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A Multi-Level Longitudinal Investigation of Transformational Leadership Influence on Team Members Development in Engineering Project Teams

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A MULTI-LEVEL LONGITUDINAL INVESTGATION OF TRANSFORMATIONAL LEADERSHIP INFLUENCE ON TEAM MEMBERS DEVELOPMENT IN ENGINEERING PROJECT TEAMS

by

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ABSTRACT

A MULTI-LEVEL LONGITUDINAL INVESTIGATION OF TRANSFORMATIONAL LEADERSHIP INFLUENCE ON TEAM MEMBERS DEVELOPMENT IN ENGINEERING PROJECT TEAMS

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The purpose of the current study is to contribute to the existing Transformational Leadership literature. Despite the overwhelming support that Transformational Leadership theory has garnered over the recent years, the underlying mechanisms and processes by which these leaders exert influence on their followers have yet to be adequately examined. More importantly, while the majority of advances in leadership research can largely be attributed to traditional areas of management and social sciences, studies of leadership in the context of engineering still remain relatively unexplored. Drawing on previous empirical research as well as the concept of Core Self-Evaluations, this study sets out to examine an antecedent of Transformational Leadership in the context of engineering project teams. Using a longitudinal research design, this study also examines the relationship between Transformational Leadership and followers' Core Self-Evaluations developments. Data were collected over 16 weeks from 143 undergraduate engineering students enrolled in their respective department-required engineering design courses. Results illustrate a positive and significant relationship between leader Core Self-Evaluations and followers' perception of Transformational Leadership. A multi-level and longitudinal analysis also revealed that Transformational Leadership is positively related to increases in followers' Core Self-Evaluations. These findings contribute to a better understanding of Transformational Leadership in the context of engineering. Both the theoretical and practical implications from this research are discussed. Limitations and suggestions for future research are also provided.

This dissertation is dedicated to my family.

I love you all. Forever.

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CHAPTER I

INTRODUCTION

Leadership and team-based work structures continue to become increasingly relevant as organizations must strive to establish and maintain prosperity in today's competitive environment. Effective teamwork enables organizations to accomplish complex and challenging tasks through the collaborative efforts of individuals who bring with them different set of knowledge, skills, and abilities. Individuals can be brought together to solve problems that require knowledge and capabilities that lie beyond those possessed by a single person. Through the use of team-based work structures, organizations can rely on effective task delegation to decentralize decision making while also enabling the sharing of knowledge and ideas. Indeed, of the many advantages of team-based work structures, the distribution, consolidation, and integration of knowledge and ideas have led many organizations and firms to begin to transform their organizational infrastructure to become more decentralized (Argote, Gruenfeld, & Naquin, 2001; Burke, Fiore, & Salas, 2003; Zaccaro, Rittman, & Marks, 2001).

Research on team-based work structures has attracted much interest of organizational and management scholars over the past few decades (Ancona & Caldwell, 1992, Berney, 1991; Kratzer, Leenders, Van Engelen, 2008; March & Simon, 1958). In the engineering discipline in particular, team-based work structures and their use have been gaining research attention over the recent years (Kratzer et al., 2008; Verner, Babar, Cerpa, Hall, & Beecham, 2014; Yilmaz, O'connor, Colomo-Palacios, & Clarke, 2017; Zhang & Cheng, 2015). Indeed, decentralized team-based work structures in engineering can provide many advantages over the traditional hierarchical processes. The use of team-based work structures for engineering design, for instance, can bring together team members to strike a balance between technical skills, design understanding, and

strategic knowledge. Similarly, research and development engineering teams can be structured in ways that enable collaboration and knowledge sharing to increase the likelihood of innovation and creativity. The essence of team-based capabilities, as Grant (1996a, 1996b) noted, is the integration of individually-held knowledge. Knowledge in and of itself is not what makes teams so valuable. It is the effective integration of such knowledge that results in the value of teams.

While effective teamwork depends upon a variety of team characteristics and contextual factors, leadership plays a critical role that can largely influence success or failure (Bass & Riggio, 2006; Chen, Kirkman, Kanfer, Allen, & Rosen, 2007; Hackman, 2002; Kozlowski & Bell, 2003; Yukl, 2002; Zaccaro et al., 2001). To a large degree, team leadership is about being able to clearly define a sense of direction and to inspire motivation and commitment (Dust, Resick, & Mawritz, 2014; Kark & Shamir, 2002; Kark, Sharmir, & Chen, 2003). Effective leaders promote team commitment by aligning the goals and values of individual team members to those of the collective. Leadership can also promote a sense of cohesion, enabling team members to trust and be supportive of one another. Leaders can instill a sense of purpose and meaning to the team and the work by articulating a clear direction and painting a vision of an attractive future. Team members can be led to feel a sense of collective duty not to let each other down and to become inspired to overlook their own self-interests for the sake of something larger. Indeed, even when teams are self-directed, it is the leadership of individual team members that can lead to effective teamwork to ensure success (Bass & Riggio, 2006).

Transformational Leadership and Core Self-Evaluations

Of the many leadership theories that have ever been studied to date, the theory of Transformational Leadership is arguably the most recognizable and well-researched leadership

concept (Dust et al., 2014; Hiller, DeChurch, Murase, & Doty, 2011). In fact, empirical support for the positive impacts of Transformational Leadership exists vastly throughout the current literature (Bass, Avolio, Jung, & Berson, 2003; Judge & Piccolo, 2004; Liu, Siu, & Shi, 2010; Schaubroeck, Lam, & Peng, 2011; Wang & Howell, 2010, 2012). At its core, a critical theoretical element of Transformational Leadership is the capacity for these leaders to develop and enhance their followers' self-concepts and capabilities (Bass 1985; Bass & Riggio, 2006; Day & Antonakis, 2012; Dust et al., 2014; Shamir, House, & Arthur, 1993). Unfortunately, despite the overwhelming support that Transformational Leadership theory has garnered over the recent years, the underlying mechanisms and processes by which these leaders exert influence on their followers are yet to have been adequately examined (Avolio, Zhu, Koh, & Bhatia, 2004; Day & Antonakis, 2012; Dust et al., 2014; Huang, 2013; Northouse, 2016; Wang & Howell, 2010, 2012).

The purpose of the current study is to extend upon the current Transformational Leadership literature. To do this, a dispositional concept, termed Core Self-Evaluations (Judge, Locke, Durham, 1997), is drawn upon to help explain several of the critical theoretical elements of Transformational Leadership. At its core, Core Self-Evaluations represents a self-perception theory that describes how individuals evaluate themselves in terms of worthiness and capabilities (Rode, Judge, & Sun, 2012). According to Judge et al. (1997), Core Self-Evaluations is a higher-order latent construct that captures the commonalities between its four core dispositional indicators: Self-Esteem, or an individual's sense of worthiness; Generalized Self-Efficacy, or the beliefs about one's own capabilities to successfully perform; Locus of Control, or an individual's beliefs that he or she is in control of his or her own circumstances; and Emotional Stability, or the positive outlook that one has with regard to the self and the environment (see also Judge, Erez, Bono, & Thoresen, 2003). In general, high Core Self-Evaluations individuals are those who

demonstrate high levels of self-esteem, general self-efficacy, internal locus of control, and emotional stability. These individuals are confident in their own abilities and see themselves as being worthy of success. As Judge et al. (1997) noted, Core Self-Evaluations provides a theoretical basis that can help explain why people are motivated to display certain actions and behaviors (Bono & Colbert, 2005; Bono & Judge, 2003b; Chang, Ferris, Johnson, Rosen, & Tan, 2012). Applied to the leadership concept, Core Self-Evaluations is viewed as a desirable disposition that can lead to leadership effectiveness (Hu, Wang, Liden, Sun, 2012). More importantly, based on evidence that exists in the current literature, this research argues that the development of followers' Core Self-Evaluations can help explain the positive impacts of Transformational Leadership.

The interplay between Transformational Leadership and Core Self-Evaluations is the central focus of this research. More specifically, the primary goal of this study is to make at least two contributions to the existing leadership literature. First, given the positive impacts that Transformational Leadership has been shown to have on individual and team outcomes, this study sets out to examine the relationship between leader's Core Self-Evaluations and followers' perception of Transformational Leadership. This research is particularly interested in examining whether leader's Core Self-Evaluations serves as an antecedent to a leader's display of Transformational Leadership. Second, given that a critical theoretical element of Transformational Leadership is the ability for these leaders to influence and enhance followers' self-concepts (Bass 1985; Bass & Riggio, 2006; Day & Antonakis, 2012; Dust et al., 2014; Shamir et al., 1993), this study also sets out empirically examine the impact of Transformational Leadership on followers' Core Self-Evaluations developments.

While the primary purpose of the current study is to contribute to a better understanding of the relationship between Transformational Leadership and Core Self-Evaluations, the current

study aims to also offer several methodological contributions to the existing leadership literature. First, recent researchers have underscored the inherent multi-level nature of leadership (Braun & Nieberle, 2017; Day & Antonakis, 2012; Leroy, Anseel, Gardner, Sels, 2015; Shamir, Zakay, Breinin, Popper, 1998; Wang & Howell, 2012; Yammarino & Dansereau, 2008). Despite this, however, the majority of Transformational Leadership research to date has been conducted predominately at a single level of analysis. Failure to account for the multi-level nature of leadership could lead to incomplete understanding of the underlying theories. To this end, this research aims to contribute to the current literature by examining the relationship between Transformational Leadership and followers' developments in Core Self-Evaluations from a multi-level perspective.

Second, many questions in leadership research are fundamentally related to the prediction and consequences of leadership over time. Yet, the majority of leadership research to date often overlooks the importance of integrating time as a research dimension (Ployhart, Holtz, Bliese, 2002; Rank, Nelson, Allen, Xu, 2009; Zhu, Newman, Miao, Hooke, 2013). Indeed, the cross-sectional research design, whereby variables of interest are observed at a single point in time, is arguably the most widely utilized methodological approach in leadership research. While cross-sectional research can certainly help advance both the theoretical and practical understanding of effective leadership, studies that fail to consider the dynamics of leadership over time could potentially result in misleading conclusions (Ployhart et al., 2002). For this reason, many recent scholars have called upon the need for more longitudinal studies of leadership (Bass & Riggio, 2006; Day & Antonakis, 2012; Ployhart et al., 2002; Rank et al., 2009; Yukl, 2002; Zhu et al., 2013). In response to these calls, the current study utilizes a longitudinal research design approach

to empirically examine the relationship between Transformational Leadership and followers' developments in Core Self-Evaluations.

Finally, despite the enormous support for Transformational Leadership theory, Transformational Leadership research conducted within the context of engineering is still very limited (Kratzer et al., 2008, Verner et al., 2014; Yilmaz et al., 2017; Zhang & Cheng, 2015). While the positive impacts of Transformational Leadership have been demonstrated in various management and organizational contexts (Bass & Riggio, 2006; Yukl, 2002; Zaccaro et al., 2001), a better understanding of the impact of Transformational Leadership in the context of engineering could help advance the generalizability of the theory. To this end, this research is set out to examine Transformational Leadership within the context of engineering project teams. It is hoped that results from the current study can inspire future researchers to further investigate the importance of leadership in the engineering discipline.

Dissertation Overview

In summary, the current study aims to extend upon the existing literature by examining the interplay between Transformational Leadership and Core Self-Evaluations. In doing this, the goal of this study is to make at least two theoretical contributions to the existing leadership literature. First, by examining leader's Core Self-Evaluations as a potential driver, this study attempts to explain why some leaders are more likely to engage in Transformational Leadership behaviors. Second, this study attempts to shed light on the mechanisms and processes underlying the positive influences of Transformational Leadership by examining the relationship between Transformational Leadership and the development in followers' Core Self-Evaluations. In addition to these theoretical contributions, this research aims to also offer several important methodological

contributions to the existing literature. First, a multi-level research design is adopted to address the inherent multi-level nature of leadership (Wang & Howell, 2012; Yammarino & Dansereau, 2008). More specifically, the relationship between Transformational Leadership and followers' Core Self-Evaluations is examined from a multi-level perspective. Second, this research also responds to calls for more longitudinal studies of leadership (Avey, Luthans, & Mhatre, 2008; Day & Antonakis, 2012; Rank et al., 2009; Zhu et al., 2013) by utilizing a longitudinal research design to examine changes in followers' Core Self-Evaluations in relation to Transformational Leadership. Lastly, this research also sets out to study Transformational Leadership in the context of engineering to further contribute to the generalizability of Transformational Leadership theory.

The central implication of findings from the current study is that Transformational Leadership and Core Self-Evaluations seem to be reciprocally related. Leaders' Core Self-Evaluations was found to be positively related to followers' perception of the leader's display of Transformational Leadership. Particularly, the current study found that high Core Self-Evaluations leaders were more likely to be perceived by their followers to display characteristics consistent with a transformational leader. Transformational Leadership was also found to be positively related to the development of followers' Core Self-Evaluations. These findings provide empirical support for several of the core theoretical elements of Transformational Leadership (Antonakis, Avolio, & Sivasubramaniam, 2003; Bass & Riggio, 2006; Day & Antonakis, 2012, Hu, Wang, Liden, Sun, 2012). It is hoped that this research can inspire future researchers to further contribute to the existing literature on leadership research and practice.

The next chapter provides a review of the existing Transformational Leadership and Core Self-Evaluations literatures. In the first section, a review and discussion of the conceptualization and components of Transformational Leadership will be provided. Following this, literature

concerning the Core Self-Evaluations construct will be examined and discussed. Results from previous research on Transformational Leadership and Core Self-Evaluations will serve as a basis for the formulation of testable research hypotheses. Chapter III discusses the design and methodological approach for the current study. Particularly, the current study's research procedures, participants, data collection, measurement instruments, and analytic strategy will be discussed in detail. Results from the research are presented in detail in Chapter IV. Finally, a discussion of the research findings, theoretical and practical implications, strengths and limitations, and directions for future research is provided in Chapter V.

CHAPTER II

LITERATURE REVIEW

The primary purpose of the current study is to contribute to the existing Transformational Leadership literature. Transformational Leadership is a style of leadership that can be described as a process that changes and transforms people (Northouse, 2016). This style of leadership focuses the majority of its attention on the development of followers. Transformational leaders are theorized to enhance followers' motivation and performance by exhibiting a class of charismatic and inspirational behaviors: (1) *Idealized Influence*, or serving as an appropriate role model; (2) *Inspirational Motivation*, or articulating compelling visions of attractive future states; (3) *Intellectual Stimulation*, or encouraging followers to be creative and challenging the traditional approach to problem solving; and (4) *Individualized Consideration*, or attending to followers' needs and providing individualized coaching and support (Bass & Riggio, 2006; Hu et al., 2012). The positive impacts of Transformational Leadership, as well as the theory's relationship to positive organizational outcomes, have been vastly studied and empirically examined. In fact, in a content analysis of articles published in the *Leadership Quarterly* between the year 1990 to 1999, Lowe and Gardner (2000) found that nearly one-third of all leadership research was about Transformational and Charismatic Leadership theories. Not surprisingly, a large body of research exists that demonstrates the positive impacts of Transformational Leadership on individual and team outcomes (see Bass & Riggio, 2006; Judge & Piccolo, 2004; Wang, Oh, Courtright, & Colbert, 2011 for a review). To date, Transformational leadership is considered by many to be among the most influential contemporary leadership theories that has ever been developed (Bass & Riggio, 2006; Hu et al., 2012; Kirkbirde, 2006; Muenjohn & Armstrong, 2008; Northouse, 2016; Ozaralli, 2003).

Despite the enormous support for Transformational Leadership theory, much is still left to be explored. On one hand, recent scholars have demonstrated growing research interests in trying to identify dispositional characteristics associated with transformational leaders (Hu et al., 2012; Judge & Long, 2012; Khoo & Burch, 2008; Rubin, Munz, & Bommer, 2005). While transformational leaders can be described as leaders who are charismatic, inspirational, and visionary, dispositional antecedents to these leadership behaviors still remain relatively unexamined (Hu et al., 2012; Judge & Long, 2012). On the other hand, while Transformational Leadership has been linked to a wide variety of positive and desirable outcomes, research that examines the underlying mechanisms and processes to explain how these leaders are able to achieve these positive results is still lacking (Avolio et al., 2004; Day & Antonakis, 2012; Dust et al., 2014; Huang, 2013; Northouse, 2016; Wang & Howell, 2010, 2012). To this end, the goal of this research is to attempt to fill these gaps in the current literature and contribute to a more comprehensive understanding of Transformational Leadership.

Of the many relevant theories and concepts that exist in the current literature, the concept of Core Self-Evaluations appears to be pertinent to the study of Transformational Leadership (Hu et al., 2012; Judge, Piccolo, & Kosalka, 2009; Nübold, Muck, & Maier, 2013). Core Self-Evaluations was developed from the disciplines of personality and social psychology as a dispositional construct that describes an individual's evaluations of one's worthiness, competence, and capabilities (Judge, Locke, Durham, & Kluger, 1998). As a higher order construct, Core Self-Evaluations was conceptualized to represent the commonalities between *Self-Esteem, Generalized Self-Efficacy, Locus of Control,* and *Emotional Stability* (Judge et al., 1997; Judge, Erez, Bono, & Thoresen, 2002, 2003; Judge Van Vianen & De Pater, 2004). In general, individuals with high Core Self-Evaluations can be described as those who perceive themselves to be worthy, competent,

and in control. These individuals believe that they have the ability to influence positive outcomes, and that challenges and difficulties provide them with opportunities to test their capabilities as well as to learn and grow. From an empirical perspective, Core Self-Evaluations has been linked with, but not limited to, positive job satisfaction (Judge, Heller, & Klinger, 2008), job performance (Rode et al., 2012), goal setting and motivation (Erez & Judge, 2001), and organizational citizenship behavior (Debusscher, Hofmans, & De Fruyt, 2016). Indeed, a large body of research exists that demonstrates the merits of Core Self-Evaluations as a predictor of a variety of desirable outcomes (Chang et al., 2012).

The role of Core Self-Evaluations in relation to leadership has been an area of interest for many researchers. Judge and Kammeyer-Mueller (2011), for instance, hinted at the possibility that leader's Core Self-Evaluations may be a valid predictor of the leader's leadership style. Particularly, the authors argued that "it is … possible that individuals with higher levels of Core Self-Evaluations will undertake different leadership behaviors than those with lower levels of Core Self-Evaluations" (p. 336). Core Self-Evaluations has also been linked to a person's motivation to lead (Kessler, Radosevich, Cho, & Kim, 2008). In a more recent study, Hu and colleagues (2012) found a positive relationship between leader Core Self-Evaluations and follower's perception of Transformational Leadership in a sample of Chinese workers. Individuals with high Core Self-Evaluations are those who see themselves to be competent and in control (Chang et al., 2012). Certainly, these are characteristics that are likely to be associated with leaders who are seen by their followers to be charismatic and inspirational.

The concept of Core Self-Evaluations is likely to also be useful to help explain how transformational leaders are able to influence their followers to achieve better and more satisfying

outcomes. Transformational leaders are by definition supportive, inspirational, and empowering (Avolio et al., 2004; Bass & Riggio, 2006; Dust et al., 2014). Through the display of charisma, followers identify with transformational leaders and aspire to become leaders themselves. Transformational leaders promote group cohesion by influencing their followers to identify with the group. These leaders also express high expectations to help followers gain a sense of confidence and self-efficacy. Through Transformational Leadership, followers are moved to accomplish more than what they originally thought was possible (Northouse, 2016). To this end, this research argues that it is possible that leaders' engagement in Transformational Leadership behaviors will tend to lead to enhancements in followers' Core Self-Evaluations. While many scholars have theorized that transformational leaders are able to transform their followers by influencing followers to enhance their own self-concepts (Bass & Riggio, 2006; Day & Antonakis, 2012; Northouse, 2016; Wang et al., 2011), research that directly examined this proposition is still very limited. Indeed, the concept of Core Self-Evaluations may prove to be valuable to help explain the transformational effects of Transformational Leadership.

The purpose of this chapter is to provide a thorough review of the relevant literature concerning the interplay between Transformational Leadership and Core Self-Evaluations. In the sections that follow, the history and development of Transformational Leadership theory will first be reviewed and discussed. Following this, a review of the Core Self-Evaluations literature will be provided. Results from previous empirical research in support of Transformational Leadership and Core Self-Evaluations will also be discussed throughout this chapter. Finally, several pertinent theories will be drawn upon in an attempt to formulate testable research hypotheses to address the gap in the current literature.

Transformational Leadership

Research on effective leadership can be traced back many centuries and through a variety of theories and branches (Antonakis & House, 2002; Antonakis et al., 2003; Fleishman, 1953; Fiedler, 1967; Halpin & Winer, 1957; Quigley, 2003; Seers, 1996; Stogdill, 1948; Weber, 1947). One of the most prominent theories of leadership that has been central to leadership research over the past three decades is the theory of Transformational Leadership. As a branch of leadership that was built upon previous leadership theories (e.g., trait-approach, skills-approach, behavioral-approach), Transformational Leadership theory was conceptualized to be part of a 'New Leadership' paradigm that focuses much of its attention on the charismatic and inspirational aspects of the leader (Northouse, 2016).

Transformational leadership has received tremendous support from researchers since its inception in the mid-1980s. Over the recent years, a large number of papers and citations concerning the core elements of Transformational Leadership has expanded beyond traditional areas of management and social psychology to also include areas such as nursing, education, and industrial engineering (Bass & Riggio, 2006; Day & Antonakis, 2012; Northouse, 2016). A large part of the increasing interests in Transformational Leadership research, as Bass and Riggio (2006) noted, can be attributed to the theory's emphasis on intrinsic motivation, empowerment, and follower development. As organizations must strive to gain and maintain a competitive edge in today's increasingly challenging environments, an approach to leadership that can be relied upon to help inspire and empower members and workgroups certainly offers several benefits to organizations and practitioners. Indeed, literature clearly demonstrates the value of

transformational leaders, and this approach to leadership remains central in much of today's leadership research (Northouse, 2016).

A core theoretical element of Transformational Leadership is centered on a leadership process that changes and transform people (Avolio et al., 2004; Bass and Riggio, 2006; Northouse, 2016). Transformational Leadership is concerned with the leader's ethics, values, and long-term goals (Bass, 1985; Bass & Riggio, 2006; Brown & Treviño, 2006). In contrast to other leadership approaches that came before it, this style of leadership places much of its emphasis on followers' motives and emotions. One of the primary goals of transformational leaders is to satisfy followers' motives and needs to ensure that followers are given the opportunity to develop to their highest potential. By incorporating elements of charisma and inspiration into their leadership process, transformational leaders influence their followers to achieve more than is expected or originally thought was possible.

Early conceptualization of Transformational Leadership. The concept of Transformational Leadership was first conceptualized by James MacGregor Burns (1978) in an attempt to link the roles of leaders and their followers in the leadership process. Studies of leadership prior to Burns' (1978) conceptualization of the transformational approach was primarily leader-centric. Particularly, the majority of early works on leadership research focused much attention on the characteristics that make for an effective leader (e.g., leader's traits; the 'Great Man' theory) and what leaders ought to do (i.e., leader's behaviors) (Bass & Riggio, 2006). Burns (1978) argued that the dimensions associated with leadership and followership are integral and that the two should complement one another in the leadership process (Northouse, 2016). A seminal work at the time, Burns (1978) argued that effective leaders must not only be able to

influence their followers; effective leaders must also be able to tap into the motives and potentials of their followers in order to help followers better achieve higher performance.

In conceptualizing Transformational Leadership, Burns (1978) distinguishes between two types of leadership behaviors: Transactional and Transformational. Transactional leadership refers to the majority of leadership models that existed at the time. This style of leadership focuses on explicit exchanges and transactions that occur between leaders and their followers (Northouse, 2016). In other words, transactional leaders are leaders who rely on exchanges of goods and services to attempt to influence followers to act and behave in certain manners. In a business setting, for instance, Bass and Riggio (2006) gave an example of transactional leaders as those who “offer financial rewards for productivity or deny rewards for lack of productivity" (p. 3). Managers enact Transactional Leadership when they offer rewards and promotion to employees who are able who meet or surpass the assigned goals. Transactional leadership may also include a leader’s use of deadlines, strict evaluations, and rigid performance measures. Researchers have demonstrated that the impacts of Transactional Leadership can be inconsistent (Avolio & Bass, 1991; Podsakoff & Schriescheim, 1985) and sometimes even lead to negative results (Deci, Koestner, & Ryan, 1999; see also Amabile, DeJong, & Lepper, 1976; Deci & Ryan, 1985; Mossholder, 1980). Despite recent advancements in leadership research, the exchange and transaction dimension of Transactional Leadership still remain very common today.

In contrast to Transactional Leadership, Burns (1978) describes Transformational Leadership as a process whereby leaders engage with their followers in ways that raise the ethics and motivation in both the leader and the followers (Northouse, 2016). Rather than relying on explicit exchanges and interactions to encourage followers to behave, transformational leaders pay

attention and respond to the needs and emotions of their followers to attempt to motivate them to develop to higher potentials. In this way, Burns' (1978) model of Transformational Leadership treats followers as more than merely means to an end. According to Burns (1978), for a leader to be effective he or she must be transformational and focus on the development of their followers so together they can better achieve a common goal.

A review of early conceptualization of Transformational Leadership would not be complete without a discussion of House's (1976) theory of leadership charisma (see also House, 1977; House & Howell, 1992; House & Shamir, 1993). At around the same time Burns was working on his theory of Transformational and Transactional Leadership, House developed a model of Charismatic Leadership that also attempted to incorporate the roles of followers into the leadership process (Northouse, 2016). The theory of Charismatic Leadership has undergone several modifications and revisions since House's (1976) original work (Conger & Kanungo, 1987, 1998; Shamir et al., 1993). Nevertheless, House's (1976) Charismatic Leadership theory contributed greatly to the development of the current model of Transformational Leadership (Bass, 1985). In fact, the term Charismatic Leadership is still in some cases being used interchangeably with Transformational Leadership today (Bass & Riggio, 2006; Northouse, 2016).

