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Management and Leadership Style: Is Style Influenced by Engineering Education?

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MANAGEMENT AND LEADERSHIP STYLE:

IS STYLE INFLUENCED BY ENGINEERING EDUCATION?

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ABSTRACT

MANAGEMENT AND LEADERSHIP STYLE:
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This paper addresses one aspect of the opportunity for corporations to reduce leadership development infrastructure by narrowing the participant pool to candidates that, intuitively, may be multi-skilled and capable of handling diverse roles and assignments within the corporate environment. In particular, the study seeks to determine the effect that engineering education has on leadership style by comparing the leadership style of certified project managers (CPMs), and non-CPM managers with engineering degrees, to the same for CPMs, and non-CPM managers, who do not possess engineering degrees. Engineering degrees may be further defined as mechanical, electrical, industrial and the like. Leadership styles are partitioned into transformational, transactional and passive avoidant as per established scholarly definitions. The underlying assumption is that transformational leadership is a preferred leadership style in the corporate sector. CPMs, and non-CPMs, with and without engineering degrees, will comprise the sampling population. While it is beyond the scope of the current proposal to address the broader potential relationship between engineering skills and effective leadership, knowledge gained regarding the potential relationship between engineering education and leadership style may serve as the impetus for addressing the broader topic. An analysis of the sampled population suggests, at an alpha of .05, that a relationship exists between leadership style and engineering education with those managers in possession of

engineering degrees testing as more transformational and transactional than the same without engineering degrees. However, at the same level of statistical significance, neither transformational nor transactional leadership styles were determined to be the predominant style of leadership among the groups with or without engineering degrees.

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CHAPTER 1

INTRODUCTION

Many corporations employ multiple Leadership Development Programs (LDPs) aimed at accelerating the development and growth of highly capable candidates. Among these candidates, depending on the particular LDP, may be those possessing engineering skills typically afforded through engineering education as measured by completion of an engineering degree. Infrastructure reductions might be afforded corporations if multiple LDPs could be supplanted with one program such as an Engineering Leadership Development Program. Thus, the question is borne: is there a relationship between engineering education and leadership style (transformational or transactional) between candidates with engineering degrees and those without. Further, if such a relationship exists, is it predominantly transformational or transactional? In an attempt to normalize the research in this area, two categories have been selected – CPMs and non-CPM managers with engineering degrees and the same without engineering degrees. The concept of assessing various leadership environments for the presence of transformational or transactional leadership attributes is not entirely new. For example, Barling, Beauchamp, Masse, Morton, Rhodes and Zumbo (2010), conducted such a study seeking to "explain how the adoption of transformational parenting behaviors may positively influence adolescent health" (p. 129). In the next section, discussion will focus on the theoretical foundations of applicable leadership styles.

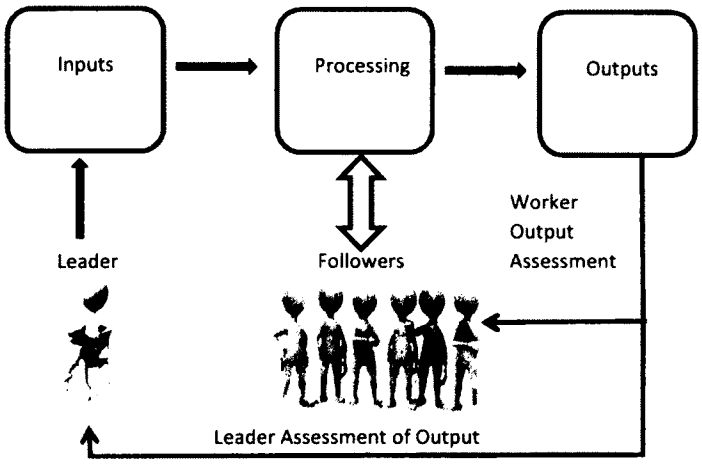
1.1 Leadership Defined

Leadership has been described and defined at length in text books, publications and other literature formats. One such descriptor is provided by Katz and Kahn (1966), as cited by Johns and Moser (1989) characterizing leadership as "any act of influence on a matter of organizational relevance" (p. 115). This would imply that one of the principle responsibilities of a leader is to move the organization forward in such a manner consistent with the best interests of the business. This notion of consistency should not be understated as all too often, instances have been documented of leadership application in a manner inconsistent with the organization's stated relevance (e.g. Enron, Global Crossings, etc.). Burns (1979), as also cited by Johns and Moser (1989), said: "I define leadership as leaders inducing followers to act for certain goals that represent the values and the motivations of both leaders and followers" (p.115). This descriptor would imply that there exists a sort of connectedness between and among the leaders and followers. Perhaps this is the intent of the following comments offered by Boyatzis et al. (2005), "great leaders are awake, aware, and attuned to themselves, to others and to the world around them" (p. 3). Chemers (2001), as cited by Kark and Yaffe (2011), defines leadership as "a process of social influence through which an individual enlists and mobilizes the aid of others in the attainment of a collective goal" (p. 806). This perspective, similar to the preceding comments, suggests that leadership involves not only the leader but also the stalwart participation of those to whom the leader is looked to for guidance and direction. A key distinction here, however, is the reference to "social influence" which could suggest that the leader's actions and behaviors are somehow swayed by those with whom the leader interacts. Another key distinction in this

leadership characterization is reference to "a collective goal." Focusing for a moment on the two words "social" and "collective" warrants some discussion regarding cultural influences on leadership. That a leader may be influenced by, or at a minimum consider, perceptions and priorities of others (e.g. social and collective aspects), might also suggest that such a leader values allocentrism (i.e., "viewing oneself in terms of the in-groups to which one belongs [this versus the contrasting perspective idiocentrism which is] viewing oneself as the basic social unit where individual goals have primacy over in-group goals)" (Avolio, Lawler & Walumba, 2007, p. 214). Considering the context of the word "collective" implies that Kark and Yaffe would most likely adopt the former term allocentrism as a surrogate for "collective" in the process description of leadership. Expanding discussions regarding the cultural influences on leadership behavior, in the context of social and collective leadership, suggests a further link to allocentrism. According to Christopher & Weber (1998), "individualism emphasizes personal freedom and responsibility; collectivism endorses social relatedness and interdependence with others in one's family or social group" (p. 1209). Interestingly, collectivism and individualism, as is the case with allocentrism and indiocentrism, suggest contrasting styles or behaviors which, in the context of the previously discussed leadership process, might offer clues as to how one leader might interact with his followers. For example, leaders who are closely aligned with a collectivism culture may engage in a more participative style of leadership when compared to those more aligned with an individualist culture. Thus, leadership culture, "may play an important role in predicting how followers respond to different leadership styles/orientations" (Triandis, Chan, Bhawuk, Iwao, & Sinha, 1995) as cited by (Avolio et al., 2007, p. 214.).

Leadership, according to Northouse (2013), "is a process whereby an individual influences a group of individuals to achieve a common goal" (p. 5). This definition attempts to transform leadership from the psychological realm to a sort of interdependent network. Merriam-Webster's Dictionary and Thesaurus (2007), defines process as follows: "a forward or onward movement...something going on...a natural phenomenon marked by gradual changes that lead toward a particular result" (p. 638). With this definition in mind, it may be inferred that leadership, viewed as a process, is about a leader providing direction or inputs to the followers who, in turn, move forward with that direction (i.e. transform it into a qualitative or quantitative deliverable) seeking consistency of the output with the initially provided direction (input). Systematizing this thinking (refer to Figure I below) would yield a codependence characterized by inputs, processing and outputs, with the addition of a feedback mechanism to close the loop.

Figure 1: Leadership Systemization.



Focusing on Figure 1, the leader provides direction in the form of inputs to the workers who, in turn, process that direction to develop an output. The initial output is reviewed by employees and modified to fit their interpretation of leader inputs. Follower output is submitted to the leader for assessment. Upon assessment by the leader, the output is either "re-worked" by the followers, or it is accepted by the leader who then provides a new input for processing.

Hesburgh (1971), as cited by Johns and Moser (1989), "gave an inspiring definition of leadership, 'the mystic of leadership, be it educations, political, religious, commercial or whatever, is next to impossible to describe, but wherever it exists, morale flourishes, people pull together toward common goals, spirits soar, order is maintained, not as an end in itself, but as a means to move forward together it requires courage as well as wisdom,'" (p. 115). This leadership characterization suggests that, almost in a supernatural manner, one is able to galvanize the team, the organization, and perhaps, a nation. Further, those who receive the message all march, on one accord, en route to accomplishing the unimaginable. Nowhere was this perspective more evident than in the following passage provided by Burton, (2009), quoting then President Kennedy: "we choose to go to the moon in this decade and do the other things...not because they are easy, but because they are hard" (p. 29). Such direction provided in the twenty first century would not be unexpected and may seem quite trivial. However, this proclamation was issued at a time when those accountable for the ultimate deliverable were asking very fundamental questions regarding how to make it happen. This perspective was evidenced by the comments written by Burton (2009), as he shared,

"immediately following Kennedy's announcement, NASA managers asked themselves, 'how do you get to the moon'" (p. 29).

Despite having touched on several leadership perspectives, it was not the intent of the current research to offer exhaustive comments in this area. Indeed, as offered by Burns (1978), as cited by Johns & Moser (1989), "the list of well-reasoned definitions of leadership could go on and on" (p. 116). With these comments, discussion now shifts toward reviewing attempts to prototype leader functions and behaviors.

1.1.1 Theoretical Leadership Models

Modeling leadership approaches and patterns has proven quite useful, particularly, in an academic setting where the students have yet to experience first-hand the joys and pains of leadership. Among the many leadership models is "contingency theory" which is, according to Fiedler & Garcia (1987), as cited by Northouse (2013), "the most widely recognized [contingency theory model]" (p. 123). As the name implies, the model posits that leadership styles and responses are contingent on various situations and, based on these situations, characterizes the leader as either "relationship motivated" or "task motivated." Specific situations may be characterized in terms of "leader-member relations, task structure, and position power." As an example regarding leader-member relations, in an environment where trust and good overall perception of the leader is experienced, such relations are "defined as good." Task structure refers to "the degree to which requirements of a task are clear and spelled out" while position power has to do with "the amount of authority a leader has to reward or to punish followers" (Northouse, 2013, pp. 124, 125). From these comments, it should be clear that the

contingency theory model suggests certain paths be embarked on driven by the situation at hand. For example, if the situation to be addressed is "moderately favorable or moderately unfavorable" the model suggested approach is one that is "relationship oriented." Further, "if a leader is moderately liked and possesses some power" under somewhat ambiguous job conditions for subordinates a "relationship orientation" should provide the best chance for success. The underlying premise for this contingency approach is that leaders must be perceptive enough to recognize certain situations and circumstances which, in turn, will prompt them to adjust that environment to better match their leadership approach. Another way to interpret this is that "when leaders can recognize the situations in which they are most successful, they can then begin to modify their own situations" (Ivancevich & Matteson, 1993, p. 444). This approach may seem a bit counter intuitive as it suggests that, rather than exhibit leadership flexibility, the leader modify the situation to one more compatible with his/her style. The premise for this approach was that "Fiedler [was] not particularly optimistic that leaders [could] be retrained successfully to change their preferred leadership style" (Ivancevich & Matteson, 1993, p. 444).

