level civil engineers and those in leadership positions have the capacity to mentor staff as role models and motivators. Five of the 10 participants specifically referred to this skill, using the words mentor or role model. Participant 5 stated: “Leadership is to be a role model how people should be treated and how to challenge the norm and to establish standards for excellence.” Participant 6 also listed this under leadership as “Positive example/role model to fellow employees and/or staff.” Participant 10 explained that a job description/announcement includes the following statement: “Must have the personality to motivate, be positive, and serve as a mentor to staff.”

Ability to manage in a rapidly changing environment. This theme describes the need expressed by construction industry managers for entry-level civil engineers and those in leadership positions to be able to adapt to changes in the work environment. Four of the 10 participants used the word “adapt,” and four referred to changing environment.

Participant 8 noted that possible hires must be able to "adapt to the possible changing work environment, and be willing to work cooperatively with the team." The same participant also said that in leadership "an employee should be proactive; take initiative to lead and enable the process of change and transition." Participant 8 stated that entry-level civil engineers should be able to "adapt to the possible changing work environment, and be willing to work cooperatively with the team."

Second Phase: Cross-Case Synthesis and Analysis

I utilized the cross-case synthesis and analysis as the technique to synthesize important findings from individual cases and after themes were synthesized across the study's 10 cases overall (Yin, 2017). Given the relatively small number of cases, as recommended for such a qualitative study, word tables allowed me to search for patterns across cases. Cross-case synthesis reinforced validity and permitted generalizations through the process of analysis (Yin, 2017). By consolidating and interpreting the data, trustworthiness of the data is strengthened, and I was able to establish an evidence-based argument to be analyzed through the study's Conceptual Framework (Cooper & White, 2012; Yin, 2017). Cross-case analysis was a continuous process as each of the 10 cases was analyzed separately. This helped to identify recurrent themes emerging from the data to meet the study purpose of exploring views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers.

The most prominent category across the 10 cases was management skills. The two particularly recurrent and dominant themes in this category were: ability to share and

execute goals with a team, and strong mentoring skills. The first of these was built on data provided by nine participants who used terms such as "work cooperatively," "work as a team," "team leadership," "team up," "personality to motivate," and "team players." The second theme in this category was identified through comments by five participants relevant to mentoring and/or being a "role model." Another three themes produced by this category are ability to overcome obstacles, ability to work effectively under pressure, and ability to manage in a rapidly changing environment.

Another prominent category was that of technical knowledge. This category produced one distinct theme: exceptional technical knowledge in engineering applications. Six of the 10 study participants discussed this in relation to "technical knowledge" and "technical qualifications." Four of these participants listed specific academic degrees, licenses, or certificates they considered to be important when considering entry-level civil engineer applicants and possible hires.

Another prominent category was that of communication. This category produced the overarching theme of effective written and spoken communication. The theme relating to ability to share and execute goals with a team, previously discussed under the category of management skills, can also be considered to apply to this category of communication. All 10 participants referred to communication using words or phrases such as "communicate effectively," "good communication," "good communicators," "communications and public relations capabilities," "maintain good partnerships with both internal and external project stakeholders," "verbal communication skills," "written communication skills," and "discuss and share their vision."

A final category was that of experience. This category produced the theme of strong work-related experience in a leadership position. Seven of the 10 participants mentioned experience in the following ways: “work-related experience matters,” “analytical experience,” “good experience,” “with experience or internship,” “position-related work experiences,” “education and experience,” “leadership experience,” and “relevant internship or volunteer experience.”

Triangulation. Codes helped to bridge themes across various methodologies such as interviews, field notes, and literature (Patton, 2014). This triangulation of data sources enhanced the quality of the study (Yin, 2017). Maintaining observational field notes proved to be a valuable part of the data collection process. These notes complemented the data captured on a digital audio recorder, and provided references to and context of nonverbal behaviors (Patton, 2014). Each study participant received a copy of the digital transcript, which they were asked to read and verify for accuracy and associated meaning (Merriam & Tisdell, 2015). The transcripts also proved useful for reviewing my own positionality and reflexivity (Berger, 2015).

To standardize the data collection process, an interview protocol was used for the semistructured interviews (see Appendix). I synthesized reports for member checking, coding structure, and notes on the research progress, which allowed this study to undergo an audit. To ensure dependability of the study results I also used an audit trail and methodological triangulation that included referencing data from my handwritten reflective notes and reviews of relevant literature (Guion et al., 2011; Patton, 2014).