Charismatic Leadership is a branch of leadership that focuses much of its attention on the charismatic effects of exceptional leaders. House (1977) explained that charismatic leaders act in unique ways that tend to draw people to want to identify with the leader. Acts of Charismatic Leadership also put people into a state that is susceptible to being influenced. These leaders exude an air of confidence in knowing what to do in times of needs. Charismatic leaders are dominant and have a strong desire to influence others (Northouse, 2016). Because followers tend to identify

and look up to charismatic leaders, it is suggested that Charismatic Leadership can stimulate the process of transformation in followers (Choi, 2006; Shamir et al., 1993).

Charismatic Leadership is suggested to have several direct effects on followers (House 1976, 1977; House & Howell, 1992; House & Shamir, 1993; Shamir et al., 1993). Through the display of charisma, followers trust and show affection for charismatic leaders. Because these leaders tend to demonstrate strong ethics and moral values, followers identify with the leader's vision, are emotionally attached, and are motivated and committed to fulfill the leader's goals. As will be discussed in more detail later in this chapter, Shamir, House, and Arthur (1993) argued that charismatic leaders transform followers' self-concept by linking the identity of followers to the collective identity of the group. These leaders also express high expectations for themselves and their followers which in turns help followers gain an increased sense of confidence and self-efficacy. In summary, charismatic leadership works because these leaders are ethical role models and are able to promote a sense of collectivity to enhance followers' self-concepts (Avolio & Yammarino, 2002; Northouse, 2016).

Current model of Transformational Leadership. A major shift in the development of Transformational Leadership theory occurred in the mid-1980s when Bass (1985) proposed a more refined Transformational Leadership model that expanded upon the prior works of Burns (1978) and House (1976). Extending upon Burns' (1978) work, Bass (1985) recognized that effective leaders need to pay attention and respond to followers' needs and motives. Bass (1985) also suggested that Transformational Leadership behaviors would be particularly essential in contexts and situations that are uncertain and offer no foreseeable outcomes. While Burns (1978) argued that a leader can be either Transformational or Transactional but not both, Bass (1985) argued that

Transformational and Transactional leadership exist together on a single continuum. For instance, in some cases transformational leaders may need to rely on the use of explicit rewards to stimulate their followers to carry out the assigned tasks. What sets transformational leaders apart from transactional leaders, according to Bass (1985), is that transformational leaders will tend to focus much of their attention on long-term outcomes and followers' personal developments (Bass & Riggio, 2006). In other words, Bass's (1985) theory of Transformational Leadership is consistent with Burns' original theory in recognizing that Transformational and Transactional Leadership behaviors are indeed different. In contrast to Burn's theory, however, Bass (1985) argued that these two leadership styles can be enacted by a single leader, albeit with Transformational Leadership being the more effective of the two (Bass, 1985; see also Bass & Riggio, 2006). In addition to expanding upon Burns' (1978) original work, Bass (1985) also extended upon House's (1976) work by arguing that transformational leaders are likely to also be charismatic. It was suggested that the charismatic and emotional elements should also be part of Transformational Leadership due how these leaders are likely to be perceived by their followers (Bass, 1985; see also Northouse, 2016; Yammarino, 1993).

While Bass's (1985) theory of Transformational Leadership shared a number of similarities with the works of Burns (1978) and House (1976), his approach to conceptualizing Transformational Leadership also offered several unique dimensions. Particularly, Bass (1985) argued that Transformational Leadership goes beyond the focus of explicit transactions and other related studies of leadership and management that existed at the time. The essence of Transformational Leadership, as Bass (1985) noted, involves the dynamics of leader-follower dyads that stems from leadership behaviors associated with charisma, individualized consideration, and intellectual stimulation (Longshore, 1987). By engaging in Transformational

Leadership behaviors, Bass (1985) argued that transformational leaders motivate their followers to do more than is expected by:

> (a) Raising followers' levels of consciousness about the importance and value of specified and idealized goals, (b) getting followers to transcend their own self-interest for the sake of the team or organization, and (c) moving followers to address higher-level needs (p. 20).

Bass's theory of Transformational Leadership and its effects on followers' transformations are elaborated in greater detail in Bass and colleagues' subsequent works (Bass, 1985, 1990, 1998; Bass & Avolio, 1993, 1994; Bass & Riggio, 2006). The current study will focus on the current model of Transformational and Transactional Leadership that came as result the many refinements made to Bass's (1985) original work. Termed the *Full Range Leadership* model (Avolio & Bass, 1991; Avolio, Bass, & Jung, 1995; 1999; Bass & Riggio, 2006), this current model of Transformational and Transactional Leadership will serve as a theoretical basis for this research.

Full Range Leadership model. The Full Range Leadership model contains nine components that incorporates elements of Transformational Leadership (i.e., *Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration*), Transactional Leadership (i.e., *Contingent Reward, Active and Passive Management-by-Exception*), and Non-Leadership (i.e., *Laissez-Faire Leadership*) behaviors (Antonakis et al., 2003; Avolio et al., 1995, 1999; Bass & Riggio, 2006). These nine components and their categorization are illustrated in Figure 1 below. A discussion of each of these components will help to clarify the Full Range Leadership model in greater detail.

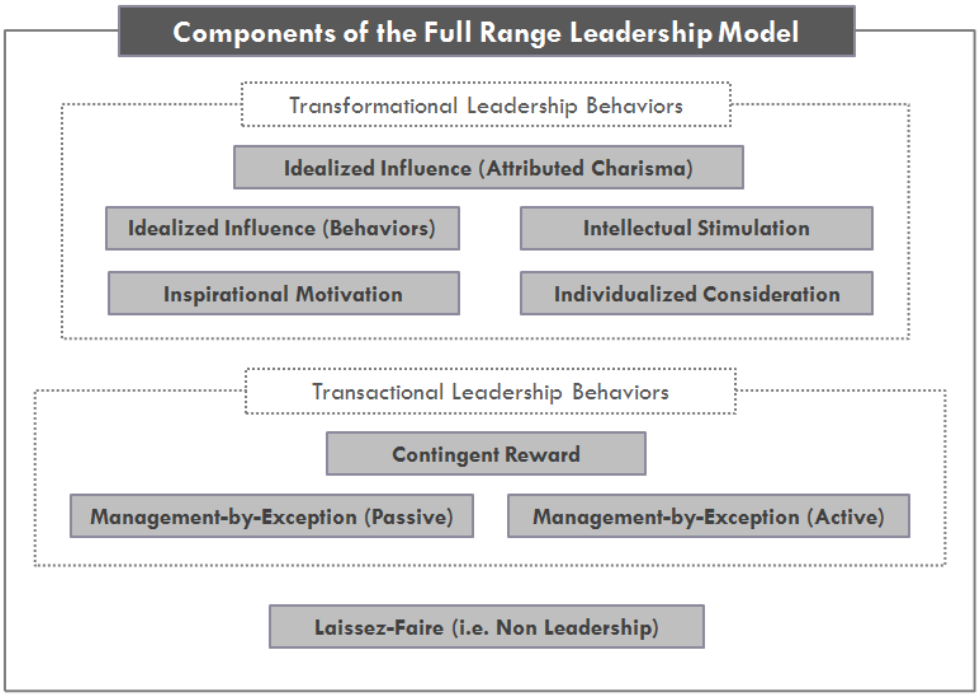

Figure 1: Components of the Full Range Leadership Model

*Each component represents a factor associated with Bass's Model of Transformational and Transactional Leadership
*The components are grouped together to represent Transformational Leadership (i.e., Idealized Influence Attributed & Charisma, Intellectual Stimulation, Inspirational Motivation, Individualized Consideration), Transactional Leadership (i.e., Contingent Reward, Active & Passive Management-by-Exception), and Non-Leadership (i.e., Laissez-Faire Leadership).

Transformational Leadership Components. As noted earlier in this chapter, Transformational Leadership is primarily concerned with the process that changes and transforms people. In doing this, transformational leaders enact a style of leadership that can be identified by four distinct behavioral characteristics: *Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration* (Avolio et al., 1995, 1999; Bass & Riggio, 2006). These behaviors help transformational leaders tap into the motives and emotional responses of their followers to aid in followers' developmental process (Avolio et al., 1995, 1999). The Transformational Leadership components from the Full Range Leadership model are discussed in more detail below.

Idealized Influence. Transformational leaders behave in ways that make them attractive role models for their followers. Idealized influence is an emotional component of Transformational Leadership (Day & Antonakis, 2012) and can be described as the leader's display of charisma and other role-modeling qualities (Bass, 1985). Transformational leaders establish idealized influence through the display of confidence, ethics, standards, trustworthiness, and dependability. Idealized leaders also consider moral values to be of great importance when making decisions. Followers identify with these leaders, making them leaders that their followers approve, trust, and respect. It has been argued that the idealized influence component of Transformational Leadership is closely related to the components of Ethical Leadership (Brown & Treviño, 2006).

The Idealized Influence component on Transformational Leadership can further be categorized into two distinct dimensions (Bass & Riggio, 2006; Northouse, 2016). On one hand, *Attributed* Idealized Influence refers to followers' attributions of the leader based on how the leader's qualities and characteristics are perceived. On the other hand, *Behavioral* Idealized Influence refers to leader's behaviors that followers can observe. Idealized Influence is considered by many to be the essential factor that separates Transformational Leadership from other leadership approaches (Bass & Riggio, 2006; Quigley, 2003; Judge, Bono, Ilies, & Gerhardt, 2002).

Inspirational Motivation. Transformational leaders motivate and inspire their followers to achieve higher performance (Liu et al., 2010). By articulating and painting a clear and attractive vision of the future, transformational leaders inspire their followers to go beyond the call of duty to obtain greater results. These leaders are also enthusiastic and optimistic. Followers are encouraged to transcend their individualistic needs because these leaders instill a sense of purpose

and meaning to followers' work (Bass & Riggio, 2006). Through Inspirational Motivation, followers are aroused, motivated, and are driven to accomplish greater results and higher goals.

Intellectual Stimulation. Transformational Leaders stimulate creativity and the intellectual efforts of their followers. By appropriately questioning followers' assumptions and beliefs, transformational leaders behave in ways that trigger innovative ideas and solutions. Followers are challenged to look at problems from new perspectives and are encouraged to try new approaches. Transformational leaders welcome new ideas and creativity. These leaders also pay attention to followers' ideas and propositions and consider them highly. Mistakes or ideas that differ from those of the leader are not publicly or negatively criticized (Bass & Riggio, 2006).

Individualized Consideration. Transformational leaders are considerate and go out of their way to address the specific needs of their followers. Special attention and support are given to each follower to ensure growth and development. These leaders act as mentors and coaches and may interact with each of their followers differently depending upon each individual's needs and concerns. They recognize diversity within their work groups and seek to understand specific challenges and difficulties that are unique to each of their follower. By addressing the specific problems and concerns of their followers, transformational leaders provide specialized consideration appropriate to each individual. Scholars have argued that the individualized consideration component of Transformational Leadership is particularly important in helping transformational leaders influence long-term developments of their followers (Bass & Riggio, 2006; Shamir et al., 1993). Because transformational leaders provide the needed support and consideration to help followers cope with problems, followers are able to overcome challenges and focus on developing to their fullest potentials (Koestner, Ryan, Bernieri, & Holt, 1984; Zuckerman, Porac, Lathin, Smith, & Deci, 1978). As noted by Deci and colleagues (1999), "events

such as the provisions of choice and the acknowledgment of feelings have been found to enhance intrinsic motivation" (p. 658).

On the basis of the Full Range Leadership model, Transformational Leadership has been shown to produce positive results more consistently when compared to Transactional Leadership and non-leadership components (Lowe, Kroeck, & Sivasubramaniam, 1996; Rowold & Heinitz, 2007). While leaders can engage in Transactional Leadership behaviors to influence followers to do as expected, Transformational Leadership behaviors tend to lead to results that are beyond expectations. Empirical support for Transformational Leadership will be discussed later in this chapter. In reviewing the Full Range Leadership model, however, an examination of the Transactional Leadership components will provide a clearer distinction between Transformational and Transactional Leadership.

Transactional Leadership Components. Transactional Leadership is generally concerned with leader's use of rewards and punishments as means to influence specific actions and behaviors. Transactional Leadership differs from Transformational Leadership in that these leadership behaviors are less concerned with the emotional elements of the leader-follower relationships. Transactional leadership behaviors may include setting up explicit contracts and agreements while carefully monitoring followers' actions and behaviors (Antonakis et al., 2003). Transactional leaders may choose to reward or punish based on the adequacy of follower's performance. Although Transactional Leadership has been found to be reasonably effective in some situations, this style of leadership is generally less effective than Transformational Leadership behaviors (Bass & Riggio, 2006). Three components from the Full Range Leadership model are used to identify Transactional Leadership behaviors: (1) *Contingent Reward,* (2) *Active-*, and (3) *Passive-Management by Exception*.

Contingent Reward. The use of rewards and punishments as means to influence and motivate others is central to the theory of Transactional Leadership. Contingent reward can be best described as the leader's reliance on a set of *transactions* through various reward and punishment mechanisms in exchange for specific outcomes. Researchers have argued that the use of rewards can be reasonably useful in some situation (Antonakis et. al, 2003; Bass & Raggio, 2006). Nevertheless, concrete evidence in support of the long-term benefits of contingent rewards is still lacking (Avolio & Bass, 1991; Bass & Riggio, 2006; Deci et al., 1999; Podsakoff & Schriescheim, 1985). Although contingent rewards may in some situations be positive and useful, it is suggested that effective leaders are those who extend on its use by also engaging in Transformational Leadership behaviors (Bass & Riggio, 2006).

Management-by-Exception. Management-by-Exception emphasizes a set of behaviors whereby a leader monitors followers' actions for any deviation from the predetermined standards or conduct (Bass & Riggio, 2006). This style of leadership can further be categorized into two distinct components (i.e., *Active* and *Passive*). *Active* Management-by-Exception is a style of leadership whereby a leader actively monitors follower's actions in anticipation for any deviation from what the leader considers to be desired or acceptable. Corrective steps are taken to prevent problematic situations from emerging. On the other hand, *Passive* Management-by-Exception represents behaviors whereby a leader passively waits for problems to arise before taking the necessary steps to resolve issues.

Compared to contingent reward and the components of Transformational Leadership, Management-by-Exception is the lesser participative behavioral component within the Full Range Leadership model. Whereas contingent reward and the components of Transformational Leadership involve encouragements from the leader to a certain extent, Management-by-Exception

is generally enacted for the purpose of preventing (i.e., Active) and correcting (i.e., Passive) problematic situations. It is not surprising, then, that this style of leadership is not generally considered to be a representation of effective leadership behaviors (Bass & Riggio 2006).

Non-Leadership Component. The final component from the Full Range Leadership model represents the least effective of all leadership behaviors. Termed *Laissez-Faire* Leadership, these behaviors deviate from Transformational and Transactional leadership and is considered to be a non-leadership component from the Full Range Leadership model.

Laissez-Faire Leadership. By definition, the word 'Laissez-Faire' refers to the practice of not interfering in the affairs of others, especially with respect to individual actions and conducts. Bass and Riggio (2006) suggested that Laissez-Faire leadership represents the lack of transactions between leaders and their followers. Laissez-Faire leaders avoid acts of providing support, decision making, and other responsibilities that are often expected from those in leadership positions. It is not surprising to find that leadership scholars generally agree that Laissez-Faire Leadership is the least effective of all identifiable leadership behaviors (Bass & Riggio, 2006).

With respect to the Full Range Leadership model, Bass and Riggio (2006) proposed that the components associated with Transformational Leadership are most effective. Transformational Leaders are those who are regarded by their followers to be effective role models (i.e., *Idealized Influence*). Acting as a mentor, these leaders encourage followers to seek new and innovative approaches to address challenging problems (i.e., *Intellectual Stimulation*). Transformational leaders enable their followers to reach higher potentials because these leaders recognize and respond to their followers' individualistic needs (i.e., *Individualized Consideration*). Transformational leaders also express confidence and followers' abilities to achieve higher

performance levels (i.e., *Inspirational Motivation*). Followers of transformational leaders tend to be more motivated to perform because these leaders articulate an attractive future and promote a sense of the collective. The *Contingent Reward* component, although not part of Transformational Leadership, can still be effective in certain situations. Evidence exists to suggest that the use of rewards can be reasonably effective in extracting short-term performances (Podsakoff & Schriescheim, 1985). Bass and Riggio (2006) argued that *Management-by-Exception* (i.e., Both *Active* and *Passive*) will be less effective than the contingent reward and Transformational Leadership components because these behaviors are more reactive rather than proactive. *Active* Management-by-Exception will tend to be more effective than its *Passive* counterpart due to the former being more engaged and involved (e.g., Hawthorne experiments; Landsberger, 1958). Lastly, *Laissez-Faire* Leadership is least effective of all Full Range Leadership components because this style of leadership disregards any interactions between the leader and followers altogether.

Figure 2, below, lists the components of the Full Range Leadership model in their order of effectiveness. Viewed as the frequency by which each of the nine components are employed, an ideal leader would be one who more frequently engages in behaviors associated with Transformational Leadership. Bass and Riggio (2006) argued that every leader will inevitably engage in all of the nine components of the Full Range Leadership model at some point in one's leadership career. It was argued that leaders who display more of the Transformational Leadership components will tend to be more effective in the long run (Bass & Riggio 2006).

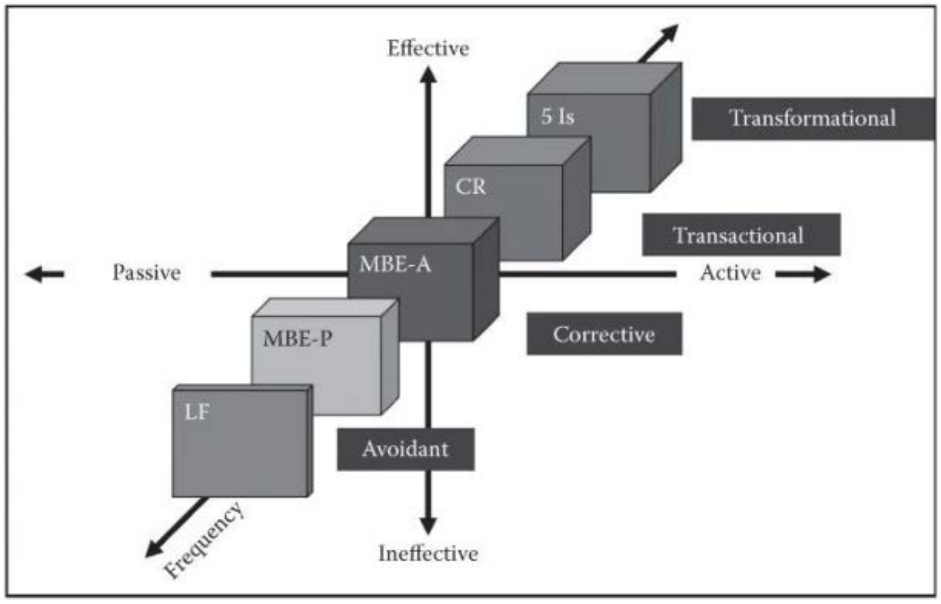

Figure 2: Full Range Leadership Model

*Laissez-Faire (LF); Management-by-Exception (MBE – Active or Passive); Contingent Reward (CR); and the Components of Transformational Leadership (5-I's).
*Image Source: Aragón (2013).

Advances in Transformational Leadership research over the last three decades can be attributed in large part to the predictive ability of the Full Range Leadership model (Bass & Riggio, 2006). In a recent review of the state of Transformational Leadership research, Antonakis and colleagues (2003) noted that "[for nearly two decades]…there has been little or no controversy surrounding the predictive nature of [the Full Range Leadership model]" (p. 64). Prior to the settling upon current nine-factor structure model, however, the Full Range Leadership model has undergone a number of modifications and refinements. This is particularly true with respect to the measurement instrument that was developed to assess the components of the Full Range Leadership model (i.e., the Multifactor Leadership Questionnaire; MLQ). A brief discussion on the development and refinements of the Multifactor Leadership Questionnaire will clarify how Transformational Leadership is going to be assessed in this study.

Originally, Bass (1985) conceptualized the Full Range Leadership model to be composed of six leadership components (i.e., Charismatic-Inspirational, Intellectually Stimulating, Individually Considerate, Contingent Rewards, Management Management-by-Exception, and Laissez-Faire Leadership) (Antonakis et al., 2003; Bass & Riggio, 2006). Early attempts to validate the six-factor structure of Bass's (1985) Full Range Leadership model failed to provide unifying and consistent results. Reports of relatively high multicollinearity in the measures of the proposed six-factor model led scholars to argue that the scale that was developed to measure Full Range Leadership at the time (i.e., MLQ Form-1) was invalid and unreliable (Bycio, Hackett, & Allen, 1995; Carless, 1998; Tepper & Percy, 1994). In response to these criticisms, Bass and Avolio (1993, 1994, and 1997) argued that the high multicollinearity and intercorrelations among the proposed six factors should not have been surprising. For instance, it is certainly possible that leaders who inspire and motivate others are also likely to be described as those who are individually considerate. Similarly, followers are likely to see leader's use of contingent rewards as being closely related to inspirational motivation and individualized consideration. It is not necessary, however, that individually considerate leaders are always going rely on the use of rewards to show their individual considerations. In response to these early criticisms, Bass and colleagues argued that the Full Range Leadership model was clearly multi-dimensional (Bass & Avolio 1993, 1994, 1997, 2000; Bass & Riggio, 2006) and that the uniqueness of the theoretical perspectives underlying each of the factors should not be ignored.

Following early criticisms of the original six-factor model, subsequent changes were made to the Full Range Leadership model and its measurement instrument (Antonakis & House, 2002; Antonakis et al., 2003; Bass & Avolio, 1994, 1997; Bass & Riggio, 2006). Most notably, the 'Charismatic-Inspirational' component was categorized into the current *Idealized Influence* and

Inspirational Motivation components. As Bass and Riggio (2006) noted, although charismatic leaders are likely to also be inspirational, this may not always be the case. *Idealized Influence* was also further categorized into the *Attribution* and *Behavioral* dimensions to give a clear distinction between leader attributes and behaviors. Lastly, a distinction between *Active* and *Passive Management by Exception* was made to address concerns regarding leader's involvement when engaging in this style of leadership behaviors.

As discussed previously, the current model of Full Range Leadership is composed of nine factors to assess Transformational Leadership, Transactional Leadership, and Non-Leadership behaviors. This nine-factor structure is a result of the subsequent changes that were made to Bass's (1985) original model of Full Range Leadership. The current version of the Multifactor Leadership Questionnaire (i.e., MLQ Form-5X; Bass & Avolio, 1997), which to date is the most popular instrument used to assess Transformational Leadership and other components of the Full Range Leadership model, has also been substantially refined and tested for it psychometric properties (Antonakis et al., 2003; Bass & Riggio, 2006). Table 1 below provides a summary of the modifications and refinements made to the underlying factor structure of the Full Range Leadership model since its inception, as well as the different versions of the Multifactor Leadership Questionnaire (Antonakis et al., 2003).

Authors	MLQ Version	Country	Sample	Number of Factors and Components
Hater & Bass (1988)	Form 5, 1985	USA	Delivery Firm	6 (CH, IS, IC, CR, MBEA, MBEP)
Yammarino, Spangler, & Bass (1993)	1985 Modified	USA	Military	5 (CH/IM, CR/IC, MBEA, MBEP, LF)
Tepper & Perey (1994)	Form X, 1990	USA	Students, Financial Institution	2 (CH/IM, CR)
Druskat (1994)	Form 8Y, 1990	USA	Church	5 (CH/IC, IS/IM, CR, MBEA, MBEP/LF)
Bycio, Hackett, & Allen (1995)	Form 1, 1985	Canada	Health Services	5 (CH, IS, IC, CR, MBE)
Koh, Steers, & Terborg (1995)	Form 5S, 1985	Singapore	Educational Institutions	5 (CH, CR, MBEA, MBEP, LF)
Hartog, Muijen, & Koopman (1997)	Form 8Y, 1989	Netherlands	Various Private and Public Firms	3 (TF, TR, LF)
Lievens, Van Geit, & Coctsier (1997)	Form 8Y, 1989	Netherlands	Various Private and Public Firms	4 (IS/IC/IM, CR, MBEA)
Hinkin, Tracey, & Enz (1997)	Form 5X, 1990	USA	Students, Hotels	3 (IM, IC, IS)
Tracey and Hinkin (1998)	Form 5X, 1990	USA	Hotels	1(II/IM/IS/IC)
Geyer and Steyrer (1998)	Form 5R	Germany	Banks	4 (CH/IS/IM/IC, IC/CH, CR/IC, MBEP/LF)
Carless (1998)	Form 5X	Australia	Banks	3 (CH, IS, IC)
Avolio, Bass, & Jung (1999)	Form 5X	Primarily USA	Various Business Firms	6 (CH/IM, IS, IC, CR, MBEA, MBEP/LF)
Tejeda, Scandura, & Pillai (2001)	Form 5X, 1993	USA	Various Business Firms	9 (IIA, IIB, IM, IS, IC, CR, MBEA, MBEP, LF)

Table 1: Summary of the Underlying Factor Structure of the FRL

*CH = Charisma; IIA = Idealized Influence Attributed; IIB = Idealized Influence Behavior; IM = Inspirational Motivation; IS = Intellectual Stimulation; IC = Individualized Consideration; CR = Contingent Rewards; MBEA = Management-by-Exception Active; MBEP = Management-by-Exception Passive; MBE = Management-by-Exception; LF = Laissez-Faire Leadership.