Path-goal theory, expanding upon the contingency theory approach, "suggests that a leader must adapt to the development level of subordinates [emphasizing] the relationship between the leader's style and the characteristics of the subordinates and work setting" (Northouse, 2013, p. 137). An important point to be made regarding path-goal theory is that it is based on subordinate perceptions of their work, themselves, and how to achieve goals within their particular work environment. Similar to "other situational or contingency leadership approaches, the path-goal attempts to predict

leadership effectiveness in different [leadership] situations" (Ivancevich & Matteson, 1993, p. 451). House and Mitchell (1974), as cited by Northouse (2013), offers four leadership behaviors applicable to the path-goal theory: "directive, supportive, participative, and achievement-oriented" (p. 139). As the stated behaviors would suggest, the directive style focuses more on providing direction whereas the supportive and participative approaches tend to enlist collaboration from subordinates, while still the achievement orientation seeks to build capability among subordinates. The key takeaway from this approach is that the leader must be fully aware of the capability of his or her subordinate staff as well as their motivational needs and the overall work environment. It is only after such analysis that the leader will be positioned to apply the appropriate leadership style.

Although it is not the intent of the present writing to address all possible theoretical leadership models, there are two remaining theoretical models that have garnered quite a bit of support, "leader-member exchange theory" and the "Vroom-Jago Model of Leadership." Regarding leader-member exchange (LMX), it is predicated not simply on the style of the leader or subordinates or even the specific situation at hand. Instead, it "takes still another approach and conceptualizes the leadership as a process that is centered on the interactions between leaders and followers" (Northouse, 2012, p. 161). To this point, we have assumed a degree of universality among subordinates; leader-member exchange, by design, seeks to segregate subordinates into two distinct groups – the "in group" or the "out group" contingent on the leader to subordinate relationship (Northouse, 2012, p. 163). Generally speaking, the more collaborative and ambitious the subordinate, the greater the likelihood that he will be aligned with the in-

group and those falling outside this area would obviously be more closely aligned with the out-group. Of course, depending on the group allocation, the leader-subordinate interaction varies accordingly. For example, as noted by (Dansereau et al., 1975), as cited by Northouse (2012), "subordinates in the in-group receive more information, influence, confidence, and concern from their leaders than do out-group subordinates" (p. 163). Barge and Schlueter (1991) suggested that LMX theory is predicated on the notion that "in-group relationships will be associated with higher levels of employee satisfaction and productivity" (p. 544). The effectiveness of LMX has been empirically confirmed as "in-group relationships are not only positively associated with increased employee satisfaction (Ferris, 1985; Graen & Ginsburgh, 1977) but with employee performance as well (Liden & Graen, 1980; Tjosvold, 1984; Vecchio, 1982), as also cited by Barge and Schlueter (1991). This perspective of success is also shared by Dubrin (2010) who wrote, based on study results, "the quality of the relationship with the leader had an impact on the effectiveness of influence tactics, a poor relationship with the leader resulted in less [co-worker to co-worker assistance while] a positive relationship with the leader positively related to helping behavior" (p. 247). While LMX can result in very positive contributions by certain team members, there are some negative implications as well. This is principally due to the variations in business relationships. Indeed, (Dockery & Steiner, 1990), as cited by Suleyman (2011), stated that, "in high-quality interactions, leaders establish closer relations with only a few key subordinates, the (in-group) due to limited resources [consequently] they provide (in-group) members with support and resources beyond the employment contract" (p. 1494).

The Vroom-Jago model has to do with decision making and the degree to which subordinate involvement should be taken into account when making such decisions. The fundamental assumption for use of this model was that "no single leadership style was appropriate" and that leaders must exhibit flexibility even if doing so required the leader to modify his style to fit the situation at hand. The model, by design, also considers the types of decisions with which leaders are faced namely, "individual and group." As implied by the terms individual and group, the former decisions have to do with leader decisions that only affect one member of the team while the latter addresses decisions that "affect several followers." Due to the complexity associated with use of this model (driven by the highly variable nature of decisions to be made), "decision making heuristics, or rules of thumb, have been developed" (Ivancevich & Matteson, 1993, pp. 446 - 448).

As previously mentioned, leadership models aimed at improving leader effectiveness, be it through subordinate motivation, performance management, decision efficiency or otherwise, abound in the related literature. And, while it was not the intent of this section to comprehensively address any and all such theoretical approaches, those mentioned should adequately introduce the topic and, possibly, precipitate additional enquiry of the topic which is left to the reader.

1.1.2 Leadership Levers

Thus far, our discussion of leadership has considered, for the most part, leadership characterizations, theories and models. Yet, there are other mechanisms at the leader's disposal that may also be of assistance in moving the needle of organizational

effectiveness. Three such critical tools are leveraging teams and their associated infrastructure, receiving and delivering feedback, and leadership coaching.

Regarding teams, there is so much to be said of the progress that can be made working in a collaborative group versus flying solo. Strength in numbers is perhaps nowhere more evidenced than with an analysis of nature's wolves. Similar to human teams, wolves achieve even the most critical and fundamental goals (e.g. hunting) in groups or packs. Operating in a sort of hierarchy, wolves are pack animals that, communicate by gestures of head, body, and limbs thus maintaining order in the pack. Similar to the responsibility of the leader of a human team, to include removing barriers to effectiveness and quenching the members' hunger for challenge, the father wolf obtains food for the family (Young Students Learning Library, 1995, pp. 2802, 2803). In this way, one construct for viewing wolves in a pack, or a team of people interacting in an interdependent manner, is to consider such in systems context. Doing so is consistent with the systems perspective offered by Kets et al. (2007) who suggest that "a system is a set of interacting units with relationships among them" (p. 31). Human teams, particularly when operating at optimum efficiency, offer such a relationship. Teams may be formed formally (e.g. as designated by a leader or sponsor) or informally whereby a group of employees with a common goal recognize the benefits of operating collectively. Despite the motivation for group formation, there are formal and specific stages of behavior that occur prior to optimization. Bateman and Zeithaml (1993) describe these stages as "forming, storming, norming and performing [then] adjourning" (p. 477). Although each stage is relatively self-explanatory, storming is, perhaps, the most controversial aspect of group and team development. Here, each member seeks to define him or herself and lobby for respective

contributions to the team. While conflict may be minimal when each team member is perceived to bring different yet valued skill sets to the team, such is not necessarily the case in the instance where one or more members appear to exhibit expertise in the same area. It is this situation which may give rise to conflict such as how to decide which team member is most suitable for the needed role. The team leader, formal or informal, is most often looked to for deciding and allocating team member roles and contributions. As well, he is accountable to ensure a clear understanding of team potency which is, according to Champion et al. (1993), as cited by Hu and Liden (2011), "team members' shared beliefs about their collective capabilities" (p. 852). This is a critical aspect of team evolution and effectiveness. If team resource capabilities are either under-utilized or overstated, the result will be team sub-optimization. Thus, the team must trust that the leader is best positioned to make such determinations while concurrently fully leveraging and valuing that which each team member has to offer. This perspective is supported by Lam, Peng, and Schaubroeck (2011) in the statement, "members' trust in their leaders is critical for effective team performance and potency" (p. 870). It is also important to note the leaders' influence on the team given certain cultural and social settings. Earlier, we discussed allocentrism and collectivism and the role that such approaches might play in leader-team dynamics. Further, according to Yukl (2010), as cited by Chang, Johnson, Mao and Venus (2012), "leadership is a social process of exerting influence over the thoughts, feelings, and actions of others" (p. 1). With this in mind, it was also noted in the same report that "leaders' group based identities have also been found to spill over to their followers" (p. 1). Thus, collective consideration should, in turn, promote healthy member collaboration.

Although providing team leadership, recognizing the unique contributions of each member, and appropriately allocating resources among team members allows the team to progress toward optimization, empowerment can accelerate such optimization. Indeed, according to a study implemented by Leach (1998), as cited by (Clegg, Cordery & Wall, 2002), which also considered enhanced feedback, "system performance improved considerably following empowerment" (p. 159). The goal with empowerment is, in essence, for the leader to provide the team with needed resources and then get out of the way and serve the team. Said differently, empowerment is simply "a means of granting work-related decision-making authority to employees as a means of enhancing performance" (Menon,, 2001, p. 154). Through empowerment, team members derive a sense of ownership for goals and accomplishments and, in this way, they execute with passion and quality. Although the leader is charged with providing direction to the team and steering them along the correct courses of action, similar to the lack of team empowerment, the leader must be careful in how much she advocates certain courses of action. Granted, there are certain paths that the team must take and the de facto decision maker in such situations is the team leader. However, when opportunities exist to engage the team in making decisions or plotting future courses of action, there is a somewhat tacit expectation among the team that they play in this space. The astute team leader recognizes these opportunities as well as the possibility of a disengaged team if such opportunities are not appropriately leveraged or if team members perceive their input to be of little value. Indeed, according to Vroom (1997), "strong advocacy by the leader of a particular course of action along with critical judgments of alternatives proposed by others, might reasonably be expected to decrease [team] participation" (p. 423). More

often than not, the team's success or failure rests with the team leader. Consequently, the team leader's strengths and development opportunities are often ultimately measured by overall team performance.