Noting down thoughts and feelings related to study events, behaviors, or conditions that can trigger an emotional reaction help a researcher to maintain a neutral stance and avoid researcher bias (Lincoln & Guba, 1985; Yin, 2017). I read through, studied and made notes on approximately 250 peer-reviewed journal articles, on business reports and news items in the media, and on school curricula. Not all of these materials were appropriate for the literature review, but they did provide an additional source of information to consider and keep in mind when conducting the semistructured interviews.

After the semistructured interviews with all 10 participants had been completed, I continued with triangulation so as to answer the research question. I did this by analyzing materials (journal articles, business reports, news items, and school curricula) directly related to my themes (Yin, 2017). This enabled me to amass thick, rich information within the following themes relating to the views of construction industry managers on leadership competencies most needed in the job market by entry-level civil engineers: exceptional technical knowledge in engineering applications, effective written and spoken communication, ability to share and execute goals with a team, strong work-related experience in a leadership position, ability to overcome obstacles, ability to work effectively under pressure, strong mentoring skills, and ability to manage in a rapidly changing environment. These readings helped me to examine the meaning behind recurring ideas and concepts to generate themes that were complete, credible, empirically accurate, and that added value. The methodological triangulation of all these data sources thus provides enough thick, rich information for the study design to be replicated (Guion

et al., 2011; Patton, 2014). I analyzed and interpreted the results of the study in the context of the conceptual framework, and have presented how the findings add to knowledge regarding leadership competencies most needed in the job market by entry-level civil engineers.

Summary

In this chapter I presented a case by case analysis of a total of 10 individual cases, followed by a cross-case analysis and synthesis that led to providing answers for this multiple case study's central research question: How do the perceptions of managers in the construction industry establish a basis of leadership competencies most needed in the job market for entry-level civil engineers? Based on the findings, I identified and presented a total of four categories that comprise a total of eight themes, leading to thick, rich data on the views of construction industry managers regarding the leadership competencies most needed in the job market for entry-level civil engineers. The four categories were: (a) technical knowledge, (b) communication, (c) experience, and (d) management skills. The eight themes cover: exceptional technical knowledge in engineering applications, effective written and spoken communication, ability to share and execute goals with a team, strong work-related experience in a leadership position, ability to overcome obstacles, ability to work effectively under pressure, strong mentoring skills, and ability to manage in a rapidly changing environment.

To enhance the trustworthiness of the study's data, I employed methodological triangulation of the following data sources: interviews, journaling/reflective field notes,

and literature (Guion et al., 2011; Patton, 2014). This triangulation provides enough thick, rich information for the study design to be replicated. I analyzed and interpreted study results in line with the conceptual framework, and presented how study findings add to the body of knowledge regarding leadership competencies most needed in the job market by entry-level civil engineers.

In Chapter 5, I will present further interpretation of the study findings with respect to how they compare or contrast with the literature reviewed in Chapter 2. Additionally, I will describe how future research can build on the findings of this study and contribute to a better understanding of construction industry managers' views on the leadership competencies most needed in the job market for entry-level civil engineers.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this multiple case study was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. To address this, a multiple case study design was used to collect qualitative data from multiple sources, including interviews, peer quality audit, and engineering school curricula (Yin, 2017). The study was framed by three concepts of engineering leadership developed hieratically by Mallette (2005), Robledo et al. (2012), and Rottmann et al. (2015). Mallette (2005) originated the conceptual framework of engineering leadership, and Robledo et al. (2012) and Rottmann et al. (2015) further extended the framework by building upon previous studies.

A multiple case analysis of 10 interviews and then thematic analysis and cross-case synthesis and analysis revealed eight prominent themes: (a) exceptional technical knowledge in engineering applications, (b) effective written and spoken communication, (c) ability to share and execute goals with a team, (d) strong work-related experience in a leadership position, (e) ability to overcome obstacles, (f) ability to work effectively under pressure, (g) strong mentoring skills, and (h) ability to manage in a rapidly changing environment.