*Table taken directly from Antonakis et al. (2003)

Empirical Support for the Full Range Leadership Model. Support for the positive impacts of Transformational Leadership exists vastly throughout the literature. In a meta-analytic study based on results obtained from both public and private organizations, Lowe, Kroeck, and Sivasubramaniam (1996) noted that "Results ... support the belief that Transformational Leadership is associated with work unit effectiveness [across different situations and sittings]" (p. 412). The authors also found that compared to Transactional Leadership, Transformational Leadership is a stronger predictor of organizational effectiveness and outcomes (Lowe et al., 1996). In a more recent meta-analytic study, Transformational Leadership was found to be positively related to follower's satisfaction with the leader, follower's job satisfaction, follower's motivation, rated leader's effectiveness, leader's job performance, and group and organizational performance (Judge & Piccolo, 2004). Based on the results obtained in Judge and Piccolo's (2004) study, the estimated true score correlations were found to be higher for Transformational Leadership ($\hat{p}$ = .44) when compared to contingent reward leadership ($\hat{p}$ = .39) and Laissez-faire leadership ($\hat{p}$ = -.37) (Judge & Piccolo, 2004). In a four- to six-week longitudinal study of military platoons, Bass and colleagues (2003) found a positive and significant relationship between Transformational Leadership and subordinate's performance (Bass et al., 2003). This relationship was also found to be partially mediated by group potency and cohesion (Bass et al., 2003). Consistent with the core theoretical elements of Transformational Leadership, followers of transformational leaders reported that they identified positively with their work group which resulted in higher performance at the individual level. Bass and colleagues (2003) suggested that transformational leaders' involvement with their subordinates, rather than simply relying on the use of contingent rewards or passive management style, played a crucial role to enhance members' cohesion and collective-efficacy, leading members to work together effectively towards a common

goal (Zaccaro, Blair, Peterson & Zazanis, 1995). A study in Australia also demonstrated similar results. Transformational Leadership behaviors demonstrated by bank managers were found to be positively related to the bank's financial performance (Carless, Mann, & Wearing, 1996). This relationship was also found to be mediated by the bank's unit-level group cohesion (Carless et al., 1996).

Transformational Leadership has also been demonstrated to be desirable in a wide variety of contexts and settings. As noted by Bass and Riggio (2006), the positive impacts of Transformational Leadership has been demonstrated in organizations located in North America, Russia, China, South Korea, New Zealand, and can range from the military to educational, governmental, public, private, and non-profit organizations (Bass, et al., 2003; Hater & Bass, 1988; Elenkov, 2002; Harvey, Royal, & Stout, 2003; Jung & Sosik, 2002; LeBrasseur, Whissell, & Ojha, 2002; Singer, 1985; Wofford, Whittington, & Goodwin, 2001).

For the purpose of this research, the current study aims to respond to the calls from various researchers who have stressed the need for more longitudinal studies of Transformational Leadership (Avolio et al., 2004; Day & Antonakis, 2012; Kark et al., 2003; Keller & Semmer, 2013; Shamir et al., 1993). In the following section, a self-concept based theory, termed Core Self-Evaluations (Judge et al., 1997) will be explored in an attempt to formulate testable research hypotheses to address the gap in the current Transformational Leadership literature.

Core Self-Evaluations

Dispositions and personality play a central role to the way in which people view themselves and others around them (Bono & Judge, 2003a; Judge, et al., 2002; Quigley, 2003). Similar to the study of leadership, studies of personality and dispositions can be traced back many centuries and

through various fields of research. One dispositional theory that seems to be pertinent to the theory of Transformational Leadership is the concept of Core Self-Evaluations (Judge et al., 1997). Core Self-Evaluations was developed from the disciplines of personality and social psychology as a dispositional construct that represents an individual's evaluations of one's worthiness, competence, and capabilities (Judge, Locke, Durham, & Kluger, 1998). More specifically, Core Self-Evaluations is defined as "the fundamental evaluations people make about themselves, their environments, and the relationship between themselves and their environment" (Judge et al., 2002, p. 58). Core Self-Evolutions was conceptualized to represent a broad dispositional construct that can be indicated by four lower order personality factors: *Self-Esteem, Generalized Self-Efficacy, Locus of Control, and Emotional Stability (i.e., Low Neuroticism)* (Judge & Bono, 2001). The underlying mentality for identifying these four lower order dispositions was due in part to their similarities in representing the fundamental views that individuals hold about themselves and their capabilities (Judge et al., 1997). Particularly, these four underlying dispositions were thought to be (a) [self] evaluation focused (i.e., each trait involves the act self-evaluating rather than offering a description of oneself), (b) fundamental and basic (i.e., each trait represents the fundamental beliefs rather than surface reflections; Cattell, 1965), and are (c) broad and encompassing (Judge et al., 1997; Wu & Griffin, 2012). Clearly, a brief discussion of each of the core components of Core Self-Evaluations is warranted.

Self-Esteem. Self-Esteem is described as "the overall value that one places on oneself as a person" (Quigley, 2003, p. 11). In other words, self-esteem represents judgments and approval of the degree to which a person sees oneself as being worthy, capable, and significant (Bono & Judge, 2003a; Campbell, 1990; Coopersmith, 1967; Harter, 1990). Individuals with high self-esteem are confident in themselves and their capabilities. These individuals are passionate about their beliefs

and view themselves as worthy and significant. Self-esteem is considered to be the most fundamental component of the Core Self-Evaluations construct (Judge et al., 1998). It is thought of as a disposition that directly represents the 'Core Evaluations' that a person places on the self. As will be discussed in a later section, factor analysis conducted on the components of Core Self-Evaluations demonstrated self-esteem to have the highest factor loading score on the Core Self-Evaluations factor (Judge, Bono, & Locke, 2000).

Generalized Self-Efficacy. Self-efficacy was first conceptualized by Bandura (1977a) in an attempt to identify a dispositional concept to help explain individual's actions and behaviors. Self-efficacy is defined as "an individual's assessment of his or her ability to perform in specific situations" (McAvay, Seeman, & Rodin, 1996, p. 243). Bandura (1977a, 1977b, 1986) argued that self-efficacy represents a cognitive antecedent that determines the amount of effort a person is willing to exert in the face of challenge. Individuals who score high on self-efficacy hold strong beliefs in their ability to effectively perform. High self-efficacy individuals tend to believe that they are competent and are more likely to endure against difficult challenges. It is suggested that self-efficacy is domain-specific (Bandura, 1977a, 1977b; McAvay, et al., 1996). That is, a person's self-efficacy does not reflect a global personality component, and a person's self-efficacy beliefs can vary across different situations and settings (Bandura, 1977a). For instance, it is possible for a person to have strong efficacy beliefs towards academic achievements but much lower efficacy beliefs towards sports. More importantly, it is suggested that self-efficacy tends to be susceptible to external influences (Bandura, 1986). According to the Social Cognitive Theory (Bandura 1977a, 1986), a person's efficacy beliefs can be formed and shaped through experiences, learning, social interactions, and other psychological states (Bandura, 1977b). Empirical studies have demonstrated positive associations between self-efficacy and work performance. For example, a

meta-analysis of 114 studies by Stajkovic and Luthans (1998) indicated positive weighted average correlations between self-efficacy and work performance (Barling & Beattie, 1983; Hill, Smith, & Mann, 1987; Taylor, Locke, Lee, & Gist, 1984).

Given that the concept Core Self-Evaluations is meant to represent the overall perceptions that a person places on oneself, Judge and colleagues (1997) suggested that a more global form of self-efficacy (i.e., rather than domain-specific) would be more appropriate to indicate the Core Self-Evaluations construct. As a result, the authors identified *Generalized Self-Efficacy* to serve as a representation of Bandura's (1977a, 1977b) self-efficacy at a more global scale (Judge, et al., 1998). *Generalized Self-Efficacy* is defined as an "estimate of one's capabilities of performing, at a global level across many contexts" (Bono & Judge, 2003a, p. S6). In other words, *Generalized Self-Efficacy* can be thought of as an individual's beliefs in his or her level of competency across all tasks and situations (Judge et al., 1998). Although the underlying definitions remain similar, a distinction between *Generalized Self-Efficacy* and Bandura's (1977a) *Self-Efficacy* is warranted in order to better understand how the disposition contributes to the Core Self-Evaluations construct.

Locus of Control. Locus of control refers to the beliefs that an individual holds with regards to his or her ability to control and influence outcomes. Locus of control has been described as "the degree to which a person believes that control of reinforcement is internal versus the degree to which it is external" (Chak & Leung, 2004, p. 562). It is generally accepted that locus of control perceptions are divided into two camps (Anderson, 1977; Chak & Leung, 2004; Judge et al., 2002). On one hand, *internal* locus of control refers to the beliefs that outcomes in life's events are caused by one's own actions and behaviors. In other words, individuals with internal locus of control generally perceive outcomes in life to be results of their own ability to control, shape, and alter events and situations. On the other hand, *external* locus of control refers to the beliefs that events

in life occur resulting from external influences. The difference between internal and external locus of control beliefs can be illustrated through an example. Students with *internal* locus of control, for instance, may attribute their high test results to their efforts, capabilities, and the overall ability to learn and retain information. On the other hand, students with *external* locus of control may direct their low test scores to their teachers, difficulties of the course materials, and deficiencies of mentoring and coaching support.

Evidence of the impact of locus of control perceptions exists vastly throughout the literature. In a longitudinal study by Howell and Avolio (1993), the authors found that business-unit performance is positively related to the unit leader's internal local of control. Internal locus of control has also been found to be positively related to job satisfaction, efforts, and motivation (Spector, 1982). Individuals who attribute their performance to themselves and believe that their actions can influence outcomes (i.e., internal locus of control) are more likely to be motivated to perform at higher levels (Anderson, 1977). In contrast, external locus of control has been linked to higher levels of stress (Abouserie, 1994), strain (Gemmill & Heisler, 1972), anxiety (Joe, 1971), and organizational turnover (Andrisani & Nestal 1976; Harvey, 1971).

Neuroticism and Emotional Stability. Out of all of the components of Core Self-Evaluations, neuroticism is arguably the most well-studied personality concept. Neuroticism represents a person's "tendency to exhibit poor emotional adjustment and experience negative feelings such as fear, self-doubt, and depression" (Quigley, 2003, p. 11). Individuals who measure high in neuroticism tend to be less able to cope effectively with stressful situations and negative life events. Research has demonstrated a strong association between neuroticism and negative affectivity (Larsen & Ketelaar, 1991). Negative affect and neuroticism act as negative lenses through which individuals view the environment and others around them (Larsen & Ketelaar,

1991). Individuals with negative affect tend to view themselves as victims, are displeased with themselves and the environment, and often see others to have negative intents towards their physical and mental well-being (Clark & Watson, 1991; Judge et al., 1998; Matthews & Deary, 1998). Indeed, a number of previous empirical research provide support for the negative impact of neuroticism. For example, McCrae and Costa (1991) found that neuroticism is negatively related to psychological well-being. Other researchers have also demonstrated neuroticism to be negatively related to job satisfaction and performance (Brief, 1998; Spector, 1997).

As noted previously, high Core Self-Evaluations individuals can be described as those who have positive views of themselves and the environment (Judge et al., 2002). Although neuroticism serves as a component of Core Self-Evaluations, its reversed effect, termed *Emotional Stability*, is used to represent the construct (Judge et al., 2002). In other words, individuals with high Core Self-Evaluations will tend to be those who are less neurotic and more emotionally stable (Judge et al., 2003). As will be discussed later in this chapter, a direct measure Core Self-Evaluations (Core Self-Evaluations Scale; Judge et al., 2003) was developed with this consideration in mind.

Predictive Ability of Core Self-Evaluations Components. Core Self-Evaluations was originally conceptualized to help researchers explain why some individuals are more likely to be satisfied with their group and organization (Judge et al., 1998). Based on the literature that existed at the time, Judge and colleagues (1997) observed that self-esteem, generalized self-efficacy, locus of control, and emotional stability shared a number of conceptual similarities that warranted further investigations. In a meta-analytic study conducted by Judge and Bono (2001), the four dispositional concepts were found to be positively related to job satisfaction. The estimated true correlations between each disposition and job satisfaction were: .26 for Self-Esteem, .45 for Generalized Self-Efficacy, .32 for Internal Locus of Control, and .23 for Emotional Stability (all

true score correlations were statistically significant). Literature also provides a number of conceptual propositions to support these findings. With respect to self-esteem, Locke, McClear, and Knight (1996) noted that "a person with high self-esteem will view a challenging job as a deserved opportunity which he can master and benefit from, whereas a person with low self-esteem is more likely to view it as an underserved opportunity to fail" (p. 21). Individuals who view themselves as worthy (i.e., high self-esteem) are more likely to be satisfied with their jobs because incremental success can help reinforce their positive self-worth and self-concept (Self-Consistency Theory; Korman, 1970). Similarly, Gist and Mitchell (1992) argued that individuals with positive self-efficacy beliefs are more likely to exert extra efforts due to the satisfaction gained from the positive reinforcements in being able to confirm their self-efficacy beliefs. Clearly, individuals who view successful outcomes as results of their own actions (i.e., internal locus of controls) are more likely to be satisfied with their jobs. Finally, Judge and Bono (2001) noted that "neuroticism is related to lower well-being because individuals who score high on neuroticism are predisposed to experience negative affects ... [which] in turn, is negatively related to job satisfaction" (p. 81). In other words, neurotic individuals are more likely to be dissatisfied with their jobs due to their inability to cope with stressful and challenging situations.

In analyzing the four components of Core Self-Evaluations, Judge and Bono (2001) also examined self-esteem, generalized self-efficacy, locus of control, and emotional stability on the basis of their relationship to job performance. Based on the results obtained, the estimated true score correlations for the four components of Core Self-Evaluations to job performance were .26 for Self-Esteem, .23 for Generalized Self-Efficacy, .22 for Internal Locus of Control, and .19 for Emotional Stability (all true score correlations were statistically significant). In summary, evidence exists that demonstrates the positive merits of the four components of Core-Self Evaluations (i.e.,

particularly with respect to job satisfaction and job performance). In the following section, the interrelationship between the components of Core Self-Evaluations will be examined.

Interrelationship between Components of Core Self-Evaluations. Self-esteem, generalized self-efficacy, locus of control, and emotional stability were often studied in isolation of one another prior to Judge and colleagues' (1997) conceptualization of the Core Self-Evaluations construct. In fact, the possibility that self-esteem, generalized self-efficacy, internal locus of control, and emotional stability could be related to one another were often negated in prior research (Hojat, 1983; Horner, 1996). Abouserie (1994), for instance, investigated the influence of self-esteem and locus of control on academic and life stress without considering the possibility that the two predictors could be related to one another. Several researchers have even considered how self-esteem, generalized self-efficacy, internal locus of control, and emotional stability may influence one another (Morelli, Krotinger, & Moore, 1979; Wambach & Panackal, 1979).

The four components of Core Self-Evaluations are clearly conceptually similar. Certainly, self-esteem and generalized self-efficacy are closely related. Individuals who view themselves as worthy and significant (i.e., high self-esteem) are also likely to see themselves to be competent and capable (i.e., high generalized self-efficacy). Self-esteem and generalized self-efficacy are also likely to be closely related to internal locus of control. That is, individuals who view themselves as worthy (i.e., high self-esteem) and capable (i.e., high generalized self-efficacy) are also likely to believe that they have the ability to influence and obtain outcomes that they desire. Although internal locus of control has been found to be negatively related to neuroticism in previous empirical research (Morelli et al., 1979), a case can be made that individuals who perceive themselves to have the ability to influence outcomes (i.e., internal locus of control) will tend to be less likely to express feeling of anxiousness, depression, and fear in the face of challenge. Indeed,

it has been suggested that neurosis is a sign of low self-esteem (Rosenberg, 1965) and that self-esteem can be linked to signs of low neuroticism (Eysenck, 1990).

The interrelationship between Core Self-Evaluations components has been empirically examined on several occasions as part of the development of the Core Self-Evaluations construct. As illustrated in Table 2 below, Judge, Erez, and Bono (1998) conducted a meta-analysis of roughly 15,000 samples (i.e., ranging from university employees to organizational managers and physicians) and found strong and significant correlations between the four Core Self-Evaluations components. In support of these findings, another meta-analytic study (Judge et al., 2002) consisting of results obtained from 127 studies published between 1966 and 2000 also demonstrated substantial and significant relationships between the four Core Self-Evaluations components. From the 2002 study, the population level correlations between each pair of the components of Core Self-Evaluations are as follows:

- Self-Esteem & Locus of Control, $\rho = .52$
- Self-Esteem & Emotional Stability, $\rho = .64$
- Self-Esteem & Generalized Self-Efficacy, $\rho = .85$
- Locus of Control & Emotional Stability, $\rho = .40$
- Locus of Control & Generalized Self-Efficacy, $\rho = .56$
- Emotional Stability & Generalized Self-Efficacy, $\rho = .62$

In summary, evidence exists to provide support for the interrelationship between the four components of Core Self-Evaluations. In the following section, support for the Core Self-Evaluations construct as well as its predictive abilities will be examined.

Core Self-Evaluations Component	1	2	3	4
1. Self-Esteem	1.00	.70	.44	-.51
2. Generalized Self-Efficacy	.86	1.00	.45	-.45
3. Locus of Control	.58	.59	1.00	-.36
4. Neuroticism	-.62	-.54	-.47	1.00

Table 2: Reported Correlations between Core Self-Evaluations Components (Judge, Erez, & Bono, 1998)

*n = 15,888 for locus of control & self-esteem, locus of control & neuroticism, and self-esteem & neuroticism correlations
*n = 14,777 for all correlations involving generalized self-efficacy
*Correlations below the diagonal are corrected for measurement and sampling error
*Correlations above the diagonal are uncorrected
*A 95% confidence interval for each correlation

Core Self-Evaluations Construct. Having determined that self-esteem, generalized self-efficacy, locus of control, and emotional stability share a number of conceptual and empirical similarities, Judge and colleagues (1997, 1998, 2001, 2002, 2003) conceptualized Core Self-Evaluations to be a latent second-order construct that represents the underlying commonalities between the four dispositional concepts. In developing the Core Self-Evaluations construct, Judge and colleagues (1998) utilized principle components factor analysis based on meta-analyzed correlations of previously published research and found that the four dispositional components loaded strongly on a single factor (i.e., .92 for Self-Esteem, .90 for Generalized Self-Efficacy, .77 for Locus of Control, and -.77 for Neuroticism). Similar results were also obtained by Erez and Judge (2001), through both principle components and confirmatory factor analyses, in that a higher-order construct exists to explain the commonalities between self-esteem, generalized self-efficacy, locus of control, and emotional stability (i.e., statistically significant factor loading scores from Erez and Judge's (2001) confirmatory factor analysis were: .88 for Self-Esteem, .79 for Generalized Self-Efficacy, .59 for Locus of Control, and -.76 for Neuroticism).

Judge and colleagues (2002) conducted several additional analyses that contributed substantially to the validity of the Core Self-Evaluations construct. In testing convergent validity of the four components of Core Self-Evaluations, it was found that "the measures of [Core Self-Evaluations components] are not independent and that a single second-order factor accounts for this dependence" (Judge et al., 2002, p. 697). This suggests that although it may be possible to measure self-esteem, generalized self-efficacy, locus of control, and emotional stability separately, it would appropriate to merge the four components to represent a single higher-order construct. Using a different sample, Judge and colleagues (2002) also found a lack of discriminant validity among the four Core Self-Evaluations components with respect to their ability to predict stress, strain, job satisfaction, and life satisfaction. The authors suggested that measures of self-esteem, generalized self-efficacy, locus of control, and emotional stability "lack discriminant validity because their intercorrelations are so strong that they suggest that the traits are not discriminable across methods or sources" (Judge et al., 2002, p. 701). In other words, it was suggested that the four components of Core Self-Evaluations illustrated similar patterns in how they are related to the dependent variables of interest. Lastly, self-esteem, generalized self-efficacy, locus of control, and emotional stability were also found to be correlated with job satisfaction in conjunction with components from the Big Five Personality factor. The authors found that although self-esteem, generalized self-efficacy, locus of control, and emotional stability are related to the components of the Big Five, their patterns of associations with job satisfaction were different. In other words, while the components of Core Self-Evaluations and the Big Five personality traits were found to be correlated, Core Self-Evaluations components explained unique variations in the outcome variables that are not explainable by those from the Big Five personality theory (Judge et al., 2002).

In a follow-up study by Judge and colleagues (2003), similar findings concerning convergent validity, discriminant validity, and empirical validity were also demonstrated.

In summary, evidence from previous empirical research provides support for the validity of the Core Self-Evaluations construct. Particularly, Core Self-Evaluations represents the shared variation between self-esteem, generalized self-efficacy, locus of control, and emotional stability that each of the components alone cannot represent.

Empirical Support for Core Self-Evaluations. Early studies of Core Self-Evaluations were primarily interested in examining the psychological influences of Core Self-Evaluations on individual-level outcomes. As mentioned previously, the components of Core Self-Evaluations have been demonstrated to be positively related to job satisfaction and performance. In a study conducted by Judge, Bono, and Locke (2000), the relationship between Core Self-Evaluations and job satisfaction was found to be mediated by intrinsic job characteristics and objective job complexity. Individuals with high Core Self-Evaluations are more likely to seek challenging jobs and view complex tasks as being more intrinsically rewarding (Bono & Judge, 2003a). These individuals are more likely to be motivated because they view challenging and complex tasks as an opportunity to learn and grow (Judge et al., 1998). According to Korman's (1970) Self-Consistency theory, people are motivated to behave in ways that help reinforce their self-view and to maintain their self-image. Because individuals with high Core Self-Evaluations tend to evaluate themselves and their capabilities highly, they will tend to also be motivated to perform at higher levels to stay consistent with their positive self-views. Indeed, Erez and Judge (2001) also found that motivation mediate the link between Core Self-Evaluations and job performance.

In addition to being positively linked to job satisfaction and job performance, Core Self-Evaluations has been demonstrated to be a valid predictor of a number of other desirable outcomes. For example, Judge, Thoresen, Pucik, and Welbourne (1999) investigated the role of Core Self-Evaluations in relation to managerial responses to organizational change and found that the components of Core Self-Evaluations are positively related to individual's ability to cope. The same study also found that the components of Core Self-Evaluations are valid predictors of positive career outcomes (i.e., organizational commitment, job satisfaction and performance, and other extrinsic measures) and that the ability to cope with organizational change serves to partially mediate this relationship. In a more recent study, Judge, Hurst, and Simon (2009) found Core Self-Evaluations to be positively related to higher income, which in turns contributes to fewer feelings of financial strain (i.e., indirect effect through income). Core Self-Evaluations has also been linked to an individual's ability to cope with stress (Kammeyer-Mueller, Judge, & Scott, 2009), the ability take constructive responses to feedback (Bono & Colbert, 2005), seeking of complex and challenging jobs (Srivastava, Locke, Judge, & Adams, 2010), risk taking (Simsek, Heavy, & Veiga, 2010), increase in salary and occupational status (Judge & Hurst, 2008), as well as goal achievement and goal attainment (Judge, Bono, Erez, & Locke, 2005).

In summary, the literature provides a number of empirical support for the merits of Core Self-Evaluations. The current study is particularly interested in examining leader's Core Self-Evaluations in relation to the leader's display of Transformational Leadership. Additionally, this study is also interested in examining the dynamics and malleability concept of Core Self-Evaluations. Based on evidence that exists in the current literature, it is possible to argue that Transformational Leadership can lead to enhancements followers' Core Self-Evaluations over

time. In the sections that follow, relevant literature will be reviewed to formulate testable hypotheses for the current research.

Core Self-Evaluations as Antecedent of Transformational Leadership

Despite the large and growing body of research on Core Self-Evaluations and Transformational Leadership, very little is known about how leader's Core Self-Evaluations may influence the leader's leadership behaviors (Flynn, Smither, & Walker, 2016). In fact, only a few studies to date have empirically examined whether leader Core Self-Evaluations serves as a critical antecedent to the leader's display of Transformational Leadership (Hu et al., 2012; Resick, Whitman, Weingarden, & Hiller, 2009). Moreover, although Transformational Leadership has been suggested to be desirable in environments that are turbulent and uncertain (Antonakis & House 2002; Bass & Riggio, 2006; Day & Antonakis, 2012), studies that examined the significance leader's Core Self-Evaluations in relation to Transformational Leadership in these settings are still lacking. To address this gap in the current leadership literature, a major focus of this study is to empirically examine whether a relationship exists between leader's Core Self-Evaluations and perceptions of Transformational Leadership in an engineering environment.

The positive self-views associated with high Core Self-Evaluations are largely consistent with the behavioral characteristics associated with Transformational Leadership (Bass 1985; Bass & Riggio, 2006; Hu et al., 2012). To be a transformational leader, the leader needs to be able to provide intellectual stimulation to encourage others to challenge assumptions, reframe problems, and be willing to take risks (Hu et al., 2012). Leaders need to also be able to garner trust from their followers in order to be able to draw followers to identify with the leaders' visions and beliefs. From the Social Cognitive perspective (Bandura, 1986), self-efficacy, a core element of Core Self-

Evaluations, enables people to be persistent in the face of challenge due to the confidence these individuals hold in regards to their own work capabilities. People who display strong positive self-views and confidence in knowing what to do despite the presence of difficult challenges are likely to be able the garner trust from others. High Core Self-Evaluations leaders who display confidence in themselves and their capabilities in times of uncertainty are likely to be able to garner trust from their followers. Indeed, trust has been found to mediate the positive relationship between Transformational Leadership and a number of desirable outcomes (Liu et al., 2010; Podsakoff, Mackenzie, Moorman, & Fetter, 1990).

Previous research has demonstrated that leaders' internal locus of control, another key component of Core Self-Evaluations, is positively related to the display of intellectual stimulation behaviors (Howell & Avolio, 1993). In general, high Core Self-Evaluations leaders will tend to view themselves as competent, capable, and in control of their work (Hu et al., 2012; Judge et al., 2004). These positive dispositions are likely to serve to explain transformational leaders' use of intellectual stimulation to motivate followers to seek new and unconventional approaches to conduct their work (Erez & Judge, 2001; Judge & Hurst, 2008). Clearly, transformational leaders who seek out to instill confidence and empower others are likely to also be confident in their own worthiness and capabilities.