A frequently used tool aimed at honing a leader's effectiveness is the 360° feedback instrument. Although the emphasis of this section, for the purposes of reviewing 360° feedback, has to do with individual improvement, it may also be used "for succession planning, merit raises, performance appraisals, and downsizing" (Capritella, 2002, as cited by Crispo & Sysinger, 2012, p. 2). Throughout this writing, reference has been made to leader to group interactions and its importance in the leadership arsenal. Here, we delve a bit deeper into a formal feedback instrument, the 360° form, as well as review aspects of its supporting infrastructure. We begin with an efficient definition of the instrument as follows: "The 360° feedback is a questionnaire that is completed by the participant, participant's supervisors, coworkers, peers, and subordinates" (Crispo & Sysinger, 2012, p. 2). Hence, reference to the tool as being "360°" feedback adequately articulates the degree to which organizational feedback (participant's strengths and weaknesses) is provided. In fact, in some instances, the word "weaknesses" is often supplanted with "development opportunities" to assure the highest chance for success in the leader's acceptance of such feedback (the latter descriptor may be viewed as less critical). This is a very important aspect associated with the 360° process as the intent is to receive balanced feedback from the organizational levels with which the participant most frequently interacts. This perspective is shared by (Hellervik, Hazucha, & Schneider, 1992), as cited by Carless, Mann and Wearing (1998) as follows: "Obtaining information on an individual's performance from multiple sources enhances

the credibility of the information and therefore, presumably the individual's motivation to change his or her behavior" (p. 482).

Aimed at providing a more coherent review of the 360° feedback questionnaire composition, we will focus on the "global executive leadership inventory (GELI)" offered by Kets, et al. (2007) which includes the following key components for inventory: "visioning, empowering, energizing, designing and aligning, rewarding and giving feedback, team-building, outside stakeholder orientation, global mindset, tenacity, emotional intelligence, life balance [and] resilience to stress" (pp. 83, 84). The significance of the balanced approach, coupled with use of the feedback circle, cannot be overstated and offers the best chance for success in elevating behavior to the desired state. Each of these components is assessed by those in the feedback circle (the raters), and information is provided to the one being rated not only with regard to how well the rated scores within the specific component (e.g. how well one scores in team-building) but also how those scores compare to an average score in the area. This specific feedback supplemented with a "personality audit" which focuses on the leader's motivation and emotional management (e.g. trustful-vigilant or extroverted-introverted) and archetypes feedback characterizing the way in which the rated deals with people and situations (e.g. strategists or coaches) helps executives obtain greater access to and understanding of their emotional lives thus adequately positioning them for comprehensive interpretation of results (Kets, et al., 2007, pp. 85 - 96). In the end, the comprehensive nature of this feedback is expected to fully convey those personality characteristics that, if modified, would facilitate increased individual and organizational effectiveness.

The final leadership tool to be discussed in this section is executive coaching. How often have we observed the underdog team miraculously execute an amazing come from behind victory or heard tale of an impoverished elementary school that succeeded against all odds in meeting testing score requirements? These stories convey the essence of the power behind coaching. Yet, effective coaching is not confined to circumstances offering low probability for success. Today, many executives depend on coaching, either formally or informally, to buttress their success. Indeed, according to the Chartered Institute of Personnel and Development (2010), as cited by Baban and Ratiu (2012), "two-thirds of organizations report using coaching..." (p. 140). One might ask how effective coaching at the executive level can actually be given that those at such responsible levels in the organization are, in essence, seasoned and, to some degree, unyielding. There is a metaphorical adage in this area which states that: "you can't teach an old dog new tricks." To the contrary, however, retraining through coaching of seasoned executives is quite doable and beneficial. According to Kets, et al. (2007) "people whose personality characteristics have been largely formed (this includes most people over 30) can still make significant changes in their behavior" (p. 13). While specific coaching strategies vary as a function of client operating environment (e.g. family owned business), the focus of this writing assumes the typical corporate environment whereby a leader has no lineage ties within that organization. Although a great deal of the coaching efficacy may rest with the one being coached, Nelson and Hogan (2009), as cited by Baban and Ratiu (2012), stated that "coaching in general can be a more productive and impactful process if coaches engage in a well-planned and intentional manner" (p. 141). One of the first steps employed in executive coaching is to

provide the client with unbiased feedback such as that offered via 360° instruments as discussed previously. Such an approach is extremely valuable given that effective coaching has to be as objectively based as possible – a sort of reality check. According to de Berg et al. (2012), "feedback is particularly relevant in coaching practices where it is provided to support self-awareness, learning, and to improve performance" (p. 14). Indeed, many CEOs have a differing perspective of their interactions and, given their positions of power, often face little resistance regarding their beliefs of themselves. This perspective is shared by Kets, et al. (2007) as the comments, "although few would admit it, many business leaders are...like the mythical Narcissus they see the person they love most in the world roughly 70% of executives believe they are in the top 25% of their profession in terms of performance" (p. 76).

With the above in mind, the need for coaching is clear as is the need to approach this task in a manner most effective for the client. Thus, in addition to implementation of 360° feedback, effective coaching should include a time for "reflection" – allocating time for the leader to freely assimilate information about his/her leadership challenges without the stresses of day to day operations. Effective coaching should also employ "group coaching" whereby all members of the session share their perspectives about themselves and their respective coaching opportunities.

The final area to be addressed in the area of coaching is "follow-up" – this is an attempt to have each group participant follow-up with one another on the progress that has or has not been made relative to received feedback (Kets, et al., 2007, pp. 111 - 115). All too often, something that is learned in a coaching classroom, particularly when it involves self-reflection and improvement, is not followed through once returning to the

workplace. While some of the responsibility for this lack of follow through may be owing to one's resistance to self-change, according to Goldsmith (2009), as cited by Baban and Ratiu (2012), "some studies suggest that not all individuals are coachable [and that] coachable individuals are committed to change, [and] have strong motivation to improve their competencies" (p. 142). Another contributing factor to the lack of follow through is the leader's return to day to day operations and respective issues that doing so poses. It is not at all atypical for an executive to return to the proverbial office with the intent of executing certain plans only to find that, when entering this space, the picture has changed significantly – sales forecasts just went south, a quality issue has occurred in a major manufacturing facility or a rumor of divestiture has spawned a precipitous company stock sell-off. Although seemingly a bit extreme, these issues come with the territory of executive leadership and cannot be put on the back burner while less threatening concerns (e.g. reflecting on received 360° feedback) are addressed. Despite the somewhat commoditized nature of executive coaching and the organizational openness to engaging in such developmental processes, there are those who may view the need for coaching as a sign of failure or weakness which may be driven by their introspective views of self-competencies. While coaching, at the superficial level, may provide a path for leadership style changes, more visceral behavior modifications require additional insights. And, given the very personal nature of coaching, it is imperative that coaches be adept in discerning the source of improvement opportunities presented by those being coached. Berglas (2002), as cited by Ellam-Dyson and Palmer (2011), also noted this perspective by "emphasizing how important it is that coaches have the ability to be able to recognize when clients may have deep seated psychological difficulties" (p.

115). Viewed in a "clinical paradigm" context, an individual's "inner theater" plays a crucial role not only in how the individual is coached but also in how he or she interprets and responds to such coaching. The "transferential patterns" (i.e. actions linked to our past lives) can be very powerful and controlling as we are, in essence, forced to relive our past behaviors perpetually (Kets, et al., 2007, p. 6). As we will see in the next section, dealing with one's past demons and ghosts often requires much more than external influences. Indeed, the fundamental core of cognition of the environment must be recognized, controlled and regulated.

1.1.3 Emotional Intelligence and Leadership

It is no secret that intelligence is a fundamental requisite for executive level leadership. However, it is not simply the technical aspect of intelligence that makes things happen it is also the personal or emotional intelligence (EI) that enables leaders to make not only critical decisions but also the best critical decisions. Motivating followers to contribute their best in every situation and in all cases is a fundamental tenet of successful leadership. Often, in order to accomplish this precept, a profound emotional connection between leaders and followers is required. According to Boyatzis, et al. (2002), "the emotional task of the leader is primal...it is both the original and most important act of leadership...[thus] the leader acts as the group's emotional guide" (p. 5). This notion that the leader serves as an emotional guide is key given that, according to Boyatzis, et al. (2002), "we rely on connections with other people for our own emotional stability" (p. 6). It would logically follow then that those leaders who possess the capacity to connect at this level are best positioned for success. The importance of

employee emotional satisfaction cannot be understated as it links directly to job performance. In fact, Boyatzis, et al. (2002) suggest "that employees who feel upbeat will likely go the extra mile to please customers and therefore improve the bottom line" (p. 15). Given the very significant role that EI plays in a leader's overall organizational effectiveness, it is appropriate that we seek to define EI through the lens of various writers. Salovey and Mayer (1990), as cited by Brackett, Rivers, and Salovey (2011), described EI as, "the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions" (p. 89). This definition suggests the capacity to be in touch not only with the vicissitudes of one's thoughts and impressions but also to control how one reacts to such. Goleman (2000), as cited by Hosein and Yousefi (2012), stated, "the emotional intelligence is an inherent ability and the genes have [an] important role in its creation, but emotional intelligence can grow by training and it needs many efforts and practices" (p. 57). This would suggest that while EI may be attributed to lineage, it is not bound by innate qualities and can therefore be acquired via learned behavior based methodologies (e.g. seminars).

Kets, et al. (2007) say that "emotional intelligence focuses fundamentally on one's capacity to manage in a social and emotional climate" (p. 18). Within this definition, we are once again reminded of the importance of recognizing the interdependencies of individuals and, perhaps more importantly, the leader's awareness of such need for connectedness. Northouse (2013) offers the following comments regarding EI, "as the two words suggest, emotional intelligence has to do with our emotions (affective domain) and thinking (cognitive domain), and the interplay between

the two" (p. 27). This definition distinguishes between the two words "emotional" and "intelligence" suggesting that effective use or implementation of EI be predicated on an understanding of emotions resulting from user intellect.