Interpretation of Findings

The findings of this multiple case study largely confirm or extend current knowledge in the discipline, with each case presenting examples of issues discussed in the literature review in Chapter 2. In this section, I present and review the study's

findings in the context of the four categories that emerged from the data analysis and compare them with relevant concepts from the conceptual framework and the reviewed literature. I provide evidence from the 10 semistructured interviews to support how the study's findings either confirm or disconfirm existing knowledge, or even extend it. Extension studies, such as this multiple case study, provide not only replication evidence but also the ability to extend prior research results with a view to offering new and important theoretical directions (Bonett, 2012).

Technical Knowledge

This study's findings confirm those of Abdulwahed and Hasna (2017), which spoke to the importance of technical knowledge, as well as those of Kotnour et al. (2014), who incorporated in their definition of engineering leadership the ability to display aptitude in technical tasks. Six of the 10 study participants referred to this using the terms"technical knowledge" and "technical qualifications." The findings also align with the work of Mallette (2005), whose Theory Pi includes in its conception leaders with expert technical knowledge, and that of Rottmann et al. (2015), who highlighted technical mastery as one of the three orientations to engineering leadership. The results of my study also confirm a focus on technical mastery as found by Klassen et al. (2017). My findings reflect that construction industry managers view technical knowledge in a similarly important light. They expect, or even assume, that both entry-level civil engineers and those in leadership positions possess such knowledge in relation to the profession in general applications as well as engineering applications in particular. This

study further found that attainment of a specific educational level in a related field is also a criterion when recruiting entry-level civil engineers. Four participants listed specific academic degrees, licenses, or certificates they deemed important when considering entry-level civil engineer applicants and potential hires.

Communication

Clear and precise communication plays an important role in all areas of engineering leadership and is very important for managers and peers in presentation, business writing, and cross-cultural exchanges (Rottmann et al., 2016). Cassin (2003) noted that leadership and communication in civil engineering means innovation, productivity, concept, and purpose for engineering students. A decade later, research by Bayless (2013) emphasized interpersonal communication in engineering leadership. The concept of communication was well supported by this research as all 10 study participants noted its importance, particularly with regard to effective written and spoken communication. One elaborated on this in connection with both fellow employees and all project stakeholders and another in relation to problem-solving skills, both aligning with communication as a desired soft skill (Hartmann, 2016).

Hartmann and Jahren (2015) identified communication as one of five themes for leadership among early-career engineers, and Handley et al. (2016) also identified it as an engineering leadership theme emerging from their research. In this regard, one participant said good communicators would grow into future leaders. This point also aligns with the research of Farr et al. (1997), who regarded good communication as one of the leadership

qualities important for engineers. Goodale (2005) deemed it part of leadership skills, and Kirschenman (2011) suggested it is very important in global businesses for successful leadership. Abdulwahed and Hasna (2017) also included communication in discussions of leadership-related attributes. This study's findings regarding communication are especially noteworthy considering the results of research by Itani and Srour (2016) pointing to an awareness of the lack of communication skills among engineers.

Experience

In their definition of a civil engineer, Stevens and Vinson (2016) noted that such a professional has, amongst other qualities, concrete experience. According to Itani and Srour (2016), while engineers are still seen as mainly technical contributors, their work in today's marketplace requires skills beyond technical know-how, skills gained through studies and professional experience. The findings of this study corroborate Itani and Srour, with the majority of participants noting their expectation that new recruits have necessary work experience. This covers experience at all levels, through education or internship/apprenticeship and including managerial, clerical, and customer service work. Prior research by Kirschenman (2011) also supported that cross-cultural awareness and experience are needed for global business activities.

There are ample opportunities for engineering graduates entering the job market to hone their skills in the construction industry and focus on professional experience. As such, it follows that seven of the 10 participants referred to experience as being one of the criteria they want applicants to fulfill. They expressed this through wording such as

"work-related experience matters," "good experience," "with experience or internship," "position-related work experiences," "education and experience," "leadership experience," and "relevant internship or volunteer experience," Based on this study's findings, experience is especially desired for positions of leadership, including in relation to personality, ethical, and analytical experience.

Management Skills

Bergeron (2001) and Kirschenman (2011) argued the need for engineers to learn how to lead in order to respond to management challenges that occasionally arise and for related responsibilities in an increasingly globalized economy. Both Goodale (2005) and Rottmann et al. (2016) included management as an important engineering leadership skill. Itani and Srour (2016) reported that to compete in and meet the demands of the postindustrial world, employers require engineers to have soft skills related to management, teamwork, communication, and entrepreneurship. My findings in this study strongly support these different research contributions with management skills proving to be the most prominent category across the 10 cases. The study participants emphasized the importance of being able to share and execute goals with a team, noting the need for team leadership and ability to motivate.