Transformational leadership requires leaders to serve as role models and be able to communicate compelling visions to motivate and inspire others to take actions. Self-confidence, self-determination, and internal locus of control are characteristics that are consistent with role-modeling qualities (Bass, 1990; Eden, 1992; House, 1977; Resick et al., 2009; Ross & Offerman, 1997; Sosik & Megarian, 1999). High Core Self-Evaluations leaders, with positive perceptions of themselves and toward the environments, are more likely than those with low Core Self-

Evaluations to be able to transmit positivity and enthusiasm to their followers (Hu et al., 2012). Consistent with the behavioral patterns associated with charisma, individuals with high Core Self-Evaluations are likely to be looked up to by others as role models due to the self-confidence and certainty exuded. These behaviors are likely to draw admiration and personal identification (Bass, 1985; House 1977). Previous research has also found Core Self-Evaluations to be positively related to goal attainment (Judge et al., 2005). Individuals with high Core Self-Evaluations are less likely to succumb to negative external pressures in the pursuit of their goals (Judge et al., 2005; Rotter, 1966). This can help high Core Self-Evaluations leaders pave the way for their followers to follow. With low levels of neuroticism, high Core Self-Evaluations leaders will also tend to be more emotionally stable and able to remain positive despite situational challenges. This, in turns, will render them to be reliable and trusting in the eyes of their followers (Dirks & Ferrin, 2002; Hu et al., 2012). The positive characteristics of high Core Self-Evaluations are likely to serve to help transformational leaders inspire others to follow their visions and to take actions to accomplish the desired goals.

Arguably the most important characteristic of Transformational Leadership is the need for these leaders to pay attention and provide individualized support to aid in the development of their followers (Bass & Riggio, 2006). High Core Self-Evaluations leaders not only demonstrate confidence in their own abilities but are also likely instill a sense of confidence in others that they can provide the support needed (Bass, 1985). Clearly, individuals who perceive themselves to be competent and in control are more likely than those with low self-evaluations to be able to provide support for others.

In sum, there are several theoretical reasoning that lend support for the link between leader Core Self-Evaluations and Transformational Leadership. This study proposes that leader's Core

Self-Evaluations will be linked positively to the leader's display of Transformational Leadership behaviors. From an empirical perspective, the relationship between leader Core Self-Evaluations and Transformational Leadership has been demonstrated in a handful of previous research. In a historiometric research based on biographical accounts of 75 CEOs of Major League Baseball organizations, Core Self-Evaluations was found to be positively related to CEOs' display of Transformational Leadership (Resick et al., 2009). Similarly, Hu and colleagues (2012) found a positive relationship between leader Core Self-Evaluations and followers' perception of Transformational Leadership in a study consisting of Chinese workers. Bono and Colbert (2005), on the other hand, found that high Core Self-Evaluations individuals rated themselves highly on Transformational Leadership whereas their colleagues did not. This research will extend upon the results of these previous studies by empirically examining the relationship between leader Core Self-Evaluations and followers' perception of Transformational Leadership in the context of engineering. With this, the first research hypothesis for the current study is as follows:

Hypothesis 1: Leader's Core Self-Evaluations is positively related to followers' perception of the leader's display of Transformational Leadership.

Transformational Leadership and Followers' Core Self-Evaluations

For over three decades, the theory of Transformational Leadership has garnered enormous support from leadership researchers for its emphasis on follower development. Yet, despite evidence linking Transformational Leadership to a wide variety of desirable outcomes and across various situations and sittings, the developmental processes by which followers of transformational leaders are suggested to undergo still remain relatively unexamined (Avolio et al., 2004; Bentein, Vandenberg, Vandenberghe, & Stinglhambe, 2005; Day & Antonakis, 2012;

Dust et al., 2014; Huang, 2013; Northouse, 2016; Wang & Howell, 2010, 2012). Clearly, as many researchers have noted, greater research attention should be paid on attempting to explain the underlying mechanisms and processes through which transformational leaders are able to influence their followers to perform beyond expectations. A better understanding of these processes could help contribute to a more comprehensive understanding of Transformational Leadership theory.

The possibility that Core Self-Evaluations is a malleable disposition is central to this research. While Core Self-Evaluations has often been thought of as a stable disposition that generally does not vary over time (Dormann, Fay, Zapf & Frese, 2006; Dormann & Zapf, 2001), theoretical and empirical support for the malleability concept of Core Self-Evaluations exists throughout the literature (Keller & Semmer, 2013; Scollon & Diener, 2006; Wu & Griffin, 2012). In fact, a handful of researchers have even hinted at the malleability of Core Self-Evaluations and recommended it to be an exciting venue for future research (Johnson, Rosen, & Levy, 2008; Judge et al., 2002, 2003; Judge et al., 2004). This study argues that transformational leaders are likely to influence their followers to the extent that these followers are going to develop to higher levels of Core Self-Evaluations. In the sections that follow, several theoretical and empirical bases for the malleability concept of Core Self-Evaluations in relation to Transformational Leadership will be examined. Several relevant leadership theories that lend support to explain how Transformational Leadership is likely to lead to enhancements in followers' Core Self-Evaluations will also be discussed.

Core Self-Evaluations Malleability. Despite numerous conceptual propositions and theoretical support, only a limited number of studies (e.g., Luthans, Avolio, Avey, & Norman, 2007) have directly examined the malleability concept of Core Self-Evaluations. Nevertheless, literature provides ample evidence that lend support for the malleability concept of the four

components that make up the Core Self-Evaluations construct. To build support for the current study's proposition that Transformational Leadership is likely to be positively related to enhancements in followers' Core Self-Evaluations, discussions of these malleability concepts will certainly be worthwhile.

Generalized Self-Efficacy. Bandura (1977) identified four major sources of influence that can shape and alter an individual's self-efficacy. First, *enactive mastery* and *performance accomplishment* is a source of influence that can enhance an individual's self-efficacy. People tend to perceive themselves to be more capable after successful task accomplishments. As Kang (2005) noted, it is not an individual's level of competence or abilities that directly drive his or her self-efficacy beliefs; it is the individual's perception of that ability that is key to his or her self-efficacy perception (Gist & Mitchell, 1992; Styvaert, 2011). Lindsey and colleagues (1995) also developed an efficacy-performance spiral proposition based on the concept of self-efficacy malleability. In it, the authors suggested that performance successes will result in an increased sense of an individual's self-efficacy, and the increased self-efficacy will then lead to higher levels of success. In a longitudinal study by Tierney and Farmer (2011), the authors demonstrated that increases in creative self-efficacy significantly corresponds to increases in creative performance. It is certainly possible for leaders to set their followers up to experience successful task accomplishments and increase followers' self-efficacy perspectives. This is particularly true for transformational leaders who are required to pay attention to their followers' strength and weaknesses in order to be individually considerate to followers' needs and concerns.

The second source of influence that can shape and alter an individual's self-efficacy is *vicarious experience* (Bandura, 1977, 1986). Individuals can learn to become more successful at a task by observing and imitating the behaviors of those who are capable. By engaging in

inspirational motivation and intellectual stimulation behaviors, transformational leaders increase self-efficacy of their followers by painting a vision that followers can also achieve similar success. Transformational leaders also serve as role models for their followers through idealized influence. A frame of reference offered by transformational leaders can serve as a model for their followers to imitate and develop to higher levels of self-efficacy in the process.

Verbal persuasion is the third source of influence that can lead individuals to develop to higher levels of self-efficacy (Bandura 1977, 1986). Transformational leaders express confidence in their followers' abilities to successfully accomplish the assigned tasks. Constructive feedback and coaching by transformational leaders, particularly through inspirational motivation and individualized consideration behaviors, is a source of influence that can help followers overcome self-doubts. Indeed, several researchers have found that both positive and negative performance feedback can have a direct effect on individual's self-efficacy (Brown & Inouye, 1978; Mohammed & Billings, 2002; Podsakoff & Farh, 1989). More importantly, leadership behaviors such as role modeling and verbal persuasion have been demonstrated to be positively related to followers' confidence and creative self-efficacy perceptions (Tierney & Farmer, 2002).

Lastly, according to Bandura (1977, 1986), *emotional and psychological arousal* is a source of influence that leaders can use to shape and develop their followers' self-efficacy perspectives. Individuals tend to experience positive emotional cues when others express confidence in their competence and abilities. When individuals are expected to fail, their psychological and emotional cues signal to them a weak sense of self-efficacy that then lead to lower performance levels. Leader's expression of high expectations can influence followers into believing that they have what it takes to accomplish the assigned tasks. From the Transformational Leadership perspective, transformational leaders utilize their individualized consideration and

intellectual stimulation behaviors to align followers' interests with task requirements as well as to motivate followers to become more involved. In doing this, these leaders also set their followers up for success. Satisfaction and enjoyment is promoted. Indeed, favorable experiences in which followers feel they are in control can contribute greatly to increases in followers' self-efficacy perceptions (Lazarus, 2008; Zautra & Reich, 1980).

In his theory-building work, Eden (1988) suggested that compared to task-specific self-efficacy, generalized self-efficacy is a broader dispositional construct that can be much more resistant to fluctuations and change (Chang et al., 2012). It is suggested that leaders need to focus on long-term goals and developments in order to be able to alter individual's generalized self-efficacy perceptions (Eden, 1988; Styvaert, 2011). While Bandura's (1977, 1986) propositions are primarily focused on the development of task-specific self-efficacy, it is likely that continued mastery of task-specific behaviors can lead to enhancements in generalized self-efficacy over time.

Self-Esteem. Until recently, the majority of research on self-esteem seems to imply that the disposition is very much unsusceptible to change. Over the last several years, however, a number of longitudinal studies in the disciplines of social science and developmental psychology have found evidence to support the idea that self-esteem can be developed and influenced (Orth & Robins, 2014). As summarized in a review study by Orth and Robins (2014), a number of longitudinal research on self-esteem development (Birkeland, Melkevik, Holsen, & Wold, 2012; Erol & Orth, 2011; Wagner, Gerstorf, Hoppmann, & Luszcz, 2013) has been quite consistent in demonstrating life-span trajectory in individual's self-esteem levels. The general consensus from these studies is that a person's self-esteem tends to show increases from adolescence to midlife and then decreases in the later years (Orth & Robins, 2014).

It is important to note that self-esteem refers to an individual's subjective perception of his or her worthiness as a person (Donnellan, Trzesniewski, & Robins, 2011; MacDonald & Leary, 2012). That is, an individual's self-esteem does not necessarily reflect the person's talent and abilities but rather the perception that he or she reflects on the self in terms of worthiness and respect (Orth & Robins, 2014). From this perspective, it may be possible for transformational leaders to influence the development of their followers' self-esteem. Deci and Ryan (2000), for instance, claimed that an individual's self-determinants are shaped by how the individual interacts with the environment. Individuals who are continually exposed to controlled environments are more likely to perceive themselves to be of less worth due to the constant pressure and burden put on them (Ryan & Deci, 2000). That is, these low self-esteem perspectives are the result of the restricted behavioral choices one can make to assert the value of one's actions or beliefs.

This research takes a position that it possible for transformational leaders to exert their influence to enhance followers' perception of worthiness and self-esteem. Transformational leaders enhance followers' self-esteem by expressing high expectations and confidence in followers' abilities (Shamir et al., 1993; Eden, 1990). Motivation and an increased sense of self-worth can be achieved through emphasizing the value of followers' tasks (Shamir et al., 1993). By instilling a sense of belonging, followers identify themselves with the values of the group and the collective. According to the plasticity theory (Brockner, 1988), individuals with low self-esteem are likely to seek approval from others and will tend to be more responsive to social influence (Styvaert, 2011). These individuals are also more likely to benefit from leaders who can instill optimism and confidence to reaffirm their positive self-worth and identity (Rank et al., 2009). Indeed, continuous exposure to these positive conditions will also likely to spill out into other aspects of the person's life.

Locus of Control. Locus of control refers to the degree to which an individual perceive oneself to have control over outcomes or events. Locus of control perspectives can be further categorized by two distinct dimensions. On one hand, individuals with *internal* locus of control believe that they are in control of the outcomes and events that they direct their efforts into. On the other hand, individuals with *external* locus of control believe that outcomes and events in their life are a result of chance, fate, or other outside forces. Several empirical and conceptual studies have provided support for the malleability concept of locus of control. In a longitudinal study of elementary school students, Kulas (1988) demonstrated that both boys and girls developed their locus of control perspectives over the course of the school year. Roberts and Nesselroade (1986), in a 2-week long study of adult couples who were expecting their first child, found locus of control to exhibit coherent day-to-day variability in both internal and external locus of control dimensions. Goldsmith, Veum, and Darity (1996) argued that individual's locus of control perspectives will tend to vary in response to the person's life experience. For example, individuals constantly exposed to uncontrollable events are likely to develop a sense of helplessness and will tend to shift toward a more external locus of control perspective (Hiroto & Seligman, 1975). This research argues that it may be possible for factors such as Transformational Leadership to have an influence insofar as to shape individual's locus of control perspective over time.

As with self-efficacy and self-esteem, it is possible for leaders to influence their followers' locus of control perspectives. Taylor, Collions, Skokan, and Aspinwall (1989) suggested that an illusion of control can be used effectively as a way to motivate people to become involved. By aligning followers' interests with the tasks assigned, transformational leaders can instill in their followers a sense of control in how goals are to be accomplished. Followers can be trained to learn to appreciate elements in their work and life that they can control. As Zautra and Reich (1980)

noted, favorable experiences can help promote a sense of control in one's work. Transformational leaders, through intellectual stimulation and individualized consideration behaviors, can coordinate followers' interests with task requirements and challenge their followers to be innovative and to take ownership of positive outcomes.

It has also been argued that transformational leaders empower their followers to become more independent on task accomplishments (Avolio et al., 2004; Özaralli, 2003). Indeed, empirical research provides support for the positive link between Transformational Leadership and employees' psychological empowerment (Avolio et al., 2004; Ismail, Mohamed, Sulaiman, Mohamad, & Yusuf, 2011; Jung & Sosik, 2002). To this end, this research takes the position that followers of transformational leaders are going to be influenced in such that they are going to develop into a more internally focused locus of control. More importantly, such positive development in locus of control perspectives will also contribute to enhancements followers' Core Self-Evaluations in the process.

Neuroticism and Emotional Stability. Neuroticism (i.e., the opposite of Emotional Stability) is a component of the five-factor model of personality (also known as the 'Big-Five' personality inventory) and has largely been studied throughout various fields of research. Early studies of the five-factor model strongly suggested that personality traits do not change as individuals enter into adulthood (Scollon & Deiner, 2006). Over the last several years, however, a number of cross-sectional and longitudinal research has contributed substantially to shed light on the dynamic nature of personality and its developmental potential (e.g., Judge, Simon, Hurst, & Kelly, 2014; Scollon & Deiner, 2006; Wood & Roberts, 2006). Indeed, literature provides several conceptual and empirical perspectives that lend support to the developmental potential of individuals' emotional stability.

According to Scollon and Deiner (2006), social dynamic transactional perspectives highlight the co-development of individuals' dispositions and their social relationships. The authors suggested that while personality characteristics can help predict one's behaviors toward life's events, experiences from these events play a crucial role to further shape the individual's personality characteristics over time. Similarly, Roberts, Wood, and Smith (2005) also elaborated on the importance of social perspectives in their concept of the 'Social Investment Model' (Scollon & Deiner, 2006). According to the social investment principles, individuals invest their psychological commitments as they take on important social roles such as work or relationship. These social roles demand certain behaviors and characteristics to be fulfilled. As individuals learn to adapt and participate in important social roles and responsibilities over time, their experiences would lead them to embody the qualities that such roles promote. Indeed, empirical research provides support for the transactional views of dispositional developments. Neyer and Asendorpf (2001), for instance, found that although neuroticism predicts feelings of insecurities towards one's relationships, experiences of positive and healthy relationships can lead to decreases in neuroticism over time. Similarly, Judge and colleagues (2014) found that work experiences such as organizational citizenship behaviors, interpersonal conflict, and intrinsic motivation can influence day-to-day fluctuations in several dimensions of the five-factor personality states. More importantly, while early researchers largely contend that personality developments are only limited to adolescents and young adults (Mcrae & Costa, 1990, 1994), fluctuations in all components of the five-factor model have been demonstrated even well into old age (Roberts, Walton, & Viechtbauer, 2006). In a panel study of 1,130 participants ranging from ages of 16 to 70, for instance, Scollon and Diener (2006) found that increases in work and relationship satisfaction predicted decreases in neuroticism and increases in extraversion regardless of age group.

The social dynamics transactional perspective lend support to help explain how transformational leaders are likely to influence followers' emotional stability. Followers of transformational leaders embrace their roles and responsibilities because these leaders instill a sense of purpose and meaning into followers' work (Bass & Riggio, 2006). Emotional aspects of work have been found to be positively related to subjective well-being, and satisfying and engaging employment has been found to help decrease negative emotions in the workplace (Roberts, Caspi, & Moffitt, 2003; Roberts & Chapman, 2000). Transformational leaders also develop strong relationships with their followers through mentoring and coaching. Followers are likely to feel an increased sense of emotional security knowing that they have their leader to rely on for guidance and support. Research has shown that negative environments such as those filled with conflicts, abuses, and poor relationship qualities can lead to increases in negative emotions (Robins, Caspi, & Moffitt, 2002). By reducing dysfunctional conflicts to promote cohesion and a sense of collective identity (Bass et al., 2003; Carless et al., 1996), transformational leaders are likely going reduce followers' feelings of anxiety and negative emotions. As with other theories previously discussed, continuous improvements in context-specific emotional responses are likely to also going to spill out to an individual's emotional stability towards other areas in life.

Based on empirical support from previous research as well as the several conceptual propositions provided, this research takes a position that Core Self-Evaluations is a malleable disposition due to the possible malleability of its core components. More importantly, this study argues that followers of transformational leaders are likely to be influenced to the extent that their Core Self-Evaluations will increase to higher levels over time. In addition to the discussion of the malleability concept of Core Self-Evaluations, several theories that have been linked to

Transformational Leadership can help to further clarify how these leaders are likely to influence enhancements in followers' Core Self-Evaluations.

Self-Concept Based Motivational Theory. A critical theoretical element of Transformational Leadership is the ability for these leaders to enhance followers' motivation (Bass & Riggio, 2006; Day & Antonakis, 2012; Masi & Cooke, 2000; Northouse, 2016; Shamir et al., 1993; Shin & Zhou, 2003). According to Shamir, House, and Arthur (1993), self-concept based motivational theory explains the process by which Transformational Leadership behaviors can lead to increases in followers' motivation and enhancements in followers' self-concepts. Drawing from the concepts of Social-Cognitive Theory (Bandura, 1986), Personal Identity Theory (Stryker, 1980), and Social Identity Theory (Ashforth & Mael, 1989; Tajfel & Turner, 1985), Shamir, House, and Arthur (1993) argued that individuals' behaviors are largely driven a number of motivational pathways that stem from their self-concepts.

First, Shamir, House, and Arthur (1993) argued that people are motivated to behave in ways that allow them to express their self-concepts and values. From the self-expressive perspective, individuals' behaviors are not always instrumentally calculated in that often times they are also largely driven by emotions, feelings, and beliefs. People do things because of who they are, and doing things a certain way help them establish an identity for themselves (Shamir et al., 1993, p. 580). The self-expressive perspective can be useful to help explain why, for instance, some people engage in behaviors that are self-sacrificial (Strauss, 1969). Put another way, people are motivated to behave in ways that allow them to express their self-concepts and to establish an identity for themselves towards others.

Transformational leaders increase the intrinsic values of followers' efforts by tapping into the self-expressive elements of followers' self-concepts (Shamir et al., 1993). These leaders inspire their followers to recognize that efforts reflect followers' identities. By aligning goals and values to what followers perceive to be meaningful, followers are going to be motivated to seek out and establish a positive identity for themselves. Increasing the meaningfulness of tasks will also lead to increases in efforts and positive behaviors that are associated with that identity. Indeed, as followers' efforts and perceptions of their identity increases, their self-concepts are also likely going to increase as a result.

Second, Shamir, House, and Arthur (1993) argued that people are motivated to maintain and enhance their self-esteem and self-worth. As discussed earlier in this chapter, self-esteem represents the values that a person places on the self in terms of worthiness and significance. Self-esteem and self-evaluations are important sources of motivation that individuals draw upon in response to social events and circumstances (Bandura 1986). It is argued that individuals are motivated to maintain and enhance their sense of significance and self-worth because these perspectives are a form of self- and social-reflections (Bandura 1986; Shamir et al., 1993). Occurrences of behaviors such as anger and hostility, for instance, are reflections of an individual's motive to maintain his or her self-esteem when it is perceived as being threatened or compromised (Kernis, Grannemann, & Barclay, 1989).

Transformational leaders increase the effort-accomplishment expectancies in themselves and their followers to enhance followers' self-esteem and self-worth (Shamir et al., 1993). These leaders enhance followers' self-esteem by expressing high expectations for themselves and their followers. They also instill confidence in followers' abilities to meet these high expectations. In doing this, followers' sense of self-efficacy are likely to be increased. By emphasizing the value

of followers' efforts and expressing confidence in followers' abilities, followers' sense of self-esteem and self-worth are also going to be reinforced.

Third, Shamir, House, and Arthur (1993) argued that people are motivated to retain and increase their sense of self-consistency (Shamir et al. 1993). People strive to behave in ways that allow them to be consistent with who they are and who they would like to become. Perceptions of the past, present, and the projected future shape individuals' self-concepts and who they are (McHugh, 1968). A sense of 'meaning,' when derived from the continuity of the past and the projected future, motivate individuals to determine how their behaviors can serve to reflect to others who they are as they proceed forward into the future (Shamir et al. 1993).

Transformational leaders articulate the value of goal accomplishments to stimulate increases in followers' self-concepts (Shamir et al., 1993). By relating important values to goal accomplishments and ensuring that followers recognize that these goals are achievable, transformational leaders instill in their followers a sense of purpose that brings meaning to followers' lives (Jahoda, 1981). Doing this also connects followers' past to a more attractive future to create a sense of personal development, enabling followers to be consistent with who they are and who they would like to be (McHugh, 1968). Indeed, being able to instill a sense of value into followers' work is a core element of Transformational Leadership. Doing this will also likely lead to increases in followers' self-concepts and how they view themselves.

Fourth, it is also argued that self-concepts are also composed of identities (Shamir et al., 1993). In addition to personal values and beliefs that serve to drive a person's behaviors, identities also serve to link the individual's self-concept to the society (McCall & Simmons, 1978; Stryker, 1980). According to the social identity theory (Tajfel & Turner, 1985), how individuals identify

themselves with their environments largely determines the discrepancies between an individual's behaviors compared to those of the collective. From the motivational perspective, situations and environments that are perceived to be desirable can serve to motivate individuals to seek out to behave and perform according to the norms and values of that social identity.

Meindl and Lerner (1983) argued that a sense of the collective and shared identity increases the likelihood that self-interests will be overlooked for more selfless motives that are focused on the collective and will tend to be more beneficial. Transformational leaders, by increasing the intrinsic value of efforts and goal-accomplishments, encourage followers to participate in the collective by linking followers' self-concept to that of the collective identity. By making sure that followers recognize the desirability of the social identity, transformational leaders influence their followers to identify themselves to that larger entity. Followers are committed to the shared identity through a common vision, mission, or transcended goals (Bennis & Nanus; 1985; House, 1976; Shamir et al., 1993). Through social identification, followers' sense of personal identity, and thus their self-concept and self-esteem, become part of their belonging to the group (Kark et al., 2003). Indeed, Kark and colleagues (2003) demonstrated that social identification mediates the positive effects of Transformational Leadership on followers' self-esteem and collective self-efficacy. While Kark et al.'s (2003) study was not longitudinal in nature, it is certainly possible that being able to promote a sense of belonging and social identity will likely help transformational leaders influence and enhance the self-concepts of both the leader and his or her followers over time.

Finally, it is argued that people are motivated by faith (Shamir et al., 1993). When specific outcomes and probabilities of success cannot be clearly identified, being hopeful by having faith in a better future serves as a motivational pathway to make certain behaviors intrinsically

rewarding (Shamir et al., 1993). Transformational leaders tap into this motive of their followers by instilling faith in a better future. Regardless of whether outcomes are of certainty, the increased sense of self-expression, self-worth, and self-consistency becomes part of the reward in and of itself. As noted earlier in this chapter, Transformational Leadership was conceptualized as a style of leadership that does not particularly rely on the use of extrinsic rewards to motivate their followers. These leaders intentionally use concepts and symbols to motivate their followers (Bass, 1985). To this end, Shamir, House, and Arthur (1993) argued that having faith in a better future is a satisfying condition in and of itself (p. 583). Individuals' self-concepts will raise when they perceive what they are doing to have meaning and purpose. Leaders who provide to their followers a sense of hope and faith in the attainment of an attractive future are likely to also influence their followers to develop to higher and more positive self-concepts in the process.

In summary, Shamir, House, and Arthur (1993) argued that the positive effects of transformational leaders are the result of these leaders' ability to tap into the motivational elements of followers' self-concepts. These effects are theorized to be triggered by the leaders' behaviors, and the further motivational effects on followers are results of followers' self-concepts being stimulated into actions. In reviewing Shamir, House, and Arthur's (1993) self-concept based motivational theory, a number of similarities can be seen between the motivational elements of followers' self-concepts and the concept of Core Self-Evaluations. Indeed, Core Self-Evaluations has been demonstrated to be positively related to intrinsic motivation in previous empirical research (Erez & Judge, 2001). Drawing from Shamir, House, and Arthur's (1993) self-concept based motivational theory, therefore, this research takes a position that the relationship between Transformational Leadership and followers' motivation (Bass & Riggio, 2006; Day & Antonakis,

2012; Masi & Cooke, 2000; Northouse, 2016; Shin & Zhou, 2003) can be explained by these leaders' ability to enhance followers' Core Self-Evaluations.