There are "four domains of EI, self-awareness, self-management, social awareness, and relationship management" (Boyatzis, et al., 2002, p.30). Self-awareness, as the name would imply, suggests that a leader be first cognizant of his/her emotions and feelings. Demonstration of proficiency in the area of EI is given by the following example. Assume for the moment that an employee was disappointed with his or her end of year performance review. Such an environment might precipitate the proverbial fight, flee or freeze scenario. Certainly one response, though damaging it might be in this situation, would be to fight. That is to respond with anger and dissention. While this may seem to be a natural response in this situation, it is not a response consistent with the notion of self-awareness. An alternative action, in the context of self-awareness, might be to first recognize that the differential perspectives regarding performance may have resulted from a lack of calibration between subordinate and superior. With this in mind, the conversation may be shifted to how to circumvent a similar situation going forward. The key point here is that the first step for an emotionally intelligent individual is to recognize personal doldrums and proactively respond (self-manage) in such a manner as to eliminate any further erosion, in the negative sense, of the situation at hand. It is only after one is able to be in tune with his/her emotions (self-awareness) that he/she will be able to self-manage and subsequently resonate with others. This perspective is shared by (Boyatzis, et al., 2002), in the following statement: "self-awareness also plays a crucial role in empathy or sensing how someone else sees a situation" (p. 30). Expanding a bit

on empathy, it is important to understand what it is not. It is not about trying to modify one's actions such that the masses are sure to like you or, for that matter, taking on another's feelings as your own. It is, instead, about appropriately processing the feelings of others. Boyatzis, et al. (2002) address the topic of empathy as follows: "empathy means taking employees' feelings into thoughtful consideration and then making intelligent decisions that work those feelings into the response" (p. 50). Social awareness, as we have discussed in the context of allocentrism, takes into account the emotions of those around us. The leader in this case having first developed competencies in self-awareness as well as empathy and self-management is now positioned to perceive, and appropriately acknowledge, the feelings of others.

Having an awareness of, and capacity to manage, one's own feelings as well as being able to empathize and connect with others' feelings positions the leader to implement effective relationship management, our last of the four EI domains. More specifically, relationship management is about "authenticity" and how its use may serve to strengthen a leader's connectedness with not simply employees but also those with whom the leader interacts on a 360° basis. Thus far, we have discussed the four domains of EI and how each might be effectively implemented. However, simply mastering the domains of EI without fully addressing their integration within the leadership realm is incomplete. Thus, leaders should continue to build on existing EI skills and seek to expand the strengths (e.g. organizational awareness and collaboration) associated with these skills. "Having a larger repertoire of emotional intelligence strengths can make a leader more effective because it means that leader is flexible enough

to handle the wide-ranging demands of running an organization" (Boyatzis, et al., 2002, pp. 51, 85).

There still remains an open question in the area of EI: How does one develop the EI competency? According to (Boyatzis, et al., 2002), "to begin or sustain real development in emotional intelligence, you must first engage that power of your ideal self" (p. 116). This, of course, means to contemplate the person that you want to be which should comprise the things that invoke the most passion. This profound change requires crafting of a vision reflecting 360° interactions and feedback. It is not simply what you, the leader, will be doing but also how you interact with those with whom you make contact on a day to day basis. Unfortunately, receiving accurate feedback is often elusive. No one likes to be the bearer of bad news; subordinates like to convey messages that make the boss feel good, peers sometimes refrain from candor in pursuit of their own agenda, and bosses, believe it or not, often avoid messages that precipitate conflict. Boyatzis, et al. (2002) offered the following comments in this area: "Rare are those who dare to tell the commanding leader he is too harsh, or to let a leader know he could be more visionary, or more democratic" (p. 133). With this in mind, it is only through the leader's use of EI skills, namely empathy and awareness that she is able to discover the brutal feedback regarding his behavior as well as how such affects others. The reference to brutal feedback may appear a bit harsh and inconsiderate. In fact, providing or receiving such feedback may not be in the best interest of the parties if the goal is to appear friendly and unwaveringly collaborative. Viewed as a sort of hard tactic, Knippenberg and Steensma (2003) stated that "tactics that may be assumed to place a strain on the relationship between agent and target are less frequently employed" (p. 63).

This is a very important point from a leadership perspective as, although the leader is tasked with motivating workers, which is often viewed synonymously with everyone feeling happy, he should not refrain from providing brutally honest feedback, important though is that doing so be accomplished in the context of empathy as previously discussed. Also important here is awareness and openness to feeling, listening and thinking, and appropriately acting on the inputs received.

Thus far, our discussion regarding EI has focused on the individual level. However, in order to transform the organization, a leader must transcend self-transformation; he is also responsible for transformation of the team. Key attributes of EI, such as self-awareness, are also applicable at the team level (teams will be discussed in detail in a subsequent section of this paper). It is worth noting, however, that effective use of EI at the team level begins with each member of the team acknowledging the feelings and emotions of every other member. Actions in this area "might also mean creating norms such as listening to everyone's perspective – including that of a lone dissenter – before a decision is made" (Boyatzis, et al., 2002, p. 179). The art of listening is a requisite skill for leader to organization connectedness and resonance.

1.1.4 Resonant Leadership

A not so subtle relationship exists between resonant leaders and emotionally intelligent leaders. In a sense, resonant leadership is all about connecting or being in tune with those with whom the leader interacts (e.g. subordinates, peers, and other constituents). Said differently, "when leaders drive emotions positively they bring out everyone's best we call this effect resonance [and EI is] how leaders handle themselves

and their relationship" (Boyatzis, et al., 2002, p. 5, 6). In the lexical sense, resonance is defined as "a reinforcement of sound in a vibrating body caused by waves from another body vibrating at nearly the same rate" (Merriam-Webster's Dictionary and Thesaurus, 2007, p. 689). From the foregoing definition, the relationship between resonance and EI should be lucid in the context of leadership. By definition, motivation is, "the act or process of motivating...a motivating force, stimulus, or influence" (Merriam-Webster's Dictionary and Thesaurus, 2007, p. 528). Leadership would be so much easier if all employees showed up motivated to accomplish any task with which they are charged. Unfortunately, the job of employee motivation most often rests with the leader and must be externally sourced. Sure, some help is available to the leader in the form of intrinsic motivation. Yet, according to Ivancevich & Matteson (1993), intrinsic rewards typically align with one of more of the following categories: "completion – the ability to start and finish [something], achievement – derived when a person reaches a challenging goal, autonomy – right and privilege to make decisions, [and] personal growth – expansion of capabilities" (pp. 208, 209). However, what happens in the instance whereby resulting from job design, as an example, the employee is not allowed to complete an assignment or goal prior to being reallocated to another task, or when decisions are handed down versus allowed, or when job stagnation exists? Under these circumstances, the challenge of motivation, and thus resonance, falls upon the shoulders of the leader.

One tool available to leaders which has served as an enabler for boss subordinate calibration regarding work performance is feedback. Indeed, according to DeNisi and Kluger (2000); Gregory, Levy and Jeffers (2008), as cited by de Berg, Jarzebowski and Palermo (2012), "feedback, which is information regarding individuals' current levels of

performance, has been shown to influence motivation, job satisfaction and performance" (p. 14). Implemented correctly, feedback, particularly if collected on a 360° basis, can offer tremendous returns. Indeed, according to Wimer and Nowack (1998), as cited by Crispo and Sysinger (2012), "when 360° feedback is used appropriately, it can be a very effective tool that can lead to behavioral changes and effectiveness of an individual, group, and organization" (p. 2). While it is not the intent of this section to discuss the 360° feedback instrument in detail (it was discussed in a prior section of this writing), certainly its use may facilitate leadership resonance. Whether resonance is enabled through motivation or otherwise, tuning in to the resonant frequency of multiple followers, while certainly doable, is not without tremendous effort and persistence which can be extremely exhaustive and if left unaddressed, leader burnout is inevitable. How then, should a leader continuously replenish the well – the source of motivation, guidance and emotional drain? Boyatzis & McKee (2005) believe that this is accomplished via a "cycle of sacrifice and renewal that must be regulated to maintain resonance" (p. 7). The type of stress precipitating the need for renewal is termed "power stress" and is the source for dissonance. Contributions to this stress type are provided by ambiguity and requirements for complex decision-making. "Fire-fighting" is another source of this type of stress and in some situations leaders may become physically ill as a result of the day-to-day battles.

The principal issue with power stress is not necessarily the effect experienced while in the heat of the battle; it is, instead, "too little recovery time" which results from leaders "failing to manage the cycle of sacrifice and renewal" (Boyatzis & McKee, 2005, p. 7). It is this process of renewal that allows leaders to sustain connectedness within and

among the organization. Leaders are ever being assessed, analyzed and scrutinized. Not only are the company owners (shareholders) seeking optimal returns, boards of directors are also demanding unprecedented results while employees are looking to be coached, promoted, complimented and supported, not to mention given clemency regarding mistakes. It is not unrealistic to assume that leaders contemplate the antagonizing aspects of these events ahead of their occurrence. This perspective is supported by Martin (1997), as cited by Boyatzis & McKee (2005), in the following comments: "humans have what many consider a unique ability to create their own stress by merely anticipating stress-inducing situations" (p. 206). In the most fundamental sense, the cycle of sacrifice and renewal has been presented to each of us from day one. As infants, we might be encouraged to accomplish a goal or task only later to be rewarded with something worthy of the sacrifice – a sort of renewal, if you will, for our efforts.

Another similar example is the typical sports drink commercial depicting an athlete, in some form, accomplishing a feat through physical exertion only to later be rewarded with a bottle of appropriately colored liquid consumed while in a position symbolic of achievement and gratification. In leadership, mental stress, unlike physical stress as described above, may be directly related to psychological health and well-being. Under the conditions of power stress, the "sympathetic nervous system (SNS)" is aroused which precipitates the "fight or flight" response as discussed in the context of EI. Combinations of certain types of stress encountered in the day to day leadership circle, are "said to increase the allostatic load" which can result in severe health issues. Under these stressful conditions, increases in "multiple neurotransmitters" occur which may also result in increased blood pressure (Boyatzis & McKee, 2005, p. 207). While power stress

implications may be most profoundly realized in the SNS, the "parasympathetic nervous system (PSNS)", when appropriately stimulated, is the system responsible for recovery from any such stressful condition. Such renewing stimulants may include "hope", "compassion" and "meditation" acting as a sort of "antidote to stress" (Boyatzis & McKee, 2005, p. 211).

The job of leadership is not one for the meek at heart. Not only are sacrifice and renewal integral for long term effectiveness, the leadership responsibility also requires self-discipline, a willingness to make the tough calls, an almost uncanny knack for providing brutally honest feedback and, perhaps most importantly, the ability to feel comfortable feeling uncomfortable. However, despite the vastness of a leader's soft and hard skill repertoire, nothing precipitates more respect from a leader than his or her credibility as will be discussed in the next section.