Construction managers are an integral part of the building process; they plan, coordinate, budget, and supervise construction projects from start to finish (U.S. Bureau of Labor Statistics, 2018). The results of this study echo this and other research, such as that of Hartmann (2016), underlining the importance for entry-level civil engineers to

possess a set of abilities commonly regarded as soft skills, including, among others, management skills. This aligns with Mallette's Theory of Pi and recommendations for those who manage engineers. The construction industry managers interviewed for this study supported the importance of management skills through mention of associated attributes such as being a role model, mentoring, having problem-solving skills, taking initiative to lead, ability to manage in a rapidly changing environment, and enabling the process of change and transition.

Understanding of professional and ethical responsibility is a soft skill required by ABET and entails more than just following rules; it is a process skill that requires ability to make appropriate decisions (Yaacoub et al., 2011). This follows the research of Farr and Brazil (2009) who referred to using power wisely, being a decision-maker, and being ethical and courageous as some of the leadership qualities important for engineers to possess. Pitts et al. (2013) also included ethical actions and integrity as part of leadership capabilities. This study confirms such research, evidenced through various participant responses referring to applicants or employees who commit to producing excellent results, adhere to organization and industry standards of conduct and ethical excellence, and have ethical experience.

Limitations of the Study

In this qualitative multiple case study, a key limitation was considered to be those participants who did not have the time to contribute their views on the phenomenon being investigated. To mitigate this effect, I did my best to manage and accommodate the time

limitations of participants when scheduling the interviews (Patton, 2014). Furthermore, I used the purposeful sampling approach as a means to counter potential bias through the selection of opposing views, but this remained a significant limitation of the study. Researcher bias was mitigated with the use of an audit trail, transcripts and digital recordings, and member checking to strengthen the credibility of the study results. A similar limitation was the relative novelty of the phenomenon under study in terms of the participants' knowledge. I mitigated this limitation through strict adherence to the criteria for participant inclusion and exclusion. Also, prior to each interview, I asked preinterview questions to ensure as much as possible that participants possessed in-depth knowledge of the topic under study (Merriam & Tisdell, 2015).

Finally, as with all qualitative case studies, one limitation is the transferability of results to the general population. To determine transferability, I described in detail the original context of the research so sound judgments can be made about the results (Klenke, 2016). I developed detailed descriptions so I could make an informed decision regarding the transferability of the findings to their specific contexts (Lincoln & Guba, 1985; Stake, 2006). Further, I diligently created "thick" descriptions, including accounts of the context, research methods, and examples of raw data (see Stake, 2006).

Recommendations

Abdulwahed and Hasna (2017) and Hartmann (2016) reported that a literature gap exists in clearly defining engineering leadership by specific discipline, resulting in an ambiguous connection between theory, academia, and professional practice. Further,

although Rottmann et al.'s (2015) grounded theory conceptualizes leadership from the perspective of engineers, the framework leaves a knowledge gap on how to connect engineers' actual roles on the job to definitions of engineering leadership presented in the literature to date (Rottmann et al., 2016). This study aimed to fill these gaps by gathering data in the field from construction industry managers on leadership competencies most needed in the job market for entry-level civil engineers. The potential benefits of this study thus include a better understanding of industry needs regarding leadership competencies and can contribute to a more comprehensive definition of engineering leadership. The study's findings may also provide information that can help improve engineering education and by extension enable civil engineers' progress in their profession (Itani & Srour, 2016; Simmons et al., 2017). Filling these knowledge gaps can therefore contribute overall to improved practices for civil engineers entering the job market as well as also their educators, trainers, and employers.

On the basis of the study's strengths and limitations as previously detailed, future researchers are encouraged to replicate this study utlizing qualitative research paradigms that address this topic in various contexts or to validate my research findings through appropriate quantitative research methods.