The Role of Follower Empowerment. Positive impacts of Transformational Leadership are also often attributed to these leaders' ability to instill in their followers an increased sense of empowerment (Avolio et al., 2004; Ismail et al., 2011; Jung & Sosik, 2002; Kark et al., 2003; Ozaralli, 2003). At its core, empowerment is a process whereby an individual or a group is given the authority to behave in autonomy for the purpose of achieving a common goal. Empowerment is defined as a cognitive state that can be described as the "increased intrinsic task motivation manifested in a set of four cognitions reflecting an individual's orientation to his or her work role: *competence*, *impact*, *m*eaning, and *self-determination*." (Spreitzer, 1995, p. 1443; Thomas & Velthouse, 1990). *Competence* refers to the overall perception of one's own self-efficacy and capabilities to be able to successfully accomplish tasks (Bandura, 1986). *Impact* refers to the degree to which an individual perceives his or her work to have the capacity to make a difference in contributing to the success of a larger objective. *Meaning* refers to the degree to which an individual perceives his or her work to have purpose. Finally, *self-determination*, or *choice*, refers to feelings of autonomy with respect to decision-making and how to best approach one's work (Avolio et al., 2004). In short, empowered individuals are motivated to perform well because they believe that they have the ability and autonomy to successfully carry out impactful work. These individuals are also motivated because they believe that their work will contribute to the overall success of something meaningful (Chen et al., 2007).

Transformational Leadership theory emphasizes the role of empowerment as a critical element that leads to follower development and leadership effectiveness (Avolio et al., 2004; Bass & Riggio, 2006; Dvir Eden, Avolio, & Shamir, 2002). Bass and Riggio (2006) argued that follower

empowerment is a product of individualized consideration and intellectual stimulation (p. 193). Empowerment involves effective delegation of tasks that requires leaders to pay attention to their followers' strengths and weaknesses. Authority and responsibility are moved from the leader to followers to instill pride, a sense of ownership, and psychological investment associated with efforts. Indeed, empowered employees have been found to be more committed to their leader and their organizations (Avolio et al., 2004; Dvir et al., 2002).

In addition to effective delegation of tasks, part of what makes empowerment so powerful is the role that followers play in the leadership process. Through empowerment, leaders take a step back to focus on coaching and mentoring to prepare followers to assume more responsibilities. This involves leaders challenging their followers to re-examine traditional ways to solve problems and encouraging them to see if things can be done better (Bass & Avolio, 1994; 1997). Through transformational leaders' use of feedback, encouragement, and support, followers' beliefs in their own capabilities are likely to be enhanced (Avolio et al., 2004; Hughes, Ginnett, & Curphy, 1999). A sense of impact and meaning can be communicated directly to followers through the transformational leader's articulation of a clear vision to explain how things can come together to contribute to a larger objective. By providing followers with a sense of autonomy and greater opportunities to have their voices heard, followers' self-determination is also going to be enhanced. As a result, followers will become more responsible and committed to the goals and values of the leader and the group.

While the current study would like to extend to Bass and Riggio's (2006) propositions and argue that idealized influence and inspirational motivation are also equally important in the leadership empowerment process (e.g., leader's display of moral standards, role modeling behaviors, and inspirational encouragements are also going to be valuable despite followers'

autonomy and self-determination), Transformational Leadership, in general, certainly has the potential to influence followers to feel more empowered. In support of this, it is not surprising to see that a vast number of empirical studies have demonstrated a positive relationship between Transformational Leadership and follower empowerment (Avolio et al., 2004; Ismail et al., 2011; Jung & Sosik, 2002; Kark et al., 2003; Ozaralli, 2003).

Prior studies have argued that Transformational Leadership behaviors can influence followers to be empowered, and that empowered followers are going to see themselves to be more capable and able to influence their work in a more meaningful way (Avolio et al., 2004). For the purpose of this research, it is possible that follower empowerment can be explained in part through the enhancements in followers' Core Self-Evaluations. As Spreitzer (1995) noted, empowerment can be explained as a process whereby an individual feels an increased sense of motivation resulting from positive perceptions of one's own work role. Spreitzer (1995; Thomas and Velthouse, 1990) also argued that these positive role perceptions can be identified by the person's sense of *competence*, *impact*, *meaning*, *and self-determination*. For empowered followers, it is likely that their sense of *competence* is a product of the increases in followers' self-efficacy. This proposition is consistent with Conger and Kanungo's (1998) view of empowerment in that it was argued that the process of empowerment involves raising follower's self-efficacy perceptions through verbal encouragements and other forms of positive leadership. In support of Conger and Kanungo's (1998) propositions, Kark et al. (2003) found that Transformational Leadership has a positive impact on follower empowerment through its relationship with follower self-efficacy and organization-based self-esteem.

Internalization of the *impact* and *meaning* of one's work is likely to result in an increased sense of self-esteem and self-worth. Consistent with the self-concept based motivational theory

(Shamir et al., 1993) previously discussed, individuals will tend to value themselves more positively when they recognize that what they are doing has meaning and purpose. With respect to *self-determination*, feelings of autonomy are likely to result in the internalization of one's locus of control. It is certainly possible to argue that a sense of ownership enhances the perception of being in control. When individuals see that their decisions can have direct impacts on the outcomes of their tasks, their locus of control perspectives are likely going become more internal in the process. Empowerment is also likely to lead to enhancements in emotional stability. Continuous success of meaningful work increases an individual's sense of confidence, self-efficacy, and self-determination (Avolio et al., 2004). As a result, these individuals are also going to become more emotionally stable due to the increased level of confidence they have about their own competence and autonomy.

It is important to note here that despite empowerment being very much focused on the role of followers and follower development, the process of empowerment is still in large part a responsibility of the leader. Clearly, the process of empowerment involves the transfer of responsibilities from leaders to their followers. This means that careless leaders who delegate all of their tasks could be mistaken for a type of leader that seek out to empower others. Bass and Riggio (2006) argued that acts of empowerment share a number of similarities with Laissez-Faire Leadership. This study acknowledges that it is certainly possible for followers to empower themselves through sheer commitment and self-determination. For a leader to truly empower, the leader must truly care about the development of his or her followers. It is imperative that leaders also instill in their followers a sense of competence, impact, meaning, and self-determination (Spreitzer, 1995; Thomas & Velthouse, 1990). The behavioral perspectives of Transformational Leadership supports this view of the process of empowerment.

In summary, empowerment can be defined as a process whereby an individual feels an increased sense of competence, impact, meaning, and self-determination. Researchers have argued that follower empowerment is a critical component of Transformational Leadership (Bass & Riggio, 2006). Indeed, previous studies have demonstrated that follower empowerment can explain the positive influences of Transformational Leadership on followers' performance (Dionne, Yammarino, Atwater, Spangler, 2004), satisfaction (Choi, Goh, Adam, & Tan, 2016), organizational commitment (Avolio et al., 2004), and perception of collective performance and efficacy (Jung & Sosik, 2002). This research argues that follower empowerment can be explained, in part, through enhancements in follower's Core Self-Evaluations. Particularly, this study will extend upon the results of previous studies by empirically examining the relationship between Transformational Leadership and followers' Core Self-Evaluations developments. Before a testable hypothesis is proposed, it is important that a discussion of the context in which Transformational Leadership is likely to have its most profound influence is provided. To this end, the following section discusses the role that contextual factors play in the leadership process.

Contextual Factors. Bass (1998) argued that Transformational Leadership is more likely to emerge in times of crises and periods of uncertainty and turbulence (Antonakis & House, 2002; Bass & Riggio, 2006). The reason being that these environments give transformational leaders more opportunities to redefine the status quo and articulate their visions of attractive future states (Antonakis & House, 2002). Uncertain environments tend to also make people want to gravitate to those who seem to know what they are doing. Thus, followers are likely to identify with transformational leaders in turbulence environments because these leaders display a sense of confidence, competence, and emotional stability. Burns (1961) posited that there are two types of structures that define how members of a group or organization interact with one another. On one

hand, mechanistic organizational or group structures confine interactions between leaders and their followers to be based on a set of predefined rules and regulations. Organic organizational and group structure, on the other hand, allow for decentralization and diversification of responsibilities and decision making. Bass and Riggio (2006) argued that mechanistic organizational structures will tend to be more effective for situations that are stable and predictable. On the other hand, organic types organizational structures will tend to be more suited for situations where adaptability and learning is required. Transformational leaders are more likely to emerge in organic organizational or group structures because this type of environments allows for greater flexibility of perceptions and decision making.

Physical distance between leaders and their followers also play an important role in the leadership process (Avolio et al., 2004; Dvir et al., 2002). As Antonakis and Atwater (2002) pointed out, physical distance between leaders and followers can influence the degree to which leaders are perceived and responded to. Close physical distance can facilitate higher quality communications, while larger physical distances can decrease the number of quality interactions between leaders and their followers (Chen & Bliese, 2002; Liden, Sparrowe, & Wayne, 1997). Closer distance leaders would also have more opportunities to interact directly with their followers to establish personal contacts and engage in relationship building activities (Howell and Hall-Merenda, 1999). Immediate followers of transformational leaders, for instance, are going to be able to receive better individualized support because these leaders would have more opportunities to directly observe and recognize the specific needs of their followers (Bass & Riggio, 2006; Shamir, 1995; Shamir et al., 1998). In a study of direct and indirect followers of different types of leaders, Dvir et al. (2002) found that although Transformational Leadership demonstrated positive

effects on the development and performance levels of followers from both groups, the impact was stronger on direct followers when compared to those that were indirect.

In summary, contextual factors play an important role in the leadership process. Uncertain and turbulent situations are more likely to call for Transformational Leadership to emerge (Antonakis & House, 2002; Bass & Riggio, 2006). Situations that are routine and lacking in challenges are less likely to require leaders to inspire and motivate followers to overcome difficulties. Leaders are more likely to be able to help their followers develop to higher potentials when tasks are difficult and challenging. Moreover, rigid organizational or group structures will tend put limits on what leaders can do. Transformational leaders are more likely to thieve in organic organizational or group structures because these environments allow them to be able to articulate their vision and challenge the status quo (Antonakis & House, 2002). Research has also shown that positive effects of Transformational Leadership will tend to be stronger when leaders and followers are at closer proximities (Avolio et al., 2004; Dvir et al., 2002). That is, physical distance can dictate the quality of leader-follower interactions. As Shamir (1995) argued, leaders who are in close proximity with their followers will have more opportunities to show individualized consideration because they are more likely to be able to recognize and respond to followers' specific needs.

Given the role that contexts and situations play in the leadership process, it is imperative that the current research is conducted with these factors in mind. To this end, this research takes a position that the context of engineering project teams, particularly those in the form of research and development, will be suitable for the goals of the current study. Specific characteristics of the current study's research methodology will be discussed in more detail in the subsequent chapters. Based theoretical and empirical support for the possible relationship between Transformational

Leadership and followers' Core Self-Evaluations, this study proposes that Transformational Leadership will be positively related to enhancements in followers' Core Self-Evaluations. Again, this research will be conducted within the context of engineering project teams because Transformational Leadership is likely to be needed and will tend to have a more profound impact on followers as compared to other types of leadership in this type of environments. Based on these arguments, the second research hypothesis for this study is as follows:

Hypothesis 2: Leader's display of Transformational Leadership is positively related to increases in followers' Core Self-Evaluations.

Hypothesized Research Model

In summary, the primary objective of this study is twofold. First, this study sets out to examine the relationship between leader's Core Self-Evaluations and followers' perception of Transformational Leadership. The first hypothesis proposed that high Core Self-Evaluations leaders are more likely to be viewed by their followers to display characteristics associated with Transformational Leadership. Second, this study also sets out to explore the relationship between Transformational Leadership and followers' Core Self-Evaluations. Self-concept based motivational theory (Shamir et al., 1993) argues that transformational leaders motivate their followers to perform beyond expectations by tapping into followers' motivation and also raising followers' self-concepts. Empowerment is also central to Transformational Leadership. Previous research has shown that Transformational Leadership is positively related to follower empowerment (Avolio et al., 2004; Ismail et al., 2011; Jung & Sosik, 2002; Kark et al., 2003; Ozaralli, 2003), and that follower empowerment can explain why some followers tend to be more effective than others (Dionne et al., 2004; Jung & Sosik, 2002). Extending upon the results and

findings from these previous empirical research, this study argues that follower empowerment can be explained, in part, through transformational leaders' ability to enhance followers' Core Self-Evaluations. Based on these arguments, the second hypothesis proposed that Transformational Leadership is going to be positively related to enhancements in followers' Core Self-Evaluations over time. This research will be conducted in the context of engineering project teams because researchers have argued that this type of environments is more likely to call for Transformational Leadership to emerge. With this, the theoretical framework that guides this research is illustrated in Figure 3 below.

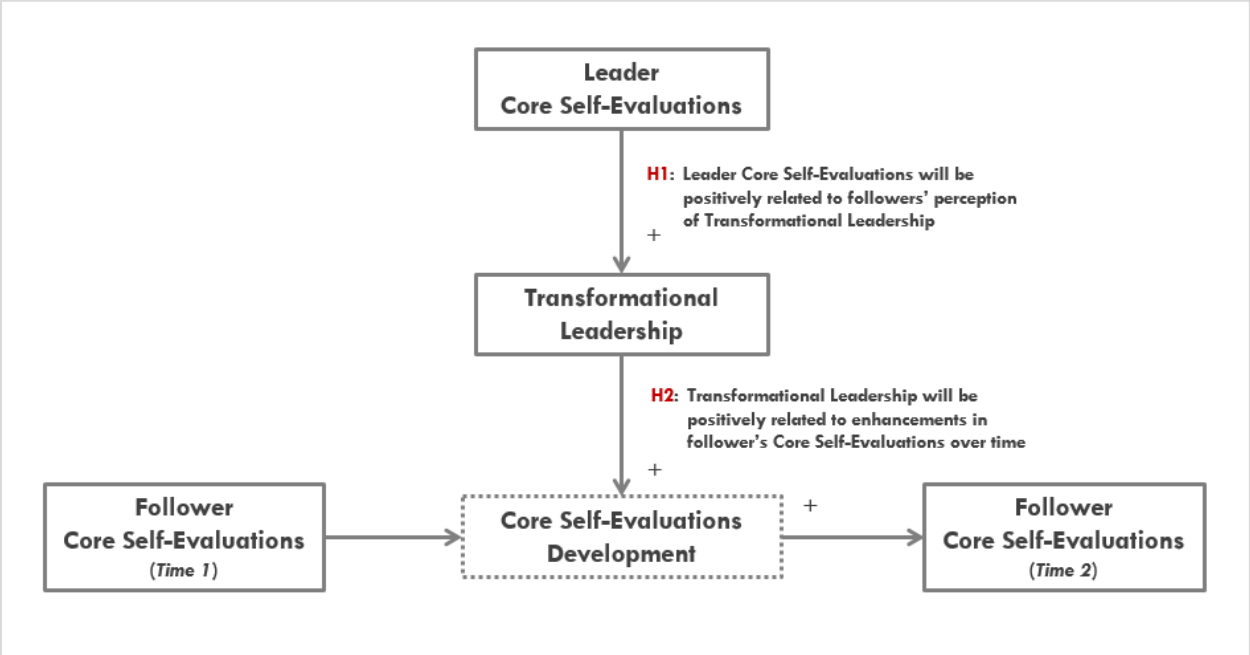

Figure 3: Hypothesized Research Model

CHAPTER III

RESEARCH METHODOLOGY

Participants and Procedures

Data for this research were collected from a large university in the eastern region of the United States. Participants consisted of undergraduate engineering students who were enrolled in their respective department-required engineering design courses. Students were required to work together in newly formed teams to successfully deliver completed design projects as part of their degree requirement. As part of the project, students were required to conduct research to develop and propose engineering solutions to address current and real-world problems. One of the major challenges of these design projects is the fact that clear-cut solutions do not currently exist. The fact that in order to pass the course the students had to demonstrate the ability to think critically and be able to work together as a team to develop innovative engineering solutions was clearly emphasized by the instructor of each course. The use of student participants in this research is consistent with those of previous leadership studies (Day & Sin, 2011; Ehrhart & Klein, 2001; Nübold et al., 2013) and has been supported theoretically by previous researchers (Berander, 2004; Höst, Regnell, Wohlin, 2000; Svahnberg, Aurum, & Wohlin, 2008). Again, the decision to conduct this research in the context of engineering is largely motivated by the critical role that contextual factors play in the leadership process (Shamir & Howell, 1999). As Antonakis et al. (2003) noted, "[different styles of leadership] ... may be seen as more or less effective depending upon the context in which they are observed and measured" (p. 268). This study argues in support of Antonakis et al. (2003) in that Transformational Leadership is likely to be more desirable in certain situations over others. In situations where tasks are relatively routine, for instance, Transformational Leadership is not likely to be very much needed due to the lack of task

difficulties and situational challenges (Antonakis et al., 2003; Bass & Riggio, 2006). Given the relatively limited number of leadership research in the field engineering, results from this study could potentially contribute to the generalizability of the theory of Transformational Leadership. For the purpose of this research, therefore, it is argued here that the context of these engineering design teams – one that requires leaders and their team members to work together creatively and collectively to solve complex engineering problems with unknown solutions – is appropriate in that it is likely to call for Transformational Leadership to emerge.

Data collection took place over a 16-week long semester. Prior to the start of the semester, instructors of 12 engineering design courses from various departments throughout the science college and the engineering college were invited to participate in the current study. Instructors were informed of the purpose of the research as well as the team-based format requirement of the research design. Because a central focus of the current research is on the leader, each team was required to have a formally assigned team leader in order to be eligible to participate. Of the 12 courses invited, the instructors of two courses did not respond and two other courses were not eligible to participate (i.e., these two courses did not require teams to have formally assigned team leaders). Overall, eight engineering design courses were included in the current study. The initial data source for this research consisted of 182 participants (i.e., 36 team leaders and 146 followers) from 36 teams.

Data for the study were collected by asking participants to complete survey instruments at three different time points throughout the semester. At two to three weeks into the semester (i.e., wave 1 of data collection), all participants were asked to provide their Core Self-Evaluations ratings to establish baseline Core Self-Evaluations scores for the study. Teams were not required to be formed at this point of data collection. However, to mitigate potential self-perception bias as

a result of leadership selection (Ross, Lepper &, Hubbard, 1975), instructors were informed that wave 1 of data collection had to take place prior to the appointment of team leadership. At 12 to 13 weeks into the semester (i.e., wave 2 of data collection), team members were asked to rate their leader with respect to the leader's display of Transformational Leadership. The 10-week time lag between the first and the second wave of data collection was implemented to allow for leaders and their followers (i.e., team members) to interact. This 10-week time-lag would have also provided team members with opportunities to learn about their leader's behaviors, as teams would have already spent the majority of the semester working together on their projects. Finally, at 15 weeks into the semester (i.e., wave 3 of data collection), prior to the final project deliverables, followers were asked to provide their Core Self-Evaluations ratings again to allow for the measurement of changes in followers' Core Self-Evaluations over time. Table 3 below provides a summary of the team processes and the data collection timeframe adopted in this research.

Wave	Week	Team Activities Leading up to Data Collection	Measures
1	2 - 3	• Team Formation • Topic Identification • Team Leader Appointed[a]	• Leaders' Core Self-Evaluations • Followers' Core Self-Evaluations (Time 1)
2	12 - 13	• Weekly Team Meetings and Engaging in the Design Project • Leader and Followers Interact as part of the Project Development • Midpoint and Preliminary Deliverables	• Followers' Perception of Transformational Leadership • Perception of Leadership Emergence • Perception of Outside Influence
3	15 - 16	• Further Interactions Between Leader and the Team Members • Final Project Deliverable[b]	• Followers' Core Self-Evaluations (Time 2)

Table 3: Summary of Data Collection Schedule

***** Data were collected over a 16-week semester.

[a] At Wave 1, Leaders' and followers' Core Self-Evaluations were measured prior to the time at which formal team leaders are selected, elected, or assigned.

[b] At Wave 3, Followers' Core Self-Evaluations scores were measured prior to the final project deliverables, before the teams had received any feedback on their final project submissions.

Of the eight engineering courses that participated in the study, data from six courses were collected live in class during the courses' mandatory weekly progress updates and meetings. Follow-up attempts were made to reach out to participants who were not able to attend the live meeting when data collection took place. The remaining two courses were offered in a hybrid live/online format. For teams enrolled in these two courses, a unique link to complete the survey was sent out to participants via the instructor of each course at each wave of data collection. Despite these two courses being offered in a hybrid live/online format, teams in these courses were also required to meet with their respective instructor weekly to discuss the progress of their projects. As such, instructors of these two courses helped to ensure that the online surveys were distributed and completed within the same time frame as the other six courses that participated in the current study. All participants received a cover letter briefly describing the purpose of the research (see Appendix A). A statement assuring anonymity and voluntary participation was also included. In order to link participants to their respective teams, team codes were generated for all participants. All participants were also assigned with unique personal codes used to match responses from all three waves of data collection. These teams and personal codes were also used to match followers to their leaders as well as to match leaders to their respective teams.

From the initial sample of 36 surveyed teams, 32 team leaders provided usable Core Self-Evaluations responses at wave 1 of data collection. 126 usable follower Core Self-Evaluations responses (i.e., from the team members) were also obtained at this time point. At wave 2 of data collection, 118 team members (i.e., followers) provided usable Transformational Leadership responses. Team members were also asked to rate their perception of leadership emergence and external influence at this wave of data collection (i.e., to be discussed in more detail below). Finally, at wave 3 of the data collection, 120 usable follower Core Self-Evaluations responses were

obtained from team members. After compiling all of the responses, two teams where only one member from the team provided usable Transformational Leadership rating had to be excluded from the analysis. These teams had to be excluded due to the potential bias pertaining to single source observation (Podsakoff, Mackenzie, Lee, & Podsakoff, 2003). An additional 20 team members who only responded to one of the two Core Self-Evaluations data collection attempts (i.e., 14 members who participated only at wave 1 and six members who participated only at wave 3 of the data collection process) were also excluded from the analysis. Five Transformational Leadership responses were usable from these excluded cases. For consistency, these Transformational Leadership responses were also excluded from the analysis.

Overall, the final dataset consisted of 31 team leaders and 112 followers. The average number of followers per leader was 3.61 (SD = 1.36, Range = 2 to 7). The follower sample consisted of 95 males (85%) and 17 females (15%) with an average age of 23.6 (SD = 5.57). The final leader sample consisted of 23 male (74%) and 8 female (26%) leaders with an average age of 24.5 (SD = 6.04). Teams were mainly those from the computer science department (57.3%; considered as software engineering teams) and the rest were from various engineering and technology disciplines.

Measures

Transformational Leadership. Team members were asked to rate their leader with respect to Transformational Leadership at wave 2 of data collection using 20 items taken from the Multifactor Leadership Questionnaire Form-5X (MLQ-5X; Bass & Avolio, 1997). The 20 items from the MLQ-5X were developed by Bass and Avolio (1997) to specifically assess the four sub-components of the Transformational Leadership construct: Idealized Influence (8 items),

Inspirational Motivation (4 items), Intellectual Stimulation (4 items), and Individualized Consideration (4 items). As noted earlier in Chapter II, the MLQ has undergone a number of rigorous validation and reliability testing since its inception (Avolio & Yammarino, 2002; Bass & Riggio, 2006). The MLQ-5X is also considered by many to be one of the best validated assessment of the Transformational Leadership construct (Antonakis et al., 2003; Bass & Riggio, 2006; Judge & Piccolo, 2004). To be consistent with previous empirical work (Avolio et al., 1999, 2004; Bono & Judge, 2003b; Jung & Sosik, 2002; Kark et al., 2003; Zhu et al, 2013), and since this research did not have any prior expectations as to how each of the Transformational Leadership sub-components would be related to Core Self-Evaluations, all of the responses from the MLQ-5X were combined to represent a single higher-order Transformational Leadership rating. All 20 items from the MLQ-5X were completed on five-point Likert scales ranging from 1 (Not at all) to 5 (Frequently, if not always). A sample item from the MLQ-5X includes: '[The Leader/Project Manager of my Team] … Expresses confidence that goals will be achieved.' Cronbach's alpha for this scale was .95.

Core Self-Evaluations. Participants' Core Self-Evaluations scores collected at wave 1 and wave 3 of data collection were measured using 12-item adapted from Judge et al.'s (2003) Core Self-Evaluations Scale (CSES). Traditionally, the Core Self-Evaluations construct is measured as a composite of the construct's sub-components (i.e., self-esteem, generalized self-efficacy, internal locus of control, and emotional stability measured separately) (Judge et al., 2002, 2003). The Core Self-Evaluations Scale was used in this research because it was developed specifically to also capture the intercorrelations between the construct's four sub-components (Judge et al., 2003). Evidence supporting the reliability and validity of the Core Self-Evaluations Scale exists vastly throughout the literature (Chang et al., 2012; Judge et al., 2002, 2003; Rode et al., 2012). At both

waves of the Core Self-Evaluations data collection, participants were asked to respond to each of the 12 items using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Given that this research is primarily focused on engineers working in the context of their design projects, two items from the Core Self-Evaluations Scale were modified by removing the phrase 'in life' from the question's stem. First, the item 'I am confident I get the success I deserve *in life*' was modified to 'I am confident I get the success I deserve.' Second, the item 'I determine what will happen *in my life*' was also modified to 'I determine what will happen.' All other items from the original Core Self-Evaluations Scale remained unchanged. The scale used in this research is included in Appendix F. Cronbach's alpha reliability for the two waves of data collection were .87 and .89, respectively.