1.1.5 Transformational Leadership and Credibility

Despite the best business school preparation, only experience in the field can prepare an executive for the vicissitudes of leadership. Transcending these ups and downs of leadership is earned credibility which often serves as the predicate for leadership effectiveness. While the principal goal of this section is to discuss leadership credibility through transformational applications, primarily to allow for reader comprehension, we will also briefly address the TL style. Nystedt (1997), as cited by Korner and Nordvik, (2004) suggests that "behavioral styles have been elaborated into constructs such as charismatic, transactional, transformational and visionary leadership" (p. 49). Focusing on XL and TL styles, we find, according to Cilliers, et al. (2008), the

following distinguishing characteristics: "Transformational leadership – idealized influence, implies that followers respect, admire, and trust the leader and emulate his or her behavior, assume his or her values, and are committed to achieving his or her vision and making sacrifices in this regard...Transactional leadership – involves a social exchange process where the leader clarifies what the followers need to do as their part of a transaction (successfully complete the task) to receive a reward or avoidance of punishment (satisfaction of the followers' needs) that is contingent on the fulfillment of the transaction (satisfying the leader's needs)..." (p. 255). It might be argued that the characterization of XL is predicated on certain aspects of Maslow's needs hierarchy as will be discussed in a subsequent section of the current research.

Referring once more to TL, which is built on openness and engagement, Lo, Min and Ramayah, (2009) wrote, "transformational leaders [have] a more significant relationship with organizational commitment" (p. 137). Through motivation and workforce engagement, TL builds equity in the form of employee loyalty which serves the entire organization and its constituents. One very simple, yet often elusive, TL practice that facilitates organizational engagement is listening to the employees which enables four dimensions of effectiveness. First, the leader is able to gain an understanding of how employees view the world around them and thus, how they might interpret direction provided to them. Second, the leader is able to begin the process of connectedness (previously discussed), which enables the engagement process. Third, quite simply, the leader gains the respect of employees because they now feel that someone – one quite powerful in the eyes of the organization – cares about what they have to say. Finally, the leader gains insight as to what is really happening within the

organization and, depending on the employee's organizational hierarchy, critical operational details that might otherwise be overlooked are now made available to the leader. Listening to and engaging employees also sets the ground work for the leader to execute the "five practices of exemplary leadership: model the way, inspire a shared vision, challenge the process, enable others to act, and encourage the heart" (Kouzes & Posner, 2007, p. 14). To this point, we have discussed benefits resulting from leader engagement with the organization. However, engagement alone is not the panacea for leadership effectiveness; such interactions, particularly in the context of TL, are assumed to be authentic. With this in mind, resulting from the leader's behavior, an increased level of organizational integrity and morality should be realized and thus leadership credibility. Indeed, according to leadership attribute survey results referenced by Kouzes and Posner (2007), "for people to follow someone, the majority of constituents believe the leader must be honest" (pp. 29, 32). This perspective is appropriately aligned with characteristics of transformational leaders. Indeed, according to Burns (1978) as cited by Plinio (2010), "in transforming leadership, persons engage with others in such a way that leaders and followers raise one another to higher levels of motivation and morality" (p. 279). Integrity and honesty are the building blocks for leadership credibility which, according to Kouzes and Posner (2007), requires leaders to "practice what they preach, walk the talk, actions are consistent with their words, put their money where their mouth is, follow through on promises, and do what they say they will do" (p. 40). Another key attribute of TL, as mentioned above, has to do with creating a shared vision. In this context, a shared vision is one whereby the organization not simply marches to the drum beat, but also, picks up and carries the torch in one accord with ownership as though the

vision was crafted from the bottom up. Kouzes and Posner (2007), suggests that "visions are ideals" and as such, "they're expressions of optimism" which should "appeal to common ideals" (p. 133).

Returning to TL attributes, if correctly imparted, the organization should also assume the leader's values. The focus here is on shared and synchronized values which "are the foundations for building productive and genuine working relationships" and as a result of this approach, "tremendous energy is generated when individual, group, and organizational values are in synch" (Kouzes and Posner, 2007, pp. 60, 61).

Another attribute of the transformational leader is trust, as viewed by others and trust in others. This is an important leadership attribute and serves as a critical factor for leadership efficiency and resource optimization. Viewed in this way, when a leader assigns work within an organization she can do so with utter reliance on the worker to accomplish the task or, conversely, she can do so with follow-up and questioning in such a way as to importune the worker. In the latter case, work efficiency is reduced in two areas. First, the leader is now allocating time that could otherwise be used to accomplish other more strategic activities and second, the worker is now focused on the next intervening moment initiated by the leader and thus reverts to a sort of wait for direction mode, effectively slowing down the processing of the received input (refer to Figure 1 description of leadership systematization as discussed earlier). In addition to efficiency losses, trust, in either direction, is an essential component of effective leadership. Kouzes and Posner (2007) share this perspective with the following comments: "At the heart of collaboration is trust...without trust you cannot lead...you cannot get extraordinary things done" (p. 224). Trust and engagement, no doubt, add to the list of leader

credentials and aid her in moving toward the state of credibility. However, as is often the case, new leaders are expected to do more than the status quo. They are expected to convert lost revenues to new profits, to replace inefficiencies with productive operations, to modify, and in some cases eliminate, existing outdated infrastructure. In effect, leaders are expected to initiate and bring about profound and sustainable change. The transformational leader is adept at delivering in this regard. This perspective is shared by Crant and Bateman (2000), as cited by Den and Belschak, in the following comments: "transformational leaders are more change oriented and proactive themselves and thus may act as role models" (p. 195).

In the quest for credibility, perhaps the most assumed quality that a leader possesses is the intellectual wherewithal to stimulate the thoughts and creativity of others. Indeed, positioned correctly, learning is fun and employees do well to know that they can be taught new strategies, approaches and ways of thinking. Transformational leaders thrive on intellectual stimulation as supported by the following comments offered by (Bass, 1985; Avolio & Bass, 1988, 1990a, 1990b; Howell & Avolio, 1993), as cited by (Atwater, Avolio & Bass, 1996), "transformational leadership has been shown to include inspirational [and] intellectual stimulation" (p. 9). Finally, leadership credibility is also about caring for and supporting those whom the leader is entrusted to lead. The reader should not assume that listening (discussed earlier) is necessarily synonymous with caring as listening alone could, in some instances, represent a purely perfunctory event aimed solely at advancing the leader's agenda. Transformational leaders gain credibility through sincere actions and caring. According to Bass (1985, 1998), as cited by Liu, Siu

and Shi (2010), "transformational leaders...show their concern for their employees' individual needs for growth and development" (p. 457).

1.1.6 The Role of Psychology in Leadership

To initiate this discussion, let us recall the definition of psychology which may be summed up as human behavior characterization. In this context, perhaps leadership can be viewed as an attempt to positively influence the follower cognition and emotion such that they, the followers, feel good about themselves and, in turn, are motivated to execute their jobs with quality. To this point, we have discussed several approaches to leadership; we have visited theoretical leadership models and have discussed, among other things, available leadership tools. What remains an open area for discussion is how the cognitive process functions while interpreting the various leadership approaches. Why is it important to understand the role of the cognitive process in leadership, and more importantly why is leadership motivation necessary at all? One response to this question is that "it has been estimated that organizations suffer up to $370 billion in lost productivity every year in the United States alone due to workers not feeling engaged" (Lawrence, 2011, p. 15). Thus, an understanding of the cognitive process, coupled with the appropriate leadership motivation, offers the potential for tremendous returns.

We will continue under the premise that while intellect is a prerequisite for good leadership, it "alone will not make a leader; leaders execute a vision by motivating, guiding, inspiring, listening, persuading – and, most crucially, through creating resonance" (Boyatzis et al., 2002, p. 27). The section of the brain that controls and provides intellect is separate from the section that guides emotion. Yet, under the

appropriate circumstances, the two are integrated such that emotion takes over and, in effect, rules (Boyatzis et al., 2002, p. 29). It should not be surprising that the brain succumbs to emotion as emotion serves as the off/on switch for responding under stressful situations (e.g. the performance review discussion mentioned in the EI section of this paper). Indeed, the "thinking brain evolved from the limbic brain and continues to take orders from it when we perceive a threat or are under stress" (Boyatzis et al., 2002, p. 28). The problem with the brain is that it was originally developed to protect us from "physical" environmental threats. The brain is not innately structured to handle the stresses associated with a bad performance review or to respond to office politics. Importantly, though, one's ability to circumvent sudden and perhaps unwanted reactions in such situations is attributed to the brain's "executive center" or, neurologically speaking, the "prefrontal area" of the brain. This communication process also facilitates leadership effectiveness in the area of EI. The "circuitry" responsible for actions executed by the "executive center" also controls "drives" and "impulses." Unlike the process required for technical learning and skill development, emotional intelligence oriented skills are "best learned through motivation, extended practice and feedback."

The emotional, or limbic, side of the brain is far less developed than the "thinking brain" (the side that aids in technical learning). As a consequence, a great deal of limbic learning results from repeated exposure and early behavior introductions. This early information is accessed through maturity and in such a manner, "as if it were factual." Thus, decision making is predicated on our cultural preferences and biases which could very easily result in disconnects with contemporary environments. As leaders, the same bias carries forward in the direction that we provide to others, and as followers, our

cultural biases serve as the basis for how we interpret information received from leaders. These comments, however, are not at all intended to suggest that the brain cannot be taught to act in an emotionally responsible manner as "human brains can create new neural tissue as well as pathways throughout adulthood" (Boyatzis et al., 2002, pp. 28, 29, 102, 103; Bailey, 2007, p. 130). In the preceding discussion, the executive center and its relationship to the prefrontal area of the brain was discussed. When a new idea is presented, say a new sales goal or mission, this area of the brain is asked to consider this new information and compare/contrast it with prior similar information (e.g. the old sales goals or mission). Another part of the brain, "the basal ganglia" are engaged for routine activities (e.g. driving a car) and represents the part of the brain that stores habits and routines. Under change conditions, however, (e.g. driving a car on the left side of the road) the prefrontal cortex becomes active. This same "cognitive dynamic" occurs when employees are exposed to organizational stresses and change. The norm is for "our brains" to descend toward that with which we are familiar and comfortable. Thus, under change conditions or, in particular, conditions that deviate from expectations, the brain "emits strong signals" reflecting acknowledgement of the deviation. The part of the brain in which these deviation signal emissions occur is the "orbital frontal cortex", situated within proximity of the "brain's fear circuitry." The occurrence of such signal emissions can precipitate emotional or impulsive responses propelling us to the fight or flight behaviors previously discussed. Some have posited that change behavior can be accomplished via "behaviorism" oriented approaches. One such example here would be to associate a desired behavior with a reward of sorts (e.g. a carrots and sticks approach)

which, despite its convincing appeal, has been disproven as effective based on clinical research (Rock & Schwartz, 2007, pp. 11, 12; Bailey, 2007, p. 130).