Methodological Recommendation 1: Quantitative Validation

Employing a quantitative research method such as a survey could offer important insights into the transferability of my investigation into leadership competencies most needed in the job market for entry-level civil engineers based on a bigger sample

population and extended geographic location. While certain sections of my study evidence near unanimity among the participants, the views of a wider sample of construction industry managers may differ based on location. A larger, quantitative study could confirm or highlight geographic similarities and discrepancies and reveal more or less prominent aspects of various components of my study in relation to such characteristics as age, gender, level of education, and specific industry discipline.

Methodological Recommendation 2: Qualitative Replication

Further qualitative research utilizing the multiple-case study method, as I have done, is also encouraged. This could prove useful for determining how research findings differ across industry-specific disciplines and location, including areas that have marked cultural differences and/or are characterized by different socioeconomic and political burdens. Additionally, future researchers could conduct a similar study with a sample that is equally represented by both genders; this could deliver valuable insights into the gendered aspect of leadership in the construction industry.

Recommendations for Future Research

Technical knowledge. All of the participants in my study were construction industry managers over the age of 18 with at least 5 years' experience in the management of a construction company. I recommend further research on construction industry managers above the age of 30 so as to reveal insights into the required technical know-how in combination with leadership competencies from those with more extensive leadership and management experience and lengthier professional activity beyond

technical contributions. This could reveal different perspectives compared to those revealed by my study and more clearly marry the two aspects. It may also shed light on what further efforts or considerations are needed in reforms related to engineering curricula. This is important given that technical engineering firms today require entry-level, full-time engineers to possess leadership skills yet have failed to indicate which leadership competencies are most important in their recruitment and hiring process (Hartmann et al., 2016; Itani & Srour, 2016; Schuhmann et al., 2014). Such a study could also help to confirm and build on Rottmann et al.'s (2015) research supporting technical mastery as one of three orientations to engineering leadership. It could also contribute to a strengthened definition of engineering leadership, such as that of Kim (2014) who suggested it includes the ability to foster creativity and aptitude in technical tasks.

Communication. Bayless (2013) made the case for a foundational approach to engineering leadership through enhancement of self-awareness and interpersonal communication. More recently, Hartmann (2016) spoke to communication as an important soft skill, and Abdulwahed and Hasna (2017) supported that it is an important people skill for engineers. Many other researchers have also underlined communication as a required leadership quality for engineers. I suggest further qualitative as well as quantitative research with samples of construction industry managers from different cultures to explore more in depth the complexities of communication in the global economy's changing dynamics and increased demand for collaboration beyond borders (Kirschenman, 2011; Norback et al., 2009). This can be seen to support the work of

Ismail et al. (2017), who noted the need for enhanced communication with good experience of and proficiency in languages, and also has implications for improved and more well-rounded engineering education. Future research could also delve into gendered aspects of communication and interpersonal interactions to provide insights into how different communication styles affect male and female engineering leadership and related business success.

Experience. The participants in this study had between 10 and 36 years of experience in managerial positions, with two holding a doctoral degree with experience numbering nearly 30 years. Against this background, it is not surprising that strong work-related experience in a leadership position emerged as a theme, supporting also Stevens and Vinson's (2016) inclusion of concrete experience being a requirement for civil engineers. However, the nature of this multiple case study did not allow deeper investigation of different or specific areas of experience that recruiters or managers in the construction industry look for in new recruits. As such, I recommend future research with a sample of construction industry managers who have at least 20 years' experience to gain a better understanding of the particular areas of experience that best enable or contribute to the potential of civil engineers to rise to positions of leadership in their profession. This could potentially also help to build on or extend Mallette's (2005) Theory of Pi, which offers a set of recommendations for managers of engineers.

Management skills. Bergeron (2001) strongly supported the need to introduce engineering management to all engineering students through an in-depth review of

research on leadership and management in engineering. Kirschenman (2011) argued that all engineers need to learn at the practical level how to lead in order to respond to the management challenges that arise. Considering therefore that the emerging body of literature recognizes and emphasizes the need to introduce engineering students to engineering management and leadership skills through targeted training (Rottmann et al., 2016; Schulz, 2008; Siller et al., 2009), I suggest further research in relation to management skills required specifically in the construction and engineering industry. Such investigation would necessarily extend beyond widely accepted notions of soft skills needed for managing and leading teams of professionals. This could help to better inform efforts aimed at reforming engineering education, including the introduction of new and complementary engineering program curricula that advance knowledge and skills/concepts of engineering leadership. One example of such a program is CU Denver's CEM master's program, regarding which Clevenger et al. (2017) reported that few models or templates existed on which to base its development. Such research may also help to increase awareness among engineering students of the different career options and organizational contexts available to them after graduation, as supported by Rottmann et al. (2016).