Control Variables. In testing the relationship between leader Core Self-Evaluations and followers' perceptions of Transformational Leadership (i.e., Hypothesis 1), leader's age and gender were included as control variables due to their demonstrated influence on perception of Transformational Leadership (Briscoe, Hoobler, & Byle, 2010). In contrast to previous Transformational Leadership studies (e.g., Avolio et al., 2004; Hu et al., 2012), leader's educational level was not controlled for because all participants were undergraduate-level engineering students. Follower tenure with the leader and the team were also not controlled for (Avolio et al., 2004; Cho & Dansereau, 2010; Hoffman, Bynum, Piccolo, & Sutton, 2011) because participants consisted of only those in newly formed teams.

In testing the relationship between Transformational Leadership and follower Core Self-Evaluations developments (i.e., Hypothesis 2), several factors that could potentially confound the main effects of interest had to also be controlled for. First, previous researchers have posited that personality traits tend to develop throughout childhood and stabilize as people become older

(McCrae & Costa, 1994, 1999). To address this, follower's age and gender were controlled for due their possible influences on the dynamics of Core Self-Evaluations developments. Followers' perception of leadership emergence (e.g., a case where one or more members who was not the team's formally assigned leader predominantly took over leadership responsibilities for the team) and perception of external influence (e.g., a case where an external member, rather than the team's formally assigned leader, took over leadership responsibilities for the team) were also included as control variables using two items adapted from Brussow's (2013) Shared Leadership Survey. These variables had to be controlled for since the formally assigned team leader is the central focus of this research. Participants were asked to respond to each of the two items using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These two control variables were measured at wave 2 of the data collection alongside ratings of Transformational Leadership. The two items include: 'In addition to the team's formal leader (e.g., the Project Manager), I can identify at least one other team member who acted as an informal team leader,' and 'Aside from the members of my team, I can identify at least one individual from outside of the team (e.g., Course Instructor, Team Mentor) who acted as a leader of this project,' respectively.

Level of Analysis

Transformational Leadership was treated as a team-level variable in this research. Conceptually, it would not be appropriate to assume that the relationship between leaders and their followers is only going to be dyadic in nature. On the basis of the Social Learning Theory, for instance, Bandura (1977a, 1977b) argued that people tend to learn appropriate actions and behaviors by observing the behaviors of others who are within the same environment. In addition to learning about the leader through direct leader-follower interactions, follower participants in the current research were also likely to learn about their leader by observing how the leader interacts

with other members of the team. There were likely to also be instances where leaders had to direct their actions to the team as a whole rather than to a particular individual (Avolio et al., 2004; Sharmir et al., 1998). For these reasons, members from the same team were considered to be nested under a single team-level leader. Drawing on previous multi-level leadership studies (Bono & Judge, 2003b; Braun, Peus, Weisweiler, & Frey, 2013; Braun & Nieberle, 2017; Jung & Sosik, 2002; Kark et al., 2003), a consensus model concept (Chan 1998) was adopted and consensus among responses at lower level was employed to specify Transformational Leadership as a higher level construct (Braun et al., 2013). More specifically, the average score based on team members' Transformational Leadership responses was used to represent team-level Transformational Leadership for each team (i.e., team's shared perceptions of Transformational Leadership). A summary of the current research model, data collection process, and levels of analysis is illustrated in Figure 4 below.

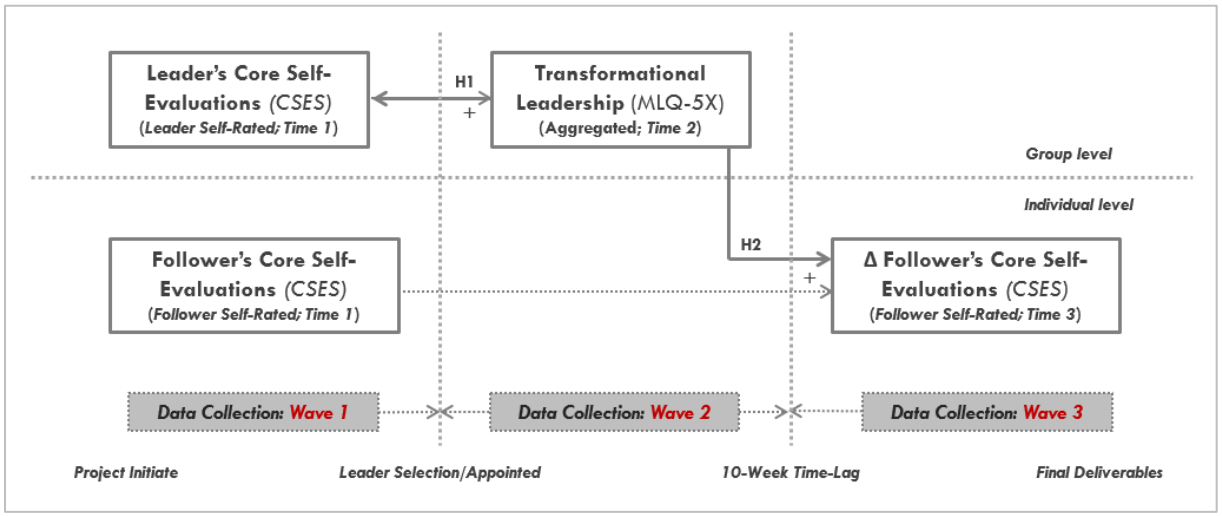

Figure 4: Summary of Research Model, Data Collection, and Level of Analysis

Analytic Strategy

While a decision was made to treat Transformational Leadership as a team-level variable, a primary objective of this research is to examine whether Transformational Leadership predicts changes in follower Core Self-Evaluations at the individual-level. Thus, Hypothesis 2, which proposed that Transformational Leadership would be positively related to increases in followers' Core Self-Evaluations, was examined from a cross-level perspective based on the relationship between variables treated at different levels of analysis. Given this multi-level structure, Hypothesis 2 was examined using the Hierarchical Linear Modeling approach (Raudenbush & Bryk, 2002). To establish meaningful results, literature also recommends the use of variable centering technique in multi-level analysis. Enders and Tofighi (2007), in particular, demonstrated that the use of the group mean centering on level-1 independent variables, particularly when a level-2 predictor is of main interest, would result in analysis of the effects of the level-2 predictor independently of the effects of the level-1 independent variables. In other words, centering level-1 variables on the group mean would not account for the covariation between the level-1 and the level-2 independent variables (Enders & Tofighi, 2007). To this end, all level-1 control variables were centered on the grand mean to allow for the covariation of the level-1 control variables and the level-2 predictor variable (i.e., Transformational Leadership) to be accounted for. HLM7 statistical software based on full maximum likelihood estimation with robust standard errors was used to test this hypothesis.

The relationship between leader Core Self-Evaluations and followers' perceptions of Transformational Leadership (i.e., Hypothesis 1) was examined as a within-level analysis. Since Transformational Leadership was treated as a team-level variable, leaders' Core Self-Evaluations were also treated at the same level of analysis. For the analysis, the aggregated team-level

Transformational Leadership ratings were matched to the appropriate team leaders' Core Self-Evaluations scores. Thus, the effective sample size for this analysis was conducted on 31 team leaders. All control variables for the test of this Hypothesis (i.e., Leader's age and gender) were also included at the team-level. Multiple Ordinary Least Squares (OLS) regression was applied to test Hypothesis 1 since all variables of interest were observed at the same level of analysis (Braun et al., 2013). Tables 4 and 5 below presents the means, standard deviations, and correlations among the variables used to examine Hypotheses 1 and Hypothesis 2, respectively.

Variable	M	S.D.	1	2	3	4
1. Leader Age[a]	24.50	5.94	-			
2. Leader Gender[b]	1.26	.44	.23	-		
3. Leader Core Self-Evaluations	3.92	.57	.12	.10	-	
4. Transformational Leadership	3.80	.49	.07	.05	.38*	-

Table 4: Hypothesis 1 Descriptive Statistics

Note: All variables observed at the leader-level. Thus, effective $N = 31$.
Leader Core Self-Evaluations and Transformational Leadership were measured on 5-point Likert scales. Transformational Leadership represents leader-level aggregation of followers' ratings of their respective team leaders.
[a] Team-level $N = 30$
[b] For Leader Gender, 1 = Male, 2 = Female

* p<.05 (Two-tailed)Variable	M	S.D.	1	2	3	4	5	6	7
1. Follower Age[a]	23.55	5.53	-						
2. Follower Gender[b]	1.15	0.36	.20*	-					
3. Follower Core Self-Evaluations (Time 1)	3.88	0.56	.24*	-.14	-				
4. Follower Core Self-Evaluations (Time 2)	3.94	0.58	.26**	-.22	.83**	-			
5. Leadership Emergence	4.47	0.77	.14	.06	.09	.09	-		
6. Outside Influence	3.29	1.49	-.09	-.01	.13	.09	.10	-	
7. Transformational Leadership[c,d]	3.80	0.49	.16	.06	-.20*	-.07	-.06	-.07	-

Table 5: Hypothesis 2 Descriptive Statistics

Note: Individual-level $N = 112$. Transformational Leadership represents the aggregated followers' ratings of their respective team leaders. These scores were then assigned to their respective follower cases. The effective N for Transformational Leadership at the Team-level, therefore, is 31. Follower Core Self-Evaluations, Follower Perception of Leadership Emergence, Follower Perception of Outside Influence, and Transformational Leadership were measured on 5-point Likert scales.

[a] Effective $N = 109$ due to missing values

[b] For Follower Gender, 1 = Male, 2 = Female

[c] Correlations reported here do not consider the multi-level structure of the data since the same Transformational Leadership score was assigned to all members within the leader's respective team.

[d] The means and standard deviations reported here do not account for the differences in team sizes. That is, larger teams may skew the overall calculations of these values.

* p<.05 (Two-tailed)

** p<.01 (Two-tailed)

CHAPTER IV

RESULTS

Aggregation Analysis

As described in the previous chapter, to account for the inherent multi-level nature of leadership (Braun & Nieberle, 2017; Day & Antonakis, 2012; Leroy et al., 2015; Wang & Howell, 2012; Yammarino & Dansereau, 2008), a consensus model concept (Chan 1998) was adopted as a theoretical basis for treating Transformational Leadership as a team-level variable. Since Transformational Leadership was measured at the individual-level (i.e., each individual team member was asked to rate his or her leader in terms of Transformational Leadership), additional analysis was required to demonstrate consensus and justify the decision to aggregate followers' responses to the team-level (Biemann, Cole & Voelpel, 2012; Bliese, 2000; Braun et al, 2013). To do this, the interrater agreement $r_{wg(j)}$ statistic for each team had to be estimated to determine whether responses from members of the team demonstrate an acceptable degree of agreement (Biemann et al., 2012; James, Demaree, & Wolf, 1984, 1993). Additionally, the intraclass correlation coefficients (i.e., ICC(1) and ICC(2) estimates) had to also be estimated to determine whether individual-level responses and group-mean scores demonstrate enough reliability (Biemann et al., 2012; Bliese, 2000; Klein et al., 2000). Lastly, an F-test was conducted on the obtained Transformational Leadership responses to determine whether the average scores differed significantly across teams (Biemann et al., 2012).

As per Biemann et al. (2012) recommendations, two different distributions (i.e., uniform and slightly skewed) were applied to determine the $r_{wg(j)}$ estimate for each team. With the slightly skewed distribution, two of the 31 teams yielded values that were out of range ($.00 \leq r_{wg(j)} \leq .98$;

to be discussed in more detail below). With the uniform distribution, on the other hand, all $r_{wg(j)}$ estimates were within range and can be considered to be acceptable ($.81 \leq r_{wg(j)} \leq .98$). These $r_{wg(j)}$ values were then used as lower- and upper-bound estimates for each team (Biemann et al., 2012). Overall, the average $r_{wg(j)}$ across all teams was .82 (SD = .08) with a range of .59 to .91 (Median = .83). The estimated intraclass correlation coefficients ICC(1) and ICC(2) were .34 and .65, respectively. The group effects scores (i.e., $F(30, 81) = 2.86$, $p < .001$) were also found to be significantly different across all teams. A summary of the obtained $r_{wg(j)}$ estimates as well as the intraclass correlation coefficients (i.e., ICC(1) and ICC(2) estimates) can be found in Appendix K.

To interpret the interrater agreement $r_{wg(j)}$, cut-off values ranging between .60 to .70 has been suggested to provide adequate justification to aggregate lower-level responses to represent a latent construct at a higher level of analysis (Bliese, Halverson, & Schriesheim, 2002). More recently, it has been argued that $r_{wg(j)}$ values within the .51 to .70 range indicate a 'moderate agreement' in the responses obtained (LeBreton & Senter, 2008). Given that the lowest $r_{wg(j)}$ estimate obtained from the current sample was .59, it was concluded that responses from all participating teams demonstrated at least moderate agreement, and that the obtained degree of agreement provide support for the decision to aggregate Transformational Leadership to the team-level in this research. With respect to the interpretation of intraclass correlation coefficients, ICC(1) and ICC(2) estimates can be used to describe the amount of variance attributed to group membership and the reliability of using the aggregated group-mean scores to distinguish between groups ratings, respectively (Biemann et al., 2012; Bliese, 2000). In the current sample, the ICC(1) value of .34 suggests that group membership explains 34 percent of the variance in individual group-members' Transformational Leadership responses (Biemann et al., 2012). The ICC(2) value of .65 obtained also indicated acceptable reliability in using the aggregated Transformational

Leadership to distinguish between groups (Biemann et al., 2012). These obtained ICC(1) and ICC(2) estimates are also consistent with those reported in prior leadership studies (Braun et al., 2013) and is well above the suggested values argued to provide enough justification for variable aggregation (Bliese, 2000; Chen Mathieu, & Bliese, 2004; LeBreton & Senter, 2008). Based on these findings, it was concluded that the decision to aggregate Transformational Leadership to the team-level of analysis in this research is statistically supported.

Hypotheses Testing

Hypothesis 1 proposed that leader Core Self-Evaluations would be positively related to followers' perception of Transformational Leadership. To examine this relationship, multiple Ordinary Least Squares regression was applied to the aggregated team-level Transformational Leadership scores (i.e., dependent variable; assigned to their respective team leader Core Self-Evaluations responses) with leaders' age, gender, and Core Self-Evaluations as independent variables. As a preliminary analysis, only the control variables (i.e., Leaders' age and gender) were included as independent variables in the regression analysis. Results from the preliminary analysis revealed that leaders' age ($\beta = .06$, $p > .50$) and gender ($\beta = .05$, $p > .50$) do not significantly predict to the aggregated followers' perception of Transformational Leadership. Following the preliminary analysis, leader Core Self-Evaluations scores were then included as an independent variable to test Hypothesis 1. After controlling for leaders' age ($\beta = .02$, $p > .50$) and gender ($\beta = .01$, $p > .50$), a positive and significant relationship was found between leaders' Core Self-Evaluations and followers' perception of Transformational Leadership ($\beta = .38$, $p < .05$). In other words, these findings suggest that after controlling for leader's age and gender, leader's Core Self-Evaluations measured at the beginning of the semester predicted followers' perception of Transformational Leadership as measured at a later stage in the project. The observed change in

R^2 statistic ($\Delta R^2 = .14$, $p < .05$) also provide support for an improvement in model fit after leader Core Self-Evaluations was added to the regression model. These results provide support for Hypothesis 1. Table 6 below provides a summary of the results obtained from the multiple Ordinary Least Squares regression analysis used to test Hypothesis 1.

	Transformational Leadership		
	B	S.D.	β
Step 1			
Constant	3.63	.43	
Leader Age	.01	.2	.06
Leader Gender	.06	.23	.05
Step 2			
Constant	2.47	.68	
Leader Age	.00	.02	.02
Leader Gender	.01	.22	.01
Leader Core Self-Evaluations	.33	.15	.38*
R^2			.15
F			1.56
ΔR^2			.14*
ΔF			4.24*

Table 6: Summary of Hypothesis 1 Multiple OLS Results

Note: *N* = 31 at the leader's level of analysis. Detailed multiple OLS regression analysis results obtained from the SPSS statistical software can be found in Appendix L.
* p<.05

Hypothesis 2 proposed that Transformational Leadership would be positively related to increases in followers' Core Self-Evaluations. This hypothesis was examined from a cross-level perspective based on the relationship between team-level Transformational Leadership and changes in followers' Core Self-Evaluations treated at the individual-level (see Figure 4). To examine this hypothesis, a 'Change in Follower Core Self-Evaluations' score (ΔCSE) for each follower was first computed by subtracting follower's baseline Core Self-Evaluations score observed at time 1 (i.e., obtained from wave 1 of data collection) from the Core Self-Evaluations

score observed at time 2 (i.e., obtained from wave 3 of data collection) for all follower cases (i.e., ΔCSE = CSE2 – CSE1). As a first step of the analysis using the HLM7 software, the computed ΔCSE scores were included in the model as a level-1 outcome variable. This outcome model (i.e., also known as the unconditional 'null' model) was then examined without any predictors. Analysis of the unconditional model was particularly necessary to test whether there is enough variability in ΔCSE at the team-level to justify the use of multi-level modeling (Hox, 2002). Based on the results obtained, an intraclass correlation coefficient (ICC) estimate was computed to determine the proportion of the total variance in ΔCSE that resides between groups. Specifically, the ICC estimate was computed as a function of the variance component of the level-2 intercept (τ_{00}) and the level-1 residual variance (σ^2) based on the output obtained from the analysis of the unconditional model (i.e., ICC estimate = $\tau_{00}/\tau_{00} + \sigma^2$). Results indicated that team membership accounted for 10.4 percent of the total variance in ΔCSE (i.e., ICC = .104). That is, 10.4 percent of the variance in ΔCSE was found to be at the team-level, while 89.6 percent of the variance in ΔCSE was observed at the individual-level. A chi-square test was also conducted to examine whether the variability in ΔCSE at the group-level is significantly different from zero. Results suggested that the variance between teams was marginally significant (i.e., $\chi^2(30) = 42.63$, $p = .06$). It is suspected that the reason for this non-significance chi-square test is due to how ΔCSE was calculated in this research. Particularly, the variance in ΔCSE across all teams were likely generally going to be low since ΔCSE was calculated as the difference between Core Self-Evaluations scores observed over a relatively short time span. The relatively small sample size in this research may have also contributed to the marginally significant chi-square estimate. While the chi-square test illustrated that the between teams variance was not significant at the .05 level (i.e., $p = .06$ obtained), this research proceeded with the cross-level analysis because Hierarchical

Linear Modeling was needed to be able to account for the nested structure of the data. This approach is consistent with those adopted in previous leadership research (Braun & Nieberle, 2017). The issue regarding sample size and data collection will be discussed in more detail in the next chapter.

Following an analysis of the unconditional 'null' model, all individual-level control variables were included at level-1 to conduct a preliminary analysis. These individual-level control variables were centered on the grand mean since the main predictor variable (i.e., Transformational Leadership; variable of interest) is at level-2 (Enders & Tofighi, 2007). Results from the control model illustrated that none of the control variables were significantly related to changes in followers' Core Self-Evaluations (i.e., Follower age: $\gamma_{10} = .00$, $p > .50$; Follower gender $\gamma_{20} = -.16$, $p > .05$; Perception of leadership emergence $\gamma_{30} = .02$, $p > .50$; Perception of outside influence $\gamma_{40} = -.01$, $p > .50$). To test Hypothesis 2, the aggregated Transformational Leadership variable was then added to the model as a team-level predictor. After controlling for follower age ($\gamma_{10} = .00$, $p > .50$), follower gender ($\gamma_{20} = -.16$, $p > .05$), perception of leadership emergence ($\gamma_{30} = .02$, $p > .50$), and perception of outside influence ($\gamma_{40} = -.01$, $p > .50$), Transformational Leadership (i.e., at the team-level) was found to be significantly related to positive increases in followers' Core Self-Evaluations (i.e., at the individual-level of analysis) ($\gamma_{01} = .15$, $p < .05$). In other words, after controlling for follower's age, gender, perception of leadership emergence, and perception of external influence, it was found that on average, a one unit increase in team's shared perception of Transformational Leadership predicts an increase of .15 in follower's Core Self-Evaluations score. A change in deviance statistic was also estimated (ΔDeviance = 3.92, $p < .05$) and found to provide support for an improvement in model fit after Transformational Leadership was added to the final

model. These results provide support for Hypothesis 2. A summary of the results obtained from the Hierarchical Linear Modeling analysis can be found in Table 7 below.

Outcome	ΔCSE					
	Null Model[a]		Preliminary Model[b]		Hypothesized Model[c]	
	γ	S.E.	γ	S.E.	γ	S.E.
Constant	.06	(0.04)	.06	(0.04)	-.53	(.27)
Individual-Level[d]						
Follower Age[e]			.00	(0.01)	.00	(0.01)
Follower Gender			-.16	(0.09)	-.16	(0.08)
Leadership Emergence			.02	(0.03)	.02	(0.04)
Outside Influence			-.01	(0.02)	-.01	(0.02)
Team-Level						
Transformational Leadership					.15*	(0.07)
Model Fit Statistics						
Deviance	70.71		59.85		55.93	
Degrees of Freedom	3		7		8	
Δ Deviance			10.86*		3.92*	

Table 7: Summary of Hypothesis 2 HLM Results

Note: Individual-Level N = 112, Team-Level N = 31. Standard errors are in parentheses. ΔCSE = Change in Followers' Core Self-Evaluations and was calculated by subtracting followers' Core Self-Evaluations observed at Time 1 from followers' Core Self-Evaluations observed at Time 2. Transformational Leadership represents the team-level aggregation of followers' ratings of their respective team leaders. Detailed results obtained from the HLM 7 software can be found in Appendix M to P.

[a] Level-1 Model: $\Delta CSE_{ij} = \beta_{0j} + r_{ij}$, Level-2 Model: $\beta_{0j} = \gamma_{00} + u_{0j}$.

[b] Level-1 Model: $\Delta CSE_{ij} = \beta_{0j} + \beta_{1j}$(Follower Age) + β_{2j}(Follower Gender) + β_{3j}(Leadership Emergence) + β_{4j}(Outside Influence) + r_{ij}, Level-2 Model: $\beta_{0j} = \gamma_{00} + u_{0j}$, $\beta_{1j} = \gamma_{10}$, $\beta_{2j} = \gamma_{20}$, $\beta_{3j} = \gamma_{30}$, $\beta_{4j} = \gamma_{40}$.

[c] Level-1 Model: $\Delta CSE_{ij} = \beta_{0j} + \beta_{1j}$(Follower Age) + β_{2j}(Follower Gender) + β_{3j}(Leadership Emergence) + β_{4j}(Outside Influence) + r_{ij}, Level-2 Model: $\beta_{0j} = \gamma_{00} + \gamma_{01}$(Transformational Leadership) + u_{0j}, $\beta_{1j} = \gamma_{10}$, $\beta_{2j} = \gamma_{20}$, $\beta_{3j} = \gamma_{30}$, $\beta_{4j} = \gamma_{40}$.

[d] All Individual-Level variables were centered on the grand mean.

[e] Due to missing values, Individual-Level N for Follower Age = 109.

* $p<.05$

CHAPTER V

DISCUSSION

Overview

Despite the large literature that has demonstrated the positive impacts of Transformational Leadership on individual and team outcomes, empirical research that examines the underlying mechanisms and processes by which transformational leaders exert influence on their followers is still relatively limited (Avolio et al., 2004; Day & Antonakis, 2012). To address this gap in the current literature, the current study sets out to examine a possible underlying influential mechanism of Transformational Leadership in the context of engineering project teams. More specifically, the primary purpose of the current study is twofold. First, drawing on previous theoretical and empirical support for the positive relationship between Transformational Leadership and leader's Core Self-Evaluations, this study examined whether leader's Core Self-Evaluations contributes to followers' perception of Transformational Leadership. Second, drawing on various leadership theories and concepts associated with Core Self-Evaluations malleability, this study examined the relationship between Transformational Leadership and the development in followers' Core Self-Evaluations. Results provide support for the hypothesized model. Using a time-lag multi-level research approach, leader Core Self-Evaluations was found to be positively related to followers' perception of Transformational Leadership. Additionally, Transformational Leadership was also found to be positively related to increases in follower Core Self-Evaluations over time. To this end, several implications for both leadership research and practice can be drawn from the current study.

Theoretical Implications

The current study provide several theoretical implications to help advance the existing leadership literature. First, early leadership researchers posited that individual's core values and beliefs play a vital role in determining whether the individual would make for an effective leader (Bass, 1985; Burns, 1978; Weber, 1947). Self-confidence and self-efficacy, in particular, has been identified as some of the most fundamental characteristics of an effective leader (Bennis & Nanus, 1985; Bass & Riggio, 2006; Northouse, 2016). In support of these claims, results from this research revealed that leader's Core Self-Evaluations contributes positively to followers' perception of the leader's display of Transformational Leadership. Particularly, it was found that high Core Self-Evaluations leaders who perceive themselves to be worthy and capable are more likely engage in Transformational Leadership behaviors in the eyes of their followers. This research argues that self-assured leaders who are confident in themselves are likely to be perceived to be charismatic and transformational due to their lack of self-doubts. High Core Self-Evaluations leaders are also more likely to be willing to put in the effort because they believe that they have the ability to influence outcomes regardless of how difficult a situation may be. High Core Self-Evaluations leaders will tend view difficult challenges as opportunities to learn and grow. With this mindset, followers are likely to look up to these leaders as inspirations. Clearly, leaders must be confident in themselves and their abilities to be able to effectively motivate their followers. To this end, findings from the current study contribute to a better understanding of the characteristics that are likely to serve as antecedents to Transformational Leadership.