Given the complexities of the human brain, it is imperative that effective leaders make appropriate connections (recall discussions regarding resonance) with those whom they lead toward change and, very often, communication serves as the enabler for such connections and must therefore be executed with the utmost care and scrutiny. This perspective is shared by Kussrow (2001) as he writes, "since it is people's brains that leaders try to influence...it follows that it is critical that the individual being [led] accurately interprets what the leader intended to communicate" (p. 10). Within this communication should be options and choices for followers – a sort of participative versus dictatorial style of leadership. The reason for this is that "humans have a social brain that loves to anticipate, to be given choices" (Kussrow, 2001, p.10). Despite the brain's desire for expectation and variation, humans bring to the table old habits that are often very difficult to change. Such includes less than optimistic habits about planning and executing their diurnal responsibilities, about meeting project deadlines and about not only solving old problems but also proactively identifying and resolving those latent problems. These attitudes are assumed to be the norm. Indeed, "changing behavior is hard, even for individuals and even when new habits can mean the difference between life and death" (Rock & Schwartz, 2007, p. 10). Each and every organization comprises individuals with disparate habits and varying levels of organizational commitment. Thus, it is not at all surprising that any attempt to change an organization's mindset may be extremely difficult. To this point, "organizational transformation that takes into account the physiological nature of the brain, and the ways in which it predisposes people to resist

some forms of leadership and accept others [may offer the best chance for success]" (Rock & Schwartz, 2007, pp. 10, 11).

In previous discussion regarding the annual performance review, and the respective disappointment, the focus was on the recipient (subordinate) and suggested that the opportunity for the application of EI rested with the follower. However, given the foregoing discussion regarding the limbic system and its relationship to EI, an alternative perspective would be to view the ownership for a successful discussion to rest with the deliverer (superior). Said differently, the superior's cognizance of how the limbic system functions, coupled with his maturity in EI, affords him the opportunity to change the conversation at the outset so that the subordinate needn't encounter the fight, flight, freeze syndrome.

Leaders should also be cognizant of the four basic drives of leadership. According to Lawrence (2011) these include the drive to acquire, defend, bond and comprehend. While the drives to acquire and defend are principally concerned with survival and self-preservation, the drives to bond and comprehend focus more on relationship building and individual perception respectively (p. 13).

With this in mind, as a leader, if something does not progress consistent with plans or expectations, (e.g. sales results do not meet forecast levels), the "drive to defend" may result in the leader overlooking key information that might otherwise provide clues as to why the sales forecast did not come to fruition. It is only through a leader's cognizance of where he or she is in such a situation that will allow engagement of the executive center, as discussed earlier, to appropriately respond. Building on this point, according to Lawrence, (2011) "to be effective, leaders must take into account how the

four drives affect the following group characteristics: purpose, competencies, trust building [and] motivation" (p. 14). Returning to the performance review discussion, in the absence of a "good review," an employee could perceive this as a threat to the right to acquire. This could logically give rise to the development of barriers to trust building with the leader. Another perspective with regard to human requisites is offered by Maslow's hierarchy of needs. According to Ivancevich & Matteson (1993), Maslow's five stage model includes the following five human needs positioned hierarchically: 1) physiological, 2) safety and security, 3) belongingness, social and love, 4) esteem, and 5) self-actualization. While an extensive review of the five stages is left to the reader, it is worth mentioning that, returning once again to the performance review discussion, the threat to an employee's right to acquire (e.g. a good performance rating) could also represent a threat to physical needs including "food and shelter" (p. 143). (The reader may recall previous references to Maslow's needs hierarchy and XL.)

Food and shelter, of course, represent those components essential for meeting human physiological needs. One might question the relevance of physical or biological needs to the topic of psychology. The bearing of such is actually quite simple and is perhaps best explained leveraging a recent natural disaster – Hurricane Sandy. Coverage of the hurricane aftermath portrays the victims as missing the most fundamental of human needs: "food, drink, shelter and relief from pain" (Ivancevich & Matteson, 1993, p. 143). Yet, the degree to which these needs no longer exist is, in reality, somewhat psychological and relative. For example, some of the victims, despite having lost homes, were provided shelter and food by philanthropic organizations such as the Red Cross. Thus, the reality is that while the victims no doubt suffered hardship, in the purest sense

of Maslow's hierarchy of needs, the first level in the needs hierarchy, with the assistance of others, continues to be met. This disconnected observation may be attributed to the realization of a tempered perception based on a pre-hurricane frame of reference. In this way, psychological factors may certainly give rise to feelings of pessimism. Indeed, many third world cultures would find great solace with the levels of post hurricane provisions (also addressing Maslow's first hierarchical need of food, water, and shelter), as were afforded to those impacted by hurricane Sandy. Psychology affects perception and perception, in turn, is linked to motivation. Effective leadership, therefore, must also address the notion of perceptions and instilling feelings of optimism.

It was not at all the intent of the foregoing comments to downplay or otherwise undermine the significance and disruption caused by Hurricane Sandy. Without a doubt, enduring such an event was a tremendous psychological and biological injustice to all impacted. The intent was, instead, to highlight the power of perception and how important it is for leaders, albeit operating in starkly different environments from the one discussed, to be cognizant of psychological influences and motivations. Leadership might be simplified were it more predictable thus optimizing the prospective leader succession list. The next section addresses construct based methods for the identification of certain leader attributes.

1.1.7 Predicting Leadership Behavior

Although advancement has been made in the area of predicting leadership behavior, based on psychometric modeling, the fundamental concept is not new. According to Lynam and Miller (2001), "since its inception, the field of personality

research has been concerned with identifying the basic traits that serve as the building blocks of personality" (p. 767). Among some of the most researched behavioral models are the Five-Factor Model (FFM) – McCrae and Costa (1990); Three Factor Model (PEN) – Eysenck (1977); Three-factor model – Tellegen (1985); Temperament and Character Model – Cloninger et al., (1993), (Lynam & Miller, 2001, p. 767). Lynam and Miller (2001) also suggest that the basis for these models ranges from "lexical hypothesis" associated with the FFM to "factor analysis and mood scales," employed by Tellegan, to "biological/pharmacological," associated with the Cloninger and Eysenck models (p. 767 -768). There is also the Myers-Briggs Type Indicator (MBTI) – Briggs and Myers, which, according to Carlson (1985), "is a test designed to implement...theory type...therefore, like the projective techniques, the MBTI is closely allied with psychodynamic thought, at least in its original conception" (p. 365). It is appropriate at this point to expand discussions regarding the FFM which is, according to Costa and McCrae (1992), as cited by Kornor and Nordvik (2004), "a hierarchical model of personality traits with five big traits called domains on the top, that is, Neuroticism, Extraversion, Openness, Agreeableness, [and] Conscientiousness" (p.49). According to Levine and Raynor (2006), each of these five domains is further defined as follows: "openness – refers to intelligent, imaginative, curious, flexible and broad minded. Conscientiousness – refers to striving for competence and achievement, and being self-disciplined, orderly, reliable, and deliberative. Extraversion – refers to enjoying the company of others, and being active, talkative, assertive and seeking stimulation. Agreeableness – refers to being courteous, good natured, cooperative, tolerant, and compassionate rather than antagonistic. Neuroticism – refers to easily experiencing

unpleasant and negative emotions, such as fear, anxiousness, pessimism, sadness, and insecurity" (p. 73).

There has been much discussion regarding the FFM and its ability to predict leadership or other behavior based traits (e.g. conscientiousness). To this end, according to Srivastava (2010), "my thesis is that we will never really understand the Five-Factor Model until we more fully come to grips with the scientific implication of lexical hypothesis" (p. 69). However, as also pointed out by Srivastava (2010) "...the Five-Factor-Model is first and foremost a model of social perceptions" (p. 69). Srivastava's position is somewhat supported by Saucier and Goldberg (1996) as they stated, "the big five [FFM] are dimensions of perceived personality." Also, D.W. Fiske (1994) wrote, as also cited by Srivastava (2010), that the FFM is useful for "the analysis of how people perceive people and what words they use in formulating such perceptions" (p. 70). Considering the breadth of the English language, it is perhaps unthinkable to consider that the lexical approach may be constrained in its capacity to fully describe personality traits, yet words are just that and how they are interpreted from one human being to the other is not as consistent or black and white as their use might suggest. An analogy to this thinking is offered by Palmer (1999) and Adelson (1990), as cited by Sricastava (2010), in the following statement: "But color perceptions have unique qualities and special relationships that do not purely reflect the extra human physical world, and the perceptual processes that ordinarily help us perceive color can lead to errors under some conditions" (p. 70). Inconsistencies of interpretation notwithstanding, the comments offered by Srivastava, as well as his cited sources in this area, precipitate recollection of an adage that we have all heard: "perception is reality." Thus, valid as arguments may be, existing

on both sides, the FFM construct is quite relevant to the core of this paper as it evidences the capacity to offer individual behavior validity through observation.

Having laid a comprehensive foundation for leadership, leadership styles and measurement constructs, the next section advances the purpose of the current research in the area of leadership style.

1.2 Purpose

The intent of this quantitative methods study is to determine the relationship, if one exists, between engineering education and leadership style. The independent variable, engineering education, is defined by CPMs and non-CPM managers with engineering degrees and the same without engineering degrees. Thus, engineering degrees are expected to serve as a surrogate for engineering education. Predicated on the above theoretical discussions, the dependent variable, leadership style, is defined in the context of transformational and transactional. The interval based Multifactor Leadership Questionnaire (MLQ) (see Appendix B) will be employed to assess the presence of the dependent variable among the targeted population. Although doing so is beyond the scope of the current proposal, results from this study may serve as the impetus for further research aimed at addressing the broader question of whether or not a relationship exists between engineering skills and effective leadership.

1.3 Problem

Many Fortune 500 companies employ specific programs aimed at developing the core skills and business acumen for future organizational leaders. Such programs are typically referred to as Leadership Development Programs (LDPs). Often times, these same companies employ multiple LDPs. General Electric, for example, offers LDPs in the areas of Communications, Finance, Information Technology, Manufacturing Operations and Sales and Marketing. Each LDP necessitates dedicated infrastructure for its respective execution which, in turn, requires resource allocation that is often redundant. If multiple LDPs could be supplanted with one LDP, leveraging highly talented entrants, economic benefits would be realized through reduced infrastructure for the support of multiple programs. Intuitively, engineers are potentially an excellent feeder pool for such a replacement program as they are tremendous thinkers and, given the rigor of their curriculum, have demonstrated resolve in the face of complex problems and challenges.