A second recommendation for future research is to focus on the different or additional management skills engineers should possess in world regions burdened by conflict or with limited resources (El-Sabek & McCabe, 2017; Kotnour et al., 2014). This again could extend the theoretical work of Mallette (2005) by providing insight into

construction and engineering management skills required in areas constrained by exceptional circumstances, including natural disasters. The findings of such research could also be applied to introduce or strengthen engineering education components tailored to management skills for business success in volatile areas.

Implications

Positive Social Change

The current study's results can potentially bring about positive social change at individual, family, corporate, and societal levels. Through my multiple case study involving construction industry managers, my findings contribute increased knowledge regarding the technical know-how, communication, experience, and management competencies required of civil engineers entering the job market, and . This study could drive new business- and societal-related research regarding engineering leadership, as well as educational research as it confirms the need identified by prior research to enhance engineering program curricula with related leadership education. Researchers may also attempt to replicate this study for transferability. My study and findings offer critical insight into the engineering leadership competencies most required of entry-level civil engineers in the job market, and can thus contribute to better practice on the part of industry and professional associations and research and theory building in academia.

Individual level. My study corroborates the findings of other studies that engineers need soft skills and leadership training (Bradford, 2017; Willmot & Colman, 2016). Awareness of this industry need on the part of both engineering students and

universities will help to better prepare engineering graduates to enter their related job market and make an impact or progress in their profession (Itani & Srour, 2016). Targeted engineering leadership and management education will complement civil engineers' technical skills acquired through studies and apprenticeship or internship. This will also enable them to make the shift from a technical to a managerial position (Bradford, 2017; Itani & Srour, 2016; Willmot & Colman, 2016). It could also help them to deal with and overcome the obstacles and practical challenges that arise in their profession (Bergeron, 2001; Kirschenman, 2011).

Family level. This study did not specifically consider or review research on familial issues in connection with civil engineers entering the job market or engineering leadership and related industry requirements. However, there is ample literature regarding the effects of work-related stress on the family (Repetti & Wang, 2017; Bowen, Govender, Edwards, & Cattell, 2018), which improved knowledge of engineering leadership could help to mitigate through better preparation of engineering students and entry-level civil engineers as well as enhanced potential for professional development at the individual level (Itani & Srour, 2016; Simmons et al., 2017; Sousa & Mouraz, 2014). The ability of civil engineers to have more confidence and motivation in their professional life and opportunities for career development or to launch their own entrepreneurial activities will by extension contribute to overall family well-being (Ilies, Liu, Liu, & Zheng, 2017).

Organizational level. The findings of my study provide suggestive evidence for technical engineering and related firms to provide ongoing training in soft skills and engineering leadership (Robledo et al., 2012). This will add value to the workplace environment as advances in engineering leadership hold potential for redressing workplace inequities and improving workplace interactions and transition (Bergeron, 2001; Kirschenman, 2011; Klassen et al., 2017). It will also strengthen business practices that ensure the successful completion of construction projects, supporting thus companies' financial health and sustainable development (Warrington et al., 2011). Advancing soft skills and competencies such as communication, leadership, and teamwork, will give engineers more confidence and motivation to capitalize on innovative ideas at their employing organizations (Menzies & Paradi, 2002; Souitaris et al., 2007).

Societal level. Engineering experts in both academia and industry highlight constructs in engineering leadership and the ability to manage change as well as synthesize business and social perspectives as critical job skills within their industry (Cox et al., 2012). This study's findings in the context of individual- and organizational-level benefits thus have the potential to make associated positive contributions to society. At the same time, it is vital that engineers come forward as leaders to realize their full potential for service to society (NAE, 2004; Pierson, 2013; Simpson et al., 2012). This is especially true with regard to engineers working in volatile areas (Back et al., 2012; James, 2017) as they need to consider high risks, short response times, need for disaster

management, and constrictions on resources (El-Sabek & McCabe, 2017; Kotnour et al., 2014).