It may be worthwhile to note that the positive relationship between leader Core Self-Evaluations and followers' perception of Transformational Leadership found in this study is consistent with the results illustrated in Hu et al.'s (2012) research. That is, in a similar study

consisted of Chinese participants, Hu et al. (2012) found a positive and significant relationship between leader's Core Self-Evaluations and followers' perceptions of Transformational Leadership. Using a multi-level modeling approach, Hu et al.'s (2012) study treated leader Core Self-Evaluations and followers' perception of Transformational Leadership at the team-level and the individual-level, respectively. Compared to the model used in Hu et al.'s (2012) research, the current research is unique in that the aggregated Transformational Leadership scores were used as an independent variable to test the relationship between leader Core Self-Evaluations and followers' perception of Transformational Leadership. The decision to aggregate Transformational Leadership to the team-level in this study enable the degree of agreement in followers' perceptions of Transformational Leadership to be accounted for. Nevertheless, although the current finding is consistent with the results illustrated in Hu et al.'s (2012) study, the current study certainly contributes to the body of knowledge by providing additional support for the link between leader Core Self-Evaluations and followers' perception of Transformational Leadership.

Second, the current study contributes to a better understanding of the Core Self-Evaluations concept. While Core Self-Evaluations has been established as a key contributor to a wide variety of desirable outcomes (Chang et al., 2012), few studies have examined the malleability of Core Self-Evaluations in relation to experiences and contextual factors (for some exceptions, see Dóci & Hofmans, 2015; Luthans et al., 2007). Results obtained this research add to the current body of knowledge by demonstrating that Core Self-Evaluations does not only vary between individuals (i.e., trait Core Self-Evaluations; Judge et al., 1997) but that it can also fluctuate within individuals over time (i.e., state Core Self-Evaluations; Debusscher et al., 2016). This finding echoes recent conceptualizations of the concept of within-individual variations in personality states (Debusscher et al., 2016; Fleeson, 2012; Fleeson & Jolley, 2006; Judge et al., 2014) and is also consistent with

previous research that has shown that self-esteem, self-efficacy, locus of control, and neuroticism contain both stable and variable components. In line with the whole trait theory of personality assessment (Fleeson, 2012), for instance, findings from this research suggest that in addition to the between individual differences in Core Self-Evaluations, it may be worthwhile to also view Core Self-Evaluations as a collection of dispositional states that can vary as a function of environmental contexts and experiences. While different people will certainly differ in their baseline Core Self-Evaluations, it was found in this research that individual's Core Self-Evaluations seem to also possess state-like characteristics (Debusscher et al., 2016; Judge et al., 2014) and that it is also possible for the disposition to fluctuate over time. It is important to note here, however, that while there is evidence suggesting that individual's personality tend to shift over one's life course (e.g., Caspi, Roberts, & Shiner, 2005), the current research only focused on short-term variations in individual's Core Self-Evaluations within the context of engineering project teams. The link between short-term variations in personality states with respect to long-term developments is still unclear (Judge et al., 2014). It may be possible that sustained short-term fluctuations in Core Self-Evaluations can lead to long-term developments over a longer period. Future researchers are encouraged to examine this topic in greater detail.

Practical Implications

Results from this research also offer several practical implications that are worth mentioning. First, because Core Self-Evaluations has been shown to contribute to a variety of desirable outcomes (Chang et al., 2012), leaders should recognize that their behaviors could have an impact insofar as to help their followers develop to higher potentials. The current study suggests that leaders do their best to be good role models for their followers to try to emulate (i.e., the idealized influence component of Transformational Leadership). To be able to exert influence,

leaders should do their best to earn trust from their followers. Indeed, the idealized influence component of Transformational Leadership has been shown to be positively related to follower's trust in the leader (Braun et al., 2013; Zhu et al., 2013). Due to the positive merits of Core Self-Evaluations, the current study suggests that it may be possible for leaders to rely on acts of Transformational Leadership to aid followers to develop to higher potentials. Leaders should allow followers to experience their own success while at the same time providing coaching and mentoring support to help followers become more confident in their own competence and autonomy (Judge et al., 2014; Nübold, Muck, Maier, 2013). Acts of Transformational Leadership are participative in nature (Bass & Riggio, 2006), and the current study suggests that leaders should not only focus on the end results but also do their best to ensure that their followers develop to higher potentials along the way.

Second, the malleability concept of Core Self-Evaluations represents a central theme in the current study. Results from the current research revealed a positive link between leader Core Self-Evaluations and followers' perception of Transformational Leadership. To this end, perhaps managers and human resource practitioners may want to incorporate the concept of Core Self-Evaluations into their leadership selection and training programs. This is not to say that every individual who measures high in Core Self-Evaluations will be a transformational leader. It should be acknowledged that not every leader can be trained to be transformational (Hu et al., 2012). Nevertheless, perhaps leadership selection and training programs can still benefit from findings obtained in this research.

Limitations and Future Research

Several methodological considerations were taken into account in the development of the current research model. First, the method of data collection, which obtained information from multiple sources (i.e., leader and followers) at multiple points in time, helped reduce problems pertaining to common source and common method bias (Podsakoff et al., 2003). Second, the use of multi-level modeling approach enabled the current research to account for the inherent multi-level nature of leadership (Braun & Nieberle, 2017; Day & Antonakis, 2012; Leroy et al., 2015; Wang & Howell, 2012; Yammarino & Dansereau, 2008) and the nested structure of the data (Raudenbush & Bryk, 2002). Lastly, in examining the relationship between Transformational Leadership and changes in follower Core Self-Evaluations, a time-lag data collection approach provides stronger support for the hypothesized model (Judge et al., 2014).

As with all research, the current study has several limitations that are worth mentioning. First, the sample of undergraduate engineering students used in this research may not be entirely representative of the larger engineering population. Although it is not uncommon to find leadership research conducted using student participants (Day & Sin, 2011; Ehrhart & Klein, 2001; Nübold et al., 2013), previous researchers have expressed concerns over the effect size and generalizability of results obtained from this type of studies (Carlson, 1971; Lynch, 1982; Sears, 1986). The current study certainly acknowledges the use of student participants as a shortcoming. In response to the possible criticisms, however, it may be worthwhile to note that the majority of participants in this research were senior-level engineering students who were enrolled in the final semester of their college careers. These participants were in a transitional stage of their life as they were about to graduate and enter into the workforce. Perhaps it would be appropriate to only apply findings from this research to individuals who are in the early stages of their professional careers. Future

researchers are encouraged to adopt the current research model to examine whether the results obtained here also apply to other, more established and professional, participants.

The second limitation of this research is that the relatively small sample size at the team level ($N = 31$) may limit interpretation of the results with respect to statistical power (Maas & Hox, 2005; Scherbaum & Ferreter, 2009; Snijders, 2005). This research acknowledges this issue and recommends that its findings are interpreted with caution. It should be noted, however, that conducting a priori power analysis to determine an appropriate sample size for multi-level research can be quite complex (Scherbaum & Ferreter, 2009). Particularly, power analysis in multi-level research requires researchers to estimate appropriate variances at both the team and individual levels which cannot be accurately determined prior to data collection. Without prior knowledge of the variance estimates expected in the variables of interest, an appropriate sample size needed cannot be accurately estimated. In fact, Scherbaum and Ferreter (2009) argued that "literature that has been developed for power in single-level designs cannot be directly translated to multi-level" (p.347). While Kreft's (1996) '30/30 rule' suggested a rule of thumb that multi-level researchers should collect at least 30 units at the team level and 30 units at the individual level (i.e., bringing a total sample size to 900), Scherbaum and Ferreter (2009) argued that "the 30/30 rule may lead to high levels of power but is probably excessive for most organizational research" (p. 354). Rough estimates for determining appropriate sample sizes in multi-level research have been provided by previous researchers. Based on results obtained from a simulation study by Maas and Hox (2005), for instance, a sample size of 30 units at the team level was suggested to be sufficient enough to provide meaningful information for fixed effects estimates. The current research, with a sample size of 31 at the team-level, is consistent with this proposition. Again, the issue of sample size is

acknowledged here. Future research that wishes to replicate findings from the current study should be conducted with this sample size consideration in mind.

The third limitation of this research concerns how data for Core Self-Evaluations were collected. Core Self-Evaluations was originally conceptualized to be a broad and general dispositional construct that represents the fundamental appraisals individuals make about themselves and the environment (Judge et al., 1997). This research, however, was predominately focused on Core Self-Evaluations towards a very specific context of the participants' work role (i.e., engineering projects). The decision to focus on individual's Core Self-Evaluations towards a particular context could raise doubts about the validity of the studied variable (Chang et al., 2012). Nevertheless, perhaps organizational and management research could still benefit from a better understanding of context-specific Core Self-Evaluations. It is possible, for instance, for an individual to have high regards for one's own capabilities towards specific contexts but not towards other aspects of one's life. A software engineer who sees oneself to be extremely capable as a programmer may not necessarily feel the same way towards other aspects of his or her life. Indeed, a growing literature on frame-of-reference effects in personality assessment has demonstrated the predictive abilities of context-specific personality that go above and beyond that of non-contextual personality traits in the work setting (Bing, Whanger, Davison, Van Hook, 2004; Bowling, Wang, Tand, & Kennedy, 2010; Schmit, Ryan, Stierwalt, & Powell, 1995). In fact, Bowling et al. (2010) found that work-specific Core Self-Evaluations demonstrated incremental validity in predicting work-related outcomes after the effects of general Core Self-Evaluations was controlled for. Results from the current research provide valuable insights into the malleability of context-specific Core Self-Evaluations. It would be interesting for future researchers to examine

whether fluctuations in context-specific Core Self-Evaluations also spill out to a more general and global Core Self-Evaluations concept.

While on the topic of data collection, the fourth limitation to this research concerns how the second hypothesis was formulated and tested. While a time-lag model of data collection presents a number of advantages over cross-sectional research designs (Willet, 1988), the 'Change in Follower Core Self-Evaluations' (i.e., ΔCSE) scores used in this research were computed based on data that were only obtained at two time points and over a relatively short time span. With only two data points for each follower, the analysis would not be able to discern whether the within-individual variations in follower's Core Self-Evaluations is either linear or nonlinear. Moreover, the second hypothesis was certainly developed based on the implications that Transformational Leadership would influence increases in follower Core Self-Evaluations over time. The method of data collection adopted in this research as well as the methodological approach for analysis of the data prevent any confidence of inference of causality. Future researchers are encouraged to seek other approaches to examine the concept of within-individual variations in Core Self-Evaluations as well as to adopt a method of data collection that rely on a longer time period.

Lastly, it should be acknowledged that the current study did not take into account other factors that could potentially contribute to a more complete research model. For instance, it may be possible that follower empowerment moderates the positive relationship between Transformational Leadership and enhancements in followers' Core Self-Evaluations. Perhaps increases in followers' Core Self-Evaluations in relation to Transformational Leadership is mediated by performance and satisfaction. The effects of team dynamics and developmental processes (Tuckman, 1965) were also not taken into account to the fullest extent in this research. It may be possible, for instance, that the display of Transformational Leadership and fluctuations

in follower's Core Self-Evaluations are influenced by the different stages of team development and dynamics (Tuckman, 1965). Omitting related variables could potentially lead to problems pertaining to endogeneity effects (Antonakis, Bendahan, Jacquart, & Lalive, 2010; Hu et al., 2012). To this end, future researchers may want to incorporate additional variables in their study. It would also be interesting to see how each of the four components of Core Self-Evaluations responds to Transformational Leadership, or how each component of Transformational Leadership influences the development in Core Self-Evaluations. Future researchers are also encouraged to further investigate whether short-term changes in Core Self-Evaluations lead to long-term changes overall. Clearly, research that extends from the current study could potentially provide unprecedented value to both the Transformational Leadership and Core Self-Evaluations literature.

Conclusion

The theory of Transformational Leadership has received substantial consideration since its inception three decades ago. Yet, despite the enormous support, researchers have only started to pay attention to the longitudinal mechanisms and processes underlying the positive impacts of Transformational Leadership. This study makes several contributions to address this gap in the current leadership literature. First, by integrating the theory of Transformational Leadership and the concept of Core Self-Evaluations, leader Core Self-Evaluations was found to be positively related to followers' perception of Transformational Leadership. Results from this research also extends upon recent studies of within-individual variations in personality states. Particularly, Transformational Leadership was found to be positively related to increases in follower's Core Self-Evaluations over time. These findings present interesting avenues for emerging areas of leadership research. It is hoped that this dissertation can inspire and encourage future researchers to further contribute to the field.

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APPENDICES

APPENDIX A: INFORMED CONSENT FOR TEAM SURVEY

Introductory Message for Participants with Agreement to Participate

(**Note:** This form was used as informed consent, as approved by IRB, at all three waves of data collection)

Dear Participant,

We are requesting for your participation in a research study to help us better understand the role of leadership in project teams. Your participation will only involve filling out a brief survey at several time points throughout your course project. Note that there will be no risk associated with your participation in this research. No personal identifiers will be reported as part of the research and you are free to withdraw from this study at any time. After completing this survey, your data will be coded and stored securely and will be accessible only by the principal investigators of this research study.

If you have any questions or would like to obtain additional information about this research, please feel free to contact the co-principal investigator, Nathapon Siangchokyoo, by email at nsiangch@odu.edu, or in person at the Graduate Assistant Lab, Engineering Systems Building, Old Dominion University, Norfolk, VA 23529.

For questions regarding the Institutional Review Board and the current research protocol, please contact the Old Dominion University Engineering college committee, Michel Audette, Ph.D., at 757-683-6940.

Once you have completed the questionnaire, please return the survey along with this cover letter to your course instructor.

I am truly grateful for your participation and contributions to this research study.

Sincerely,

Nathapon Siangchokyoo,
Ph.D. Candidate
Engineering Management and Systems Engineering Department
Old Dominion University
Graduate Assistant Lab – Engineering Systems Building
Norfolk, VA 23529
Phone: 757-550-4189
Email: nsiangch@odu.edu

APPENDIX B: IRB APPROVAL FORM

(**Note:** Please contact researcher for specific research procedures submitted to the IRB)

OFFICE OF THE VICE PRESIDENT FOR RESEARCH

Physical Address
4111 Monarch Way, Suite 203
Norfolk, Virginia 23508
Mailing Address
Office of Research
1 Old Dominion University
Norfolk, Virginia 23529
Phone(757) 683-3460
Fax(757) 683-5902

DATE:	August 19, 2016
TO:	Charles Daniels, PhD
FROM:	Old Dominion University Engineering Human Subjects Review Committee
PROJECT TITLE:	[924366-3] A Longitudinal Study of Transformational Leadership in 'Knowledge-Based' Engineering Teams: A Multi-Level Perspective.
REFERENCE #:	
SUBMISSION TYPE:	Amendment/Modification
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	
REVIEW CATEGORY:	Exemption category # *6.2*

Thank you for your submission of Amendment/Modification materials for this project. The Old Dominion University Engineering Human Subjects Review Committee has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact Stacie Ringleb at 757-683-6363 or sringleb@odu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Old Dominion University Engineering Human Subjects Review Committee's records.

APPENDIX C: MLQ-5X USAGE APPROVAL FORM

mind garden

www.mindgarden.com

To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material for his/her research:

Instrument: *Multifactor Leadership Questionnaire*

Authors: *Bruce Avolio and Bernard Bass*

Copyright: *1995 by Bruce Avolio and Bernard Bass*

Five sample items from this instrument may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any published material.

Sincerely,

Robert Most
Mind Garden, Inc.
www.mindgarden.com

APPENDIX D: MLQ-5X DISSERTATION USE

For Dissertation and Thesis Appendices:

You cannot include an entire instrument in your thesis or dissertation, however you can use up to five sample items. Academic committees understand the requirements of copyright and are satisfied with sample items for appendices and tables. For customers needing permission to reproduce five sample items in a proposal, thesis, or dissertation the following page includes the permission form and reference information needed to satisfy the requirements of an academic committee.

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APPENDIX E: MLQ-5X SAMPLE

Multifactor Leadership Questionnaire

Developed by Bruce Avolio & Bernard Bass (1995)

This questionnaire is to describe the leadership style of your formal team leader as you perceive it. Using the rating scale shown below, please describe how frequent each of the following statements fits the characteristics of your team leader. If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.

1	2	3	4	5
Not at All	**Once in a While**	**Sometimes**	**Fairly Often**	**Frequently, if not Always**

The Leader/Project Manager of My Team...

Item No.	Question	Your Response				
1	Re-examines critical assumptions to question whether they are appropriate	1	2	3	4	5
2	Talks about his/her most important values and beliefs	1	2	3	4	5
3	Seeks differing perspectives when solving problems	1	2	3	4	5
4	Talks optimistically about the future	1	2	3	4	5
5	Instills pride in me for being associated with him/her	1	2	3	4	5

***Note:** Mind Garden, Inc. permits a maximum of five items from the MLQ-5X to be published in a dissertation (see Appendix D)

APPENDIX F: CORE SELF-EVALUATIONS SCALE

Core Self-Evaluations Scale

Adapted from Judge, Erez, Bono, &Thoreson (2003)

Below are several statements with which you may agree or disagree. Using the response scale below, please indicate your level of agreement with each statement (i.e. as it relates to the course project with which you have been assigned) by checking the appropriate box shown on the right-hand column next to each item.

1	2	3	4	5
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**

Item No.	Question	Your Response				
1	I am confident I get the success I deserve	1	2	3	4	5
2	Sometimes I feel depressed (r)	1	2	3	4	5
3	When I try, I generally succeed	1	2	3	4	5
4	Sometimes when I fail I feel worthless (r)	1	2	3	4	5
5	I complete tasks successfully	1	2	3	4	5
6	Sometimes, I do not feel in control of my work (r)	1	2	3	4	5
7	Overall, I am satisfied with myself	1	2	3	4	5
8	I am filled with doubts about my competence (r)	1	2	3	4	5
9	I determine what will happen	1	2	3	4	5
10	I do not feel in control of my success in my career (r)	1	2	3	4	5
11	I am capable of coping with most of my problems	1	2	3	4	5
12	There are times when things look pretty bleak and hopeless to me (r)	1	2	3	4	5

***Note:** ‘(r)’ denotes reverse-scored and was removed in the distributed surveys.

APPENDIX G: LEADERSHIP EMERGENCE AND EXTERNAL INFLUENCE

Team-Based Research: Team Member Survey
Leadership Emergence and External Influence

Adapted from Brussow, J.A. (2013)

The following questions are used to describe the leadership influence of those who are not in your team's designated leadership position. Using the rating scale shown below, please indicate your degree of agreement towards each of the two statements. If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.

1	2	3	4	5
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**

Question	Your Response				
In addition to the team's formal leader (e.g. the Project Manager), I can identify at least one other team member who acted as an informal team leader.	1	2	3	4	5
Aside from the members of my team, I can identify at least one individual from outside of the team (e.g. Course Instructor, Team Mentor) who acted as a leader of this project team.	1	2	3	4	5

APPENDIX H: RELIABILITY ESTIMATES – CSE (TIME 1)

(**Note:** Leaders' and Followers' Core Self-Evaluations scores were measured at this time point)

Case Processing Summary

		N	%
Cases	Valid	143	100.0
	Excluded[a]	0	.0
	Total	143	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.869	.876	12

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.888	3.147	4.427	1.280	1.407	.186	12
Item Variances	.771	.336	1.366	1.030	4.068	.123	12

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
46.6503	45.454	6.74198	12

APPENDIX I: RELIABILITY ESTIMATES – CSE (TIME 2)

(**Note:** Only Followers' Core Self-Evaluations scores were measured at this time point)

Case Processing Summary

		N	%
Cases	Valid	112	100.0
	Excluded[a]	0	.0
	Total	112	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.885	.889	12

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.938	3.134	4.438	1.304	1.416	.149	12
Item Variances	.751	.320	1.202	.882	3.752	.094	12

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
47.2589	47.653	6.90312	12

APPENDIX J: RELIABILITY ESTIMATES – TFL

Case Processing Summary

		N	%
Cases	Valid	112	100.0
	Excluded[a]	0	.0
	Total	112	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.950	.950	20

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.831	2.973	4.295	1.321	1.444	.108	20
Item Variances	.957	.747	1.188	.441	1.590	.013	20

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
76.6161	196.076	14.00273	20

APPENDIX K: AGGREGATION STATISTICS – TFL

(**Note:** Team size excludes team leader)

	$r_{WG(J).uniform}$		$r_{WG(J).measure\text{-}specific}$							
Measure	Mean	SD	Shape	S^2_E	Mean	SD	F ratio	p-value	ICC(1)	ICC(2)
Transformational Leadership	0.96	0.04	Slight skew	1.34	0.86	0.25	2.86	0.000	0.34	0.65

		IRA (rWG-based) estimates by Team							
Team ID	Team size	Uniform	Slight skew	Moderate skew	Heavy skew	Triangular	Normal	r^*_{WG}	Custom null
1	6	0.96	0.89	0.00	0.00	0.88	0.62	0.76	
2	7	0.95	0.88	0.00	0.00	0.87	0.51	0.75	
3	7	0.98	0.95	0.87	0.00	0.95	0.92	0.83	
4	4	0.93	0.74	0.00	0.00	0.71	0.00	0.71	
5	5	0.81	0.00	0.00	0.00	0.00	0.00	0.59	
6	4	0.98	0.97	0.95	0.00	0.97	0.96	0.88	
7	4	0.97	0.94	0.82	0.00	0.94	0.89	0.82	
8	3	0.97	0.94	0.80	0.00	0.94	0.89	0.81	
9	3	0.99	0.97	0.95	0.00	0.97	0.96	0.88	
10	4	0.98	0.97	0.94	0.00	0.97	0.95	0.87	
11	4	0.98	0.95	0.88	0.00	0.95	0.92	0.83	
12	4	0.96	0.92	0.43	0.00	0.91	0.80	0.78	
13	3	0.96	0.90	0.00	0.00	0.90	0.73	0.77	
14	3	0.96	0.92	0.54	0.00	0.92	0.82	0.79	
15	4	0.97	0.92	0.62	0.00	0.92	0.83	0.79	
16	3	0.92	0.47	0.00	0.00	0.36	0.00	0.68	
17	2	0.91	0.00	0.00	0.00	0.00	0.00	0.66	
18	2	0.95	0.85	0.00	0.00	0.84	0.00	0.74	
19	2	0.98	0.96	0.91	0.00	0.96	0.94	0.85	
20	2	0.98	0.97	0.93	0.00	0.97	0.95	0.87	
21	2	0.98	0.97	0.95	0.00	0.97	0.96	0.88	
22	2	0.98	0.97	0.94	0.00	0.97	0.96	0.88	
23	3	0.98	0.95	0.88	0.00	0.95	0.92	0.83	
24	2	0.98	0.96	0.92	0.00	0.96	0.94	0.86	
25	3	0.98	0.96	0.92	0.00	0.96	0.94	0.85	
26	4	0.99	0.98	0.97	0.79	0.98	0.97	0.91	
27	5	0.98	0.97	0.93	0.00	0.96	0.95	0.86	
28	4	0.98	0.96	0.91	0.00	0.96	0.94	0.85	
29	4	0.99	0.98	0.97	0.82	0.98	0.97	0.91	
30	3	0.99	0.98	0.96	0.53	0.98	0.97	0.90	
31	4	0.99	0.98	0.96	0.41	0.98	0.97	0.89	

APPENDIX L: HYPOTHESIS ONE MULTIPLE OLS REGRESSION OUTPUT

Descriptive Statistics

	Mean	Std. Deviation	N
TFL	3.8029	.48577	31
Age	24.5000	5.94278	31
Gender	1.2581	.44480	31
Leader_CSE	3.9194	.56662	31

Correlations

		TFL	Age	Gender	Leader_CSE
Pearson Correlation	TFL	1.000	.072	.048	.384
	Age	.072	1.000	.221	.123
	Gender	.048	.221	1.000	.096
	Leader_CSE	.384	.123	.096	1.000
Sig. (1-tailed)	TFL	.	.350	.400	.016
	Age	.350	.	.116	.254
	Gender	.400	.116	.	.303
	Leader_CSE	.016	.254	.303	.
N	TFL	31	31	31	31
	Age	31	31	31	31
	Gender	31	31	31	31
	Leader_CSE	31	31	31	31

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Gender, Age[b]	.	Enter
2	Leader_CSE[b]	.	Enter

a. Dependent Variable: TFL

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.079[a]	.006	-.065	.50125	.006	.088	2	28	.916	
2	.385[b]	.148	.053	.47263	.142	4.494	1	27	.043	1.638

a. Predictors: (Constant), Gender, Age

b. Predictors: (Constant), Gender, Age, Leader_CSE

c. Dependent Variable: TFL

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.044	2	.022	.088	.916[b]
	Residual	7.035	28	.251		
	Total	7.079	30			
2	Regression	1.048	3	.349	1.564	.221[c]
	Residual	6.031	27	.223		
	Total	7.079	30			

a. Dependent Variable: TFL

b. Predictors: (Constant), Gender, Age

c. Predictors: (Constant), Gender, Age, Leader_CSE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	3.628	.428		8.483	.000	2.752	4.504		
	Age	.005	.016	.065	.335	.740	-.027	.038	.951	1.051
	Gender	.036	.211	.033	.173	.864	-.396	.468	.951	1.051
2	(Constant)	2.469	.679		3.635	.001	1.075	3.863		
	Age	.002	.015	.024	.130	.898	-.029	.033	.941	1.063
	Gender	.006	.199	.006	.031	.975	-.403	.415	.946	1.057
	Leader_CSE	.326	.154	.380	2.120	.043	.010	.642	.980	1.021

a. Dependent Variable: TFL

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Leader_CSE	.380[b]	2.120	.043	.378	.980	1.021	.941

a. Dependent Variable: TFL

b. Predictors in the Model: (Constant), Gender, Age

Coefficient Correlations[a]

Model			Gender	Age	Leader_CSE
1	Correlations	Gender	1.000	-.221	
		Age	-.221	1.000	
	Covariances	Gender	.044	-.001	
		Age	-.001	.000	
2	Correlations	Gender	1.000	-.211	-.071
		Age	-.211	1.000	-.105
		Leader_CSE	-.071	-.105	1.000
	Covariances	Gender	.040	-.001	-.002
		Age	-.001	.000	.000
		Leader_CSE	-.002	.000	.024

a. Dependent Variable: TFL

Collinearity Diagnostics[a]