Thus, the author's aim is to determine the role, if any, that engineering education plays in perceived leadership style as exhibited by CPMs and non-CPMs holding engineering degrees (e.g. EE, ME, IE, etc.) versus the same without engineering degrees. A secondary goal is to determine, within the management category, which style (transformational or transactional) serves as the dominant style of leadership. With this in mind, the independent variable, CPMs with and without engineering degrees, is operationally defined consistent with Project Management Institute's Project Manager Professional (PMP) certification as documented per the web address: http://www.pmi.org/en/Certification/Project-Management-Professional-PMP.aspx. Non-

CPM managers are operationally defined as those, with and without engineering degrees, from whom direct reports or matrix level reports receive their day-to-day work assignments. The integration of these groups would be operationally defined simply as the integrated population with and without engineering degrees. Leadership style, the dependent variable, is operationally defined by the transformational and transactional leadership constructs consistent with discussion in Section 1.1.5 above. As mentioned, TL includes influence and motivation while XL focuses on rewards and punishment avoidance.

1.4 Method and Procedure

Employing a quantitative approach, the proposed research seeks to assess leadership styles (transformational and transactional) as a function of engineering education. To minimize noise associated with this proposal, the author has elected to measure leadership styles among several populations: CPMs, non-CPM managers, the integrated population with engineering degrees, and the same without engineering degrees. Thus, the critical research questions are as follows.

1. Does the integrated population with engineering degrees exhibit a leadership style that statistically differs from the leadership style of the integrated population without engineering degrees?
2. Does a predominant style of leadership (transformational or transactional), emerge when comparing the two populations (managers with and without engineering degrees) and, if so, what is it?

The H1 hypothesis associated with this study is: There is no statistically significant difference between leadership styles of managers (CPMs, non-CPM managers or the

integrated manager group) with engineering degrees versus the same without engineering degrees. The H2 hypothesis is: No predominant style of leadership is evident among CPMs, non-CPM managers or the integrated population with or without engineering degrees. In an effort to address hypotheses H1 and H2, sample population descriptive statistics were formulated and tested employing parametric statistical approaches. In particular, the independent sample's t-test was used for the comparison of population means for perceived leadership style scores, analysis of variance (ANOVA) was employed to test multiple comparisons of perceived mean leadership style scores, and the one sample t-test was used to test perceived mean leadership style scores versus a gold standard.

The research environment was the domestic manufacturing environment facilitated by the internet. Leveraging Survey Monkey, an on-line survey resource, the MLQ questionnaire (see Appendix B for original sample form supplied by Mind Garden), was issued to raters who reported directly or on a matrix basis to managers as described above. Approval to conduct this human subject research was approved by the Old Dominion University Internal Review Board (ODU IRB) as evidenced by authorization as per Appendix F. The survey process, available in Appendix D, required the submission of participant profile information to the survey hosting company Survey Monkey. The hosting company then selected the participants based on the profile data provided. Based on discussions with the hosting company, it was believed that the greatest opportunity for yielding the desired sample population was to solicit participant responses from the manufacturing industry. Participants were directed to the Survey Monkey site and given the option to participate in the survey (see Figure 2 below) or exit

the survey. The completed surveys were retrieved by the researcher for compilation and analysis. The experiment utilized five (5) point Likert type scale based questionnaires as shown in Appendix B to capture leadership style results for each of the manager categories with engineering degrees and the same without engineering degrees. In order to collect applicable demographic information, the questions listed on the sample form in Appendix B were modified by the researcher and posed to the subjects as shown below. Additionally, operating within the spirit of the ODU IRB approval, all questions that would otherwise allow for the identification of the participant, or the individual being rated by the participant, were removed from the modified and issued MLQ. Shown in Figure 2 are the questions 1 – 3 which were designed to first document the voluntary participation in the research and to subsequently collect demographic information for use in future research.

Figure 2: Researcher Questions 1 - 3.

*

1. Do you agree to voluntarily participate in this study?

- Yes, I agree to participate in this study
- No, I do not agree to participate in this study

2. What is the gender of the person from whom you receive your day to day work assignments?

- Male
- Female

3. What is the race of the person from whom you receive your day to day work assignments?

- Caucasian / White
- African American / Black
- Hispanic
- Asian
- Other

Referring to Figure 2 below, question 4 sought to collect additional demographic data while question 5 was intended to buttress responses to subsequent researcher questions.

Figure 3: Researcher Questions 4 and 5.

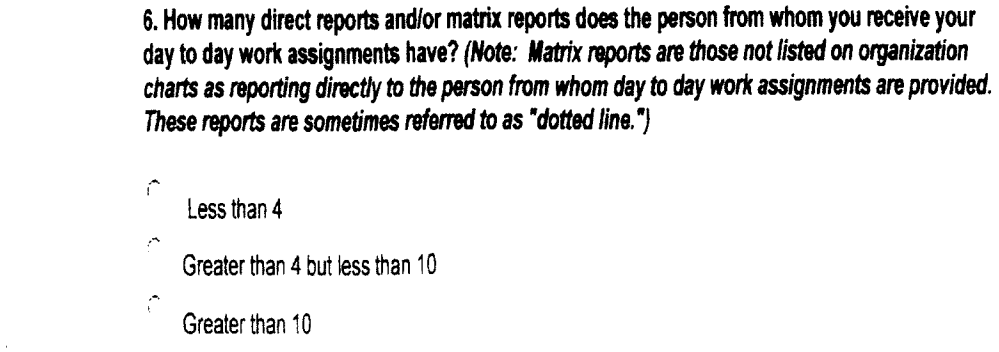
4. Approximately how many years of management experience does the person have from whom you receive your day to day work assignments?

- Less than 4 years
- Greater than 4 years but less than 10 years
- 10 or more years

5. What is the organizational title of the person from whom you receive your day to day work assignments (e.g. Manufacturing Manager, Production Manager, Engineering Manager, Project Manager, Group Leader, etc.)?

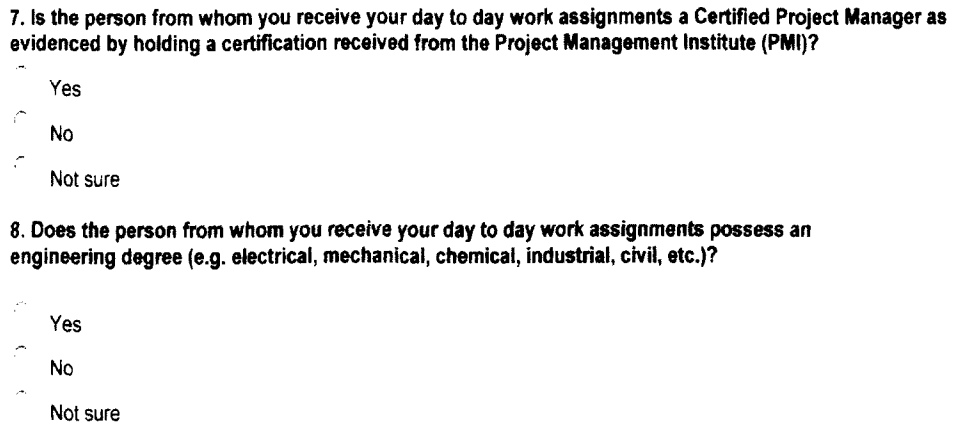
The aim of researcher question 6 (see Figure 4 below) was to establish the span of control for the individual being rated.

Figure 4: Researcher Question 6.



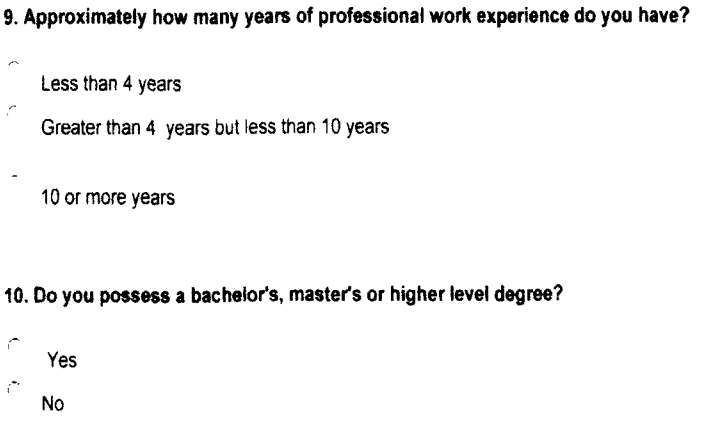
Questions 7 and 8 (see Figure 5 below), were the most critical to the current research. The initial research approach was to establish a sample population of CPMs with and without engineering degrees. Thus, in question 7, the rater was asked to identify the PMI certification status. The aim of question 8 was to establish whether or not the individual being rated possessed an engineering degree as well as the type of such degree. In both questions, the option "not sure" was introduced to assure the highest possible integrity of the responses.

Figure 5: Researcher Question 7 and 8.



Questions 9 and 10 (see Figure 6 below) were included to assist in determining possible areas for future research.

Figure 6: Researcher Question 9 and 10.



CHAPTER 2

BACKGROUND OF THE STUDY

The notion of transformational and transactional leadership being theory is not as commonly accepted as, for example, the theory regarding relativity. Indeed, (Barling et al., 2010) stated of this perspective regarding TL, "we use the word theory because it is most familiar to practitioners, but we acknowledge that much of the new research reviewed in this chapter would not fit that work in its strictest definition" (p. 32). Notwithstanding arguments regarding the application of theory in this context, literature addressing the theoretical foundation of leadership abounds.

Effective leadership is not simply about implementing canned tools, models, or applying the traditional carrot and stick rules. Despite the approach employed, any effective attempt at leadership must take into account the psychology of leadership – the cognitive process as previously discussed. Avolio and Bass (2004) reported that "when all levels of managers, students, and project leaders around the world were asked to describe the characteristics and behaviors of the most effective leaders with whom they had worked in the past" the characterizations were more transformational than transactional. Among the specific descriptors used for these leaders were "inspirational, intellectually stimulating, challenging, visionary, development oriented, and determined to maximize performance" (p. 3). These characterizations essentially mirror the five constituent elements of TL. Thus, the presence of these attributes in any one or more of the tested groups might also identify a leadership feeder pool for future effective leaders.