Theoretical and practical responses to the increasing call for a wider set of human dynamics skills training in engineering curricula, especially leadership skills (McConville et al., 2017), will no doubt have a positive impact on today's complex society. Knowledge of contemporary issues and education regarding the impact of engineering solutions in global, economic, environmental, and societal contexts (Yaacoub et al., 2011) will then also have positive influences at the societal level. Rottmann et al. (2016) included such a societal aspect to extend studies and models of engineering leadership and enable a more adequate framework for conceptual explorations of the same. As such, enhanced leadership driving business and personal successes has, overall, important implications for a better educated and more culturally sensitive and responsive society.

Methodological, theoretical, and/or empirical implications. This study was framed by three key concepts of engineering leadership: Mallette (2005) originated the conceptual framework of engineering leadership, and Robledo et al. (2012) and Rottmann et al. (2015) further extended the framework by building upon previous studies. The purpose of this qualitative, multiple-case research study was to explore views of managers in the construction industry on leadership competencies most needed in the job market for entry-level civil engineers. The research providing the foundation for the study's conceptual framework was critical in light of research that highlights the need for

a more comprehensive definition of engineering leadership and better understanding of the industry requirements regarding related competencies for civil engineers entering the job market (Hartmann et al., 2016; Itani & Srour, 2016; Schuhmann et al., 2014). The findings of my investigation are aimed at enhancing knowledge on engineering leadership and associated education requirements, and also to contribute original qualitative data to the conceptual framework framing the study. The empirical evidence I have presented for this multiple case study offers a reliable research method for data collection on construction industry managers' views of the competencies most needed in the job market for entry-level civil engineers. The chosen data collection method adds rigor and credibility to the results (Yin, 2017).

The responses from all 10 participants added relevant data to the study and with no significant divergence or discrepancies. The emergent themes presented in this study are the participants' views regarding industry requirements related to engineering leadership and competencies. The recommendations presented in this chapter are the product of this multiple case study's interviews, field notes, cross-case synthesis, and triangulation. The multiple-case study method does not target representativeness as a relationship of sample and population (Ridder, 2017). It is used to augment external validity and cross-case comparison, to safeguard against observer bias (Stake, 2013), and to advance the extension of theory. Extension studies provide replication evidence and also extend prior research results in theoretically important directions (Bonett, 2012). This research is significant to theory in that it contributes original qualitative data on

construction industry managers' views on leadership competencies most needed in the job market for entry-level civil engineers, and, thus, extends knowledge within the conceptual framework framing this study.

Conclusions

Engineering leadership is a highly sought-after competence by construction companies (Elia et al., 2017; Weilerstein & Byers, 2016), yet the leadership competencies of engineering students are significantly lacking compared to students graduating in other disciplines (Stephens & Rosch, 2015). The results of this study, in alignment with prior research findings, show that it is important for entry-level civil engineers to possess a set of abilities commonly regarded as soft skills, including, among others, communication, management skills, problem solving, and team work (Hartmann, 2016). Such soft skills augment technical expertise and add to professional standing (Sousa & Mouraz, 2014), and enable progress in the profession (Itani & Srour, 2016; Simmons et al., 2017), yet there is a noted lack of such soft skills among engineering graduates (Schulz, 2008). The findings of this study for both these aspects therefore underline the need for undergraduate engineering curricula to include leadership education and, within that, engineering soft skills training (Yaacoub et al., 2011).

The construction industry managers participating in this study played an important role in understanding the leadership competencies most needed in the job market for entry-level civil engineers. This study contributes original qualitative data that could potentially help to establish a basis of leadership competencies most needed in the

job market for entry-level civil engineers. Accomplishing this will ultimately confer benefits to engineering students, construction industry professionals, technical engineering firms, and the wider society.

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Appendix: Interview Protocol

Participant Number Identifier: _____

1. Gender: _____

2. What is your job title?

3. How long have you worked at [Company]?

4. What are your main job responsibilities at [Company]?

5. When recruiting entry-level civil engineers, what do you look for in possible hires?

    a. Follow-up questions and probes, as required.

6. What does your company mean by "leadership" in this/these job descriptions? (ask for job announcement(s)).

    a. You've told me what "leadership" means. What specific skills would you expect applicants to possess?

    b. What acceptable evidence do you expect to see for a "leader" in civil engineering?

    c. Other follow-up questions and probes as the conversation progresses.

7. Would you like to share anything else with me regarding your company's hiring policies, views on leadership skills for engineers, or anything else that you think would help me with my research?