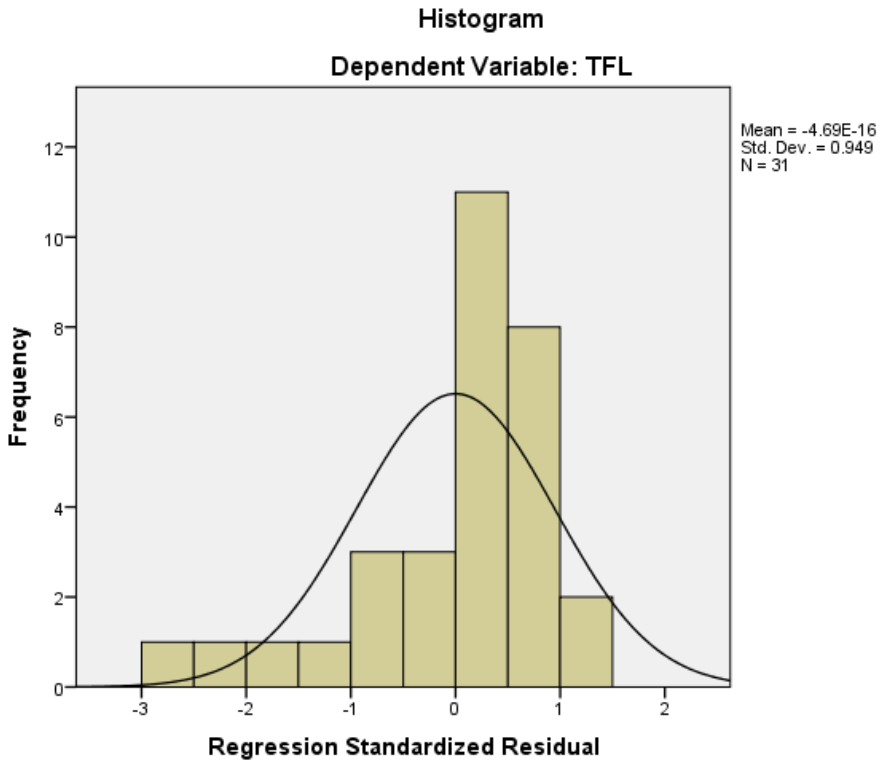
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	Age	Gender	Leader_CSE
1	1	2.902	1.000	.01	.01	.01	
	2	.071	6.375	.06	.17	.95	
	3	.027	10.427	.93	.83	.04	
2	1	3.875	1.000	.00	.00	.01	.00
	2	.078	7.035	.01	.05	.99	.02
	3	.037	10.203	.04	.90	.00	.12
	4	.010	20.183	.94	.04	.01	.85

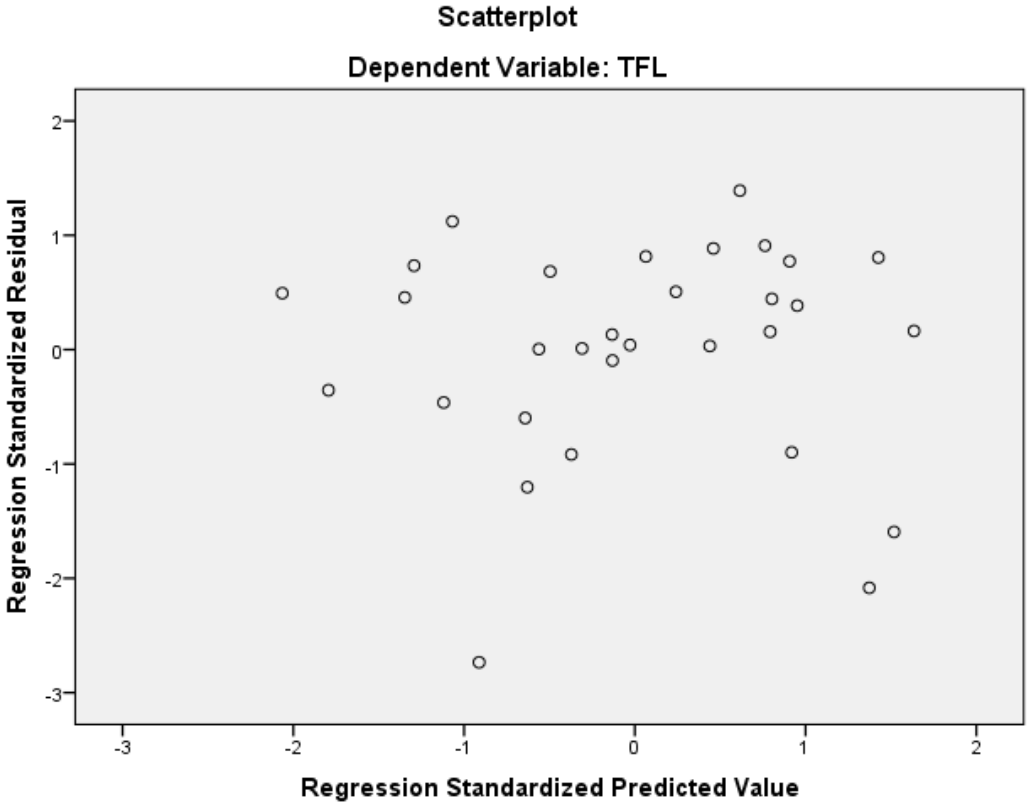
a. Dependent Variable: TFL

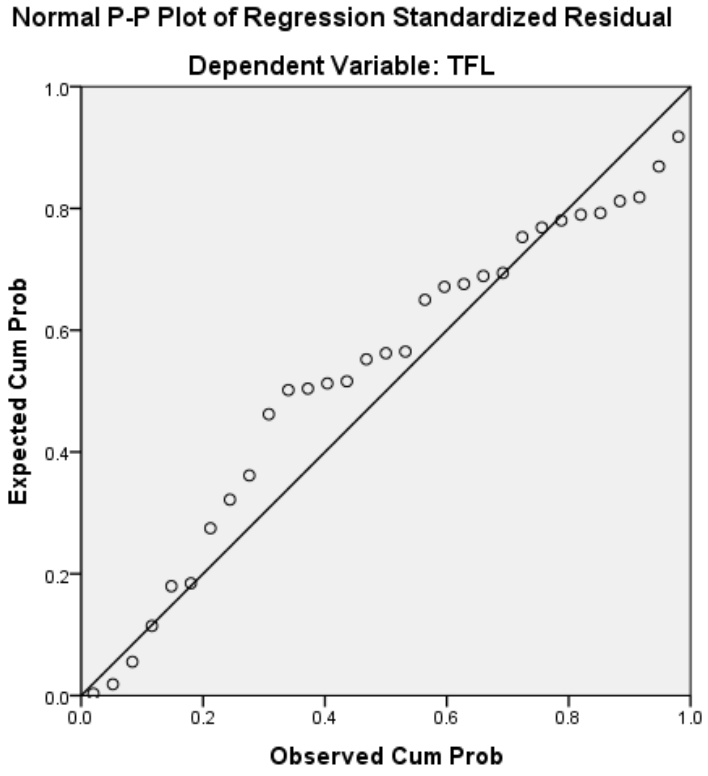
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.4170	4.1084	3.8029	.18691	31
Std. Predicted Value	-2.065	1.635	.000	1.000	31
Standard Error of Predicted Value	.099	.272	.164	.045	31
Adjusted Predicted Value	3.3660	4.2555	3.8212	.21589	31
Residual	-1.29241	.65713	.00000	.44838	31
Std. Residual	-2.735	1.390	.000	.949	31
Stud. Residual	-3.140	1.450	-.018	1.047	31
Deleted Residual	-1.70425	.71507	-.01831	.54792	31
Stud. Deleted Residual	-3.868	1.482	-.051	1.144	31
Mahal. Distance	.357	8.978	2.903	2.138	31
Cook's Distance	.000	.786	.060	.148	31
Centered Leverage Value	.012	.299	.097	.071	31

a. Dependent Variable: TFL




Scatterplot
Dependent Variable: TFL
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: TFL
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

APPENDIX M: HYPOTHESIS TWO OUTPUT – DESCRIPTIVE STATISTICS

(**Note:** Location of the MDM template file removed for privacy)

LEVEL-1 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
AGE	109	23.55	5.53	18.00	49.00
GENDER	112	1.15	0.36	1.00	2.00
EMERG_CT	112	4.47	0.77	1.00	5.00
OUTSIDE	112	3.29	1.49	1.00	5.00
CSE1_NOR	112	3.88	0.56	2.08	5.00
TFL_NORM	112	3.83	0.70	1.05	4.95
CSE2_NOR	112	3.94	0.58	1.92	5.00
CSE_CHAN	112	0.71	4.03	-11.00	11.00
DELTACSE	112	0.06	0.34	-0.92	0.92

LEVEL-2 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
TFL	31	3.80	0.49	2.34	4.58

MDM template:
MDM file name: Hypothesis_Two
Date: Jul 30, 2017
Time: 17:02:39

APPENDIX N: HYPOTHESIS TWO OUTPUT – UNCONDITIONAL MODEL

(**Note:** Location of the MDM command and output removed for privacy)

Program: HLM 7 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2010
techsupport@ssicentral.com
www.ssicentral.com

Module: HLM2S.EXE (7.01.21202.1001)
Date: 30 July 2017, Sunday
Time: 17:15:54

Specifications for this HLM2 run

Problem Title: no title

The data source for this run = Hypothesis_Two
The command file for this run =
Output file name =

The maximum number of level-1 units = 112
The maximum number of level-2 units = 31
The maximum number of iterations = 100

Method of estimation: full maximum likelihood

The outcome variable is DELTACSE

Summary of the model specified

Level-1 Model

$$DELTACSE_{ij} = \beta_{0j} + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

Mixed Model

$$DELTACSE_{ij} = \gamma_{00} + u_{0j} + r_{ij}$$

Initial results

Level-1 OLS Regressions

Level-2 Unit	INTRCPT1
1	-0.09722
2	-0.17857
3	0.27381
4	-0.10417
5	-0.11667
6	0.06250
7	0.02083
8	0.19444
9	0.05556
10	0.12500
11	0.47917
12	-0.16667
13	0.30556
14	-0.36111
15	0.39583
16	-0.05556
17	0.33333
18	0.08333
19	-0.08333
20	0.25000
21	0.08333
22	-0.08333
23	0.11111
24	-0.33333
25	-0.02778
26	0.10417
27	0.01667
28	0.12500
29	0.27083
30	-0.02778
31	0.18750

The average OLS level-1 coefficient for INTRCPT1 = 0.05943

Least Squares Estimates

$\sigma^2 = 0.11203$

Least-squares estimates of fixed effects

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.059524	0.031627	1.882	111	0.062

Least-squares estimates of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.059524	0.037447	1.590	111	0.115

The least-squares likelihood value = -3.633891E+001
Deviance = 72.67782
Number of estimated parameters = 2

Starting Values

$\sigma^2_{(0)} = 0.10223$

$\tau_{(0)}$
INTRCPT1,β_0 0.00632

Estimation of fixed effects
(Based on starting values of covariance components)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.060215	0.033748	1.784	30	0.084

The value of the log-likelihood function at iteration 1 = -3.552832E+001
The value of the log-likelihood function at iteration 2 = -3.550976E+001
The value of the log-likelihood function at iteration 3 = -3.549853E+001
The value of the log-likelihood function at iteration 4 = -3.548774E+001
The value of the log-likelihood function at iteration 5 = -3.547737E+001
. . .
The value of the log-likelihood function at iteration 13 = -3.535712E+001
The value of the log-likelihood function at iteration 14 = -3.535712E+001
The value of the log-likelihood function at iteration 15 = -3.535711E+001
The value of the log-likelihood function at iteration 16 = -3.535709E+001

Final Results - Iteration 17

Iterations stopped due to small change in likelihood function

$\sigma^2 = 0.10008$

Standard error of $\sigma^2 = 0.01555$

τ
INTRCPT1,β_0 0.01161

Standard error of τ
INTRCPT1,β_0 0.01075

Random level-1 coefficient	Reliability estimate
INTRCPT1,β_0	0.287

The value of the log-likelihood function at iteration 17 = -3.535709E+001

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.060463	0.036096	1.675	30	0.104

Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.060463	0.036091	1.675	30	0.104

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.10775	0.01161	30	42.63455	0.063
level-1, r	0.31635	0.10008			

Statistics for the current model

Deviance = 70.714181
Number of estimated parameters = 3

tauvc.dat, containing tau and the variance-covariance matrix of tauhas been created.
gamvc.dat, containing the variance-covariance matrix of gamma has been created.
gamvcr.dat, containing the robust variance-covariance matrix of gamma has been created.
The above files have been created with a (nE15.7,1X) format.

APPENDIX O: HYPOTHESIS TWO OUTPUT – PRELIMINARY MODEL

(**Note:** Location of the MDM command and output files removed for privacy)

Program: HLM 7 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2010
techsupport@ssicentral.com
www.ssicentral.com

Module: HLM2S.EXE (7.01.21202.1001)
Date: 30 July 2017, Sunday
Time: 17:16:47

Specifications for this HLM2 run

Problem Title: no title

The data source for this run = Hypothesis_Two
The command file for this run =
Output file name =

The maximum number of level-1 units = 112
The maximum number of level-2 units = 31
The maximum number of iterations = 100

Method of estimation: full maximum likelihood

The outcome variable is DELTACSE

Summary of the model specified

Level-1 Model

$$DELTACSE_{ij} = \beta_{0j} + \beta_{1j}*(AGE_{ij}) + \beta_{2j}*(GENDER_{ij}) + \beta_{3j}*(EMERG\_CT_{ij}) + \beta_{4j}*(OUTSIDE_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$
$$\beta_{4j} = \gamma_{40}$$

AGE GENDER EMERG_CT OUTSIDE have been centered around the grand mean.

Mixed Model

$$DELTACSE_{ij} = \gamma_{00} + \gamma_{10}*AGE_{ij} + \gamma_{20}*GENDER_{ij} + \gamma_{30}*EMERG\_CT_{ij} + \gamma_{40}*OUTSIDE_{ij} + u_{0j} + r_{ij}$$

Run-time deletion has reduced the number of level-1 records to 109

Initial results

Level-1 OLS Regressions

Level-2 Unit	INTRCPT1
1	-0.10091
2	-0.19136
3	0.28436
4	-0.12869
5	-0.12535
6	0.03594
7	-0.00491
8	0.22950
9	0.06009
10	0.15474
11	0.47288
12	-0.18723
13	0.36918
14	-0.37007
15	0.37232
16	-0.04036
17	-0.02251
18	0.03635
19	0.22781
20	0.30654
21	0.07082
22	-0.13735
23	0.07276
24	-0.21637
25	0.02051
26	0.10028
27	0.01261
28	0.08749
29	0.27054
30	0.05165
31	0.18585

The average OLS level-1 coefficient for INTRCPT1 = 0.06120

Least Squares Estimates

$\sigma^2 = 0.10672$

Least-squares estimates of fixed effects

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.060083	0.031297	1.920	104	0.058
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.001106	0.005908	0.187	104	0.852
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.131524	0.088419	-1.488	104	0.140
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	-0.001891	0.041918	-0.045	104	0.964
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011798	0.021232	-0.556	104	0.580

Least-squares estimates of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.060083	0.038547	1.559	104	0.122
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.001106	0.007380	0.150	104	0.881
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.131524	0.085879	-1.532	104	0.129
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	-0.001891	0.034696	-0.054	104	0.957
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011798	0.021552	-0.547	104	0.585

The least-squares likelihood value = -3.271583E+001
Deviance = 65.43165
Number of estimated parameters = 6

Starting Values

$\sigma^2_{(0)} = 0.09509$

$\tau_{(0)}$

INTRCPT1,β_0 0.00391

Estimation of fixed effects
(Based on starting values of covariance components)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.060614	0.031886	1.901	30	0.067
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.001910	0.005795	0.330	74	0.743
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.139547	0.085255	-1.637	74	0.106
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.005174	0.040349	0.128	74	0.898
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011460	0.020754	-0.552	74	0.582

The value of the log-likelihood function at iteration 1 = -3.102487E+001
The value of the log-likelihood function at iteration 2 = -3.088941E+001
The value of the log-likelihood function at iteration 3 = -3.085667E+001
The value of the log-likelihood function at iteration 4 = -3.082271E+001
The value of the log-likelihood function at iteration 5 = -3.078731E+001
. . .
The value of the log-likelihood function at iteration 7 = -2.992385E+001
The value of the log-likelihood function at iteration 8 = -2.992277E+001
The value of the log-likelihood function at iteration 9 = -2.992275E+001
The value of the log-likelihood function at iteration 10 = -2.992275E+001

Final Results - Iteration 11

Iterations stopped due to small change in likelihood function

$\sigma^2 = 0.08925$

Standard error of $\sigma^2 = 0.01413$

τ
INTRCPT1,β_0 0.01733

Standard error of τ
INTRCPT1,β_0 0.01161

Random level-1 coefficient	Reliability estimate
INTRCPT1,β_0	0.390

The value of the log-likelihood function at iteration 11 = -2.992275E+001

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.061884	0.037873	1.634	30	0.113
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.004067	0.006140	0.662	74	0.510
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.155931	0.086976	-1.793	74	0.077
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.019733	0.040930	0.482	74	0.631
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011161	0.021901	-0.510	74	0.612

Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	0.061884	0.037218	1.663	30	0.107
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.004067	0.007674	0.530	74	0.598
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.155931	0.088702	-1.758	74	0.083
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.019733	0.034631	0.570	74	0.571
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011161	0.021004	-0.531	74	0.597

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.13164	0.01733	30	50.80206	0.010
level-1, r	0.29875	0.08925			

Statistics for the current model

Deviance = 59.845495
Number of estimated parameters = 7

tauvc.dat, containing tau and the variance-covariance matrix of tauhas been created.
gamvc.dat, containing the variance-covariance matrix of gamma has been created.
gamvcr.dat, containing the robust variance-covariance matrix of gamma has been created.
The above files have been created with a (nE15.7,1X) format.

APPENDIX P: HYPOTHESIS TWO OUTPUT – HYPOTHESIZED MODEL

(**Note:** Location of the MDM command and output files removed for privacy)

Program: HLM 7 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2010
techsupport@ssicentral.com
www.ssicentral.com

Module: HLM2S.EXE (7.01.21202.1001)
Date: 30 July 2017, Sunday
Time: 17:17:24

Specifications for this HLM2 run

Problem Title: no title

The data source for this run = Hypothesis_Two
The command file for this run =
Output file name =

The maximum number of level-1 units = 112
The maximum number of level-2 units = 31
The maximum number of iterations = 100

Method of estimation: full maximum likelihood

The outcome variable is DELTACSE

Summary of the model specified

Level-1 Model

$$DELTACSE_{ij} = \beta_{0j} + \beta_{1j}*(AGE_{ij}) + \beta_{2j}*(GENDER_{ij}) + \beta_{3j}*(EMERG\_CT_{ij}) + \beta_{4j}*(OUTSIDE_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(TFL_j) + u_{0j}$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$
$$\beta_{4j} = \gamma_{40}$$

AGE GENDER EMERG_CT OUTSIDE have been centered around the grand mean.

Mixed Model

$$DELTACSE_{ij} = \gamma_{00} + \gamma_{01}*TFL_j + \gamma_{10}*AGE_{ij} + \gamma_{20}*GENDER_{ij} + \gamma_{30}*EMERG\_CT_{ij} + \gamma_{40}*OUTSIDE_{ij} + u_{0j} + r_{ij}$$

Run-time deletion has reduced the number of level-1 records to 109

Initial results

Level-1 OLS Regressions

Level-2 Unit	INTRCPT1
1	-0.10868
2	-0.18285
3	0.29598
4	-0.11572
5	-0.13009
6	0.04822
7	-0.00615
8	0.24017
9	0.06210
10	0.14481
11	0.46044
12	-0.20124
13	0.36008
14	-0.38836
15	0.35845
16	-0.04175
17	-0.02452
18	0.03259
19	0.22991
20	0.30683
21	0.05456
22	-0.12300
23	0.09592
24	-0.20846
25	0.01079
26	0.10061
27	0.01127
28	0.09078
29	0.26723
30	0.06366
31	0.18522

The average OLS level-1 coefficient for INTRCPT1 = 0.06093

Least Squares Estimates

$\sigma^2 = 0.10165$

Least-squares estimates of fixed effects

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.524500	0.252719	-2.075	103	0.040
TFL, γ_{01}	0.151989	0.065224	2.330	103	0.022
For AGE slope, β_1					
INTRCPT2, γ_{10}	-0.001364	0.005863	-0.233	103	0.816
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.148710	0.086611	-1.717	103	0.089
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.007151	0.041095	0.174	103	0.862
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011244	0.020723	-0.543	103	0.589

Least-squares estimates of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.524500	0.272887	-1.922	103	0.057
TFL, γ_{01}	0.151989	0.071665	2.121	103	0.036
For AGE slope, β_1					
INTRCPT2, γ_{10}	-0.001364	0.007006	-0.195	103	0.846
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.148710	0.080517	-1.847	103	0.068
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.007151	0.037733	0.190	103	0.850
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011244	0.021527	-0.522	103	0.603

The least-squares likelihood value = -3.006623E+001
Deviance = 60.13245
Number of estimated parameters = 7

Starting Values

$\sigma^2_{(0)} = 0.09559$

$\tau_{(0)}$
INTRCPT1,β_0 -0.00221

New $\tau_{(0)}$
INTRCPT1,β_0 0.00623

Estimation of fixed effects
(Based on starting values of covariance components)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.524615	0.272026	-1.929	29	0.064
TFL, γ_{01}	0.152581	0.070360	2.169	29	0.038
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.000251	0.005996	0.042	74	0.967
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.157029	0.086616	-1.813	74	0.074
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.015773	0.040982	0.385	74	0.701
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011290	0.021172	-0.533	74	0.595

The value of the log-likelihood function at iteration 1 = -2.829881E+001
The value of the log-likelihood function at iteration 2 = -2.819169E+001
The value of the log-likelihood function at iteration 3 = -2.817403E+001
The value of the log-likelihood function at iteration 4 = -2.815758E+001
The value of the log-likelihood function at iteration 5 = -2.814168E+001
. . .
The value of the log-likelihood function at iteration 9 = -2.796439E+001
The value of the log-likelihood function at iteration 10 = -2.796435E+001
The value of the log-likelihood function at iteration 11 = -2.796420E+001
The value of the log-likelihood function at iteration 12 = -2.796416E+001

Final Results - Iteration 13

Iterations stopped due to small change in likelihood function

$\sigma^2 = 0.08901$

Standard error of $\sigma^2 = 0.01406$

τ
INTRCPT1,β_0 0.01242

Standard error of τ
INTRCPT1,β_0 0.01029

Random level-1 coefficient	Reliability estimate
INTRCPT1, β_0	0.318

The value of the log-likelihood function at iteration 13 = -2.796416E+001

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.523710	0.288858	-1.813	29	0.080
TFL, γ_{01}	0.152751	0.074824	2.041	29	0.050
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.001645	0.006040	0.272	74	0.786
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.162940	0.085748	-1.900	74	0.061
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.021886	0.040449	0.541	74	0.590
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011443	0.021335	-0.536	74	0.593

Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.523710	0.272103	-1.925	29	0.064
TFL, γ_{01}	0.152751	0.070739	2.159	29	0.039
For AGE slope, β_1					
INTRCPT2, γ_{10}	0.001645	0.007413	0.222	74	0.825
For GENDER slope, β_2					
INTRCPT2, γ_{20}	-0.162940	0.083772	-1.945	74	0.056
For EMERG_CT slope, β_3					
INTRCPT2, γ_{30}	0.021886	0.036442	0.601	74	0.550
For OUTSIDE slope, β_4					
INTRCPT2, γ_{40}	-0.011443	0.020920	-0.547	74	0.586

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.11144	0.01242	29	43.71507	0.039
level-1, r	0.29834	0.08901			

Statistics for the current model

Deviance = 55.928326
Number of estimated parameters = 8

tauvc.dat, containing tau and the variance-covariance matrix of tauhas been created.
gamvc.dat, containing the variance-covariance matrix of gamma has been created.
gamvcr.dat, containing the robust variance-covariance matrix of gamma has
been created.
The above files have been created with a (nE15.7,1X) format.

VITA

EDUCATION

Ph.D., Engineering Management and Systems Engineering
Department of Engineering Management and Systems Engineering
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M.E.M., Engineering Management and Systems Engineering
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B.S., Computer Science
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RESEARCH INTERESTS

Leadership in Cross-Functional Teams, Followership and the Co-Creation of Leadership, Complexity Leadership Theory, Team Dynamics and Processes, Research Methods and Quantitative Analysis, Data Analytics and Visualization

EXPERIENCE

Instructor | 2013 – Present
Graduate Research & Teaching Assistant | 2012 – Present
Department of Engineering Management and Systems Engineering
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Assistant Operations Manager | 2009 – 2011
Marketing and Operations
Eastland Food Corporation, Jessup, MD

TEACHING

Instructor: ENMA420 – Statistical Concepts in Engineering Management
ENMA444 – Leadership in Engineering Organizations
ENMA480 – Ethics and Philosophy in Engineering
ENMA302 – Engineering Economics Analysis

Co-Instructor: ENMA600 – Cost Estimation and Financial Analysis
Guest Lecturer & Teaching Assistant: ENMA 603 – Operations Research
Teaching Assistant: ENMA 613 – Logistics and Supply Chain Management

PROFESSIONAL SOCIETY MEMBERSHIPS

Academy of Management
American Society for Engineering Management
American Society for Quality
Epsilon Mu Eta Engineering Management Honor Society; Golden Key International Honour Society