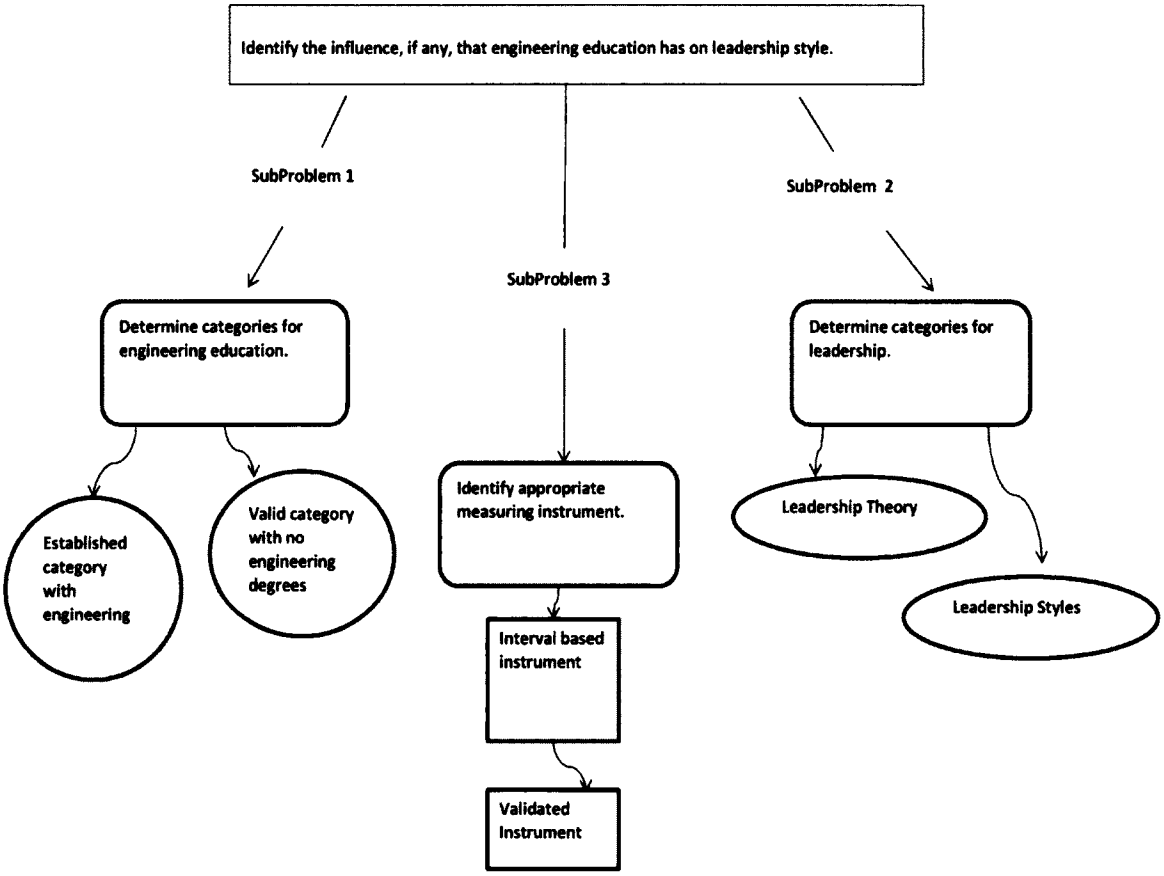
Precedent for assessing the presence of transformational and transactional leadership attributes in the general area of leaders and followers (e.g. project teams) is provided by Hoyt and Ciulla (2004), as cited by (Brooks, Levine & Muenchen, 2010) with the following comments, "transformational leadership ...examines the relationship between the leader and the followers and focuses on issues relating vision, risk-taking, enthusiasm and confidence" (p. 577). Similar sentiments exist regarding the XL style as it, too, assumes a leader – follower environment for its execution.

2.1 Literature Review

Aimed at facilitating research toward addressing the above purpose statement, a literature tree was developed and implemented. As indicated in "Figure 7" below, the first step in addressing the main problem was to determine appropriate categories, "sub-problem number 1," that may afford statistical comparisons between representative groups of candidates possessing engineering education and those without such education. The author searched literature databases for books, journals, etc. in the area of engineering oriented leadership categories. Here, the author sought to identify such categories that are commonly recognized and positioned in a leadership hierarchy. In an effort to further minimize potential noise, incumbent criteria (e.g. project management certification) were established. Thus, CPMs with and without engineering degrees served as one comparison set within the independent variable. Next, (see sub-problem 2 below), a similar search of literature databases (e.g. books, journals, etc.) was conducted in the area of leadership. The aim was to identify references to leadership theory that are commonly understood to be both observable and quantifiable. Thus, transformational

and transactional leadership styles (comprising the dependent variable) were selected for assessment when considering the target population - CPMs and non-CPM managers with and without engineering degrees. The final step in this area, (see sub-problem 3 below) leveraging the literature reviews, was to identify Likert type scale based survey instruments that were commonly regarded as validated per scholarly and peer reviewed writings. As will be discussed in subsequent sections, the Multi-Leadership Questionnaire (MLQ) was employed for leadership style assessment.

Figure 7: Literature Review Tree for Proposed Research.



2.1.1 Literature Review Detail

While literature reviews to date provide much insight regarding the areas of project management and leadership style, such reviews have not identified a study, or studies, assessing the extent that engineering training may, or may not, influence leadership style. This perspective is substantiated by a literature review conducted in support of the current research proposal. Table 1 below reflects the keywords employed, and databases interrogated, in search of literature on the topic.

Table 1: Database Searches Versus key Words.

Data Base	KeyWords
Google Scholar, JSTOR, IEEE, IEEE Xplore, Academic Search Complete	Project Management & Transformational Leadership
Google Scholar, JSTOR, IEEE, IEEE Xplore, Academic Search Complete	CPMS and Transformational Leadership + CPMS & Transactional Leadership
Google Scholar, JSTOR, IEEE, IEEE Xplore, Academic Search Complete	CPMS and Transformational Leadership + CPMS & Transactional Leadership
Google Scholar, JSTOR, IEEE, IEEE Xplore, Academic Search Complete	CPMS and Transformational Leadership
Google Scholar, JSTOR, IEEE, IEEE Xplore, Academic Search Complete	Engineering Project Managers and Transformational Leadership

Resulting from the above search, thirteen articles were retrieved as indicated in Table 2 below (a more comprehensive assessment of findings is provided in Appendix A).

Table 2: Consolidated Literature Review Results and gap Identification.

Article No.	Assessment of PM TL	Assessment of PM XL	Assessment of TL		Assessment of XL		Engineering Degree
			Certified PM's	Non-Certified PM's	Certified PM's	Non-Certified PM's	
1	X	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
2	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
3	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
4	X	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
5	X	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
6	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
7	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
8	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
9	X	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
10	X	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
11	X	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
12	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
13	X	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*

From the above table it is clear that while much research has been implemented in the area, little to no categorization of the raters, or those being rated, was identified. Thus, it is not known, for example, whether or not the project managers were certified nor is the level and or type of education documented. As a point of fact, of the thirteen retrieved articles, only six demonstrated evidence of project manager assessment for TL and of those (see Appendix A), four either only assessed one factor, were gender biased, or did

not specifically point to the subject being assessed as the project manager. Likewise, while assessments of TL were present in all articles retrieved, ten of the thirteen either referenced other studies, only assessed one factor, assessed portfolio managers, or were gender biased.

2.2 Literature Review – Beyond the Gap

Notwithstanding the lack of categorization of the sample group as discussed above, the reviewed literature does offer insights as to the potential for linkages between project management and various leadership styles including transformational and or transactional leadership (Deanne, Hartog & Keegan, 2004; Ryoma & Tapanainen, 1999; Neuhauser, 2007; Muller & Turner, 2010; Prabhakar, 2005; Kissi, Dainty & Tuuli, 2013). Attempting to assess the presence of TL within leader subordinate group is quite prevalent. Indeed, according to Deane et al. (2004) "transformational leadership is a concept that has come to prominence in the last two decades" (p. 610). And, while Deane et al. (2004) hypothesized that "transformational leadership style is positively related to employee commitment and negatively to employee's perceived stressfulness of the job" (p. 612), Muller and Turner (2010) found that "transformational leadership, and concern for people, is necessary on more-demanding projects" (p. 446). Although the former hypothesized relationship was not supported by study results, taken in concert with findings by Muller and Turner (2010), such might suggest that TL style becomes even more important as project demands increase, particularly with regard to motivation which is a key component of the TL style and which is also respectively measured by the MLQ instrument (Schriesheim et al., 2009, p. 608). Notwithstanding Muller and Turner

(2010) hypothesizing that "the project manager's leadership style influences project success and that different leadership styles are appropriate for different types of projects" (p. 12), they also cite studies suggesting that motivation falls under the emotional competency category also advancing a slightly different leadership style construct. In this vein, Dulewicz and Higgs (2003), as cited by Muller and Turner (2010), "identified fifteen [competencies] which influence leadership performance". They group the competencies into three competence types, which they term intellectual (IQ), managerial (MQ) and emotional (EQ)" (Muller and Turner, 2010, p. 23). While Neuhauser (2007) held a view of leadership style more aligned with transformational and transactional, the role that gender may play in leadership style was also brought to light. In particular, it was stated that "there is a body of research that suggests that men and women exhibit different leadership and interpersonal communication styles" (p. 23). Neuhauser (2007) also cited Rosener (1990) who "found that women tend to use transformational leadership more than men" (p. 23). Yet, as also pointed out by Neuhauser (2007), "the behaviors identified as the most important (absolutely vital and important) [in project leadership included attributes of] transformational, [and] transactional [leadership]" (p. 25). As previously referenced, one of the key aspects of TL is providing a clear vision. Indeed, according to Lussier and Achua (2009), as cited by Spieth, Tyssen and Wald (2013), "a transformational leader focuses on people and their motivations, beliefs, and behaviors, and provides them with visions that satisfy their needs and desires" (p. 5). Similarly, Christenson and Walker (2004) concurred arguing that "a significant driver of project management success is effective and intelligent leadership communicated through an inspiring vision of what the project is meant to achieve and how it can make a significant

positive impact" (p. 57). And, in so much as vision is subsumed by TL style, it could be argued that TL is therefore instrumental in project success. To this end, Kissi et al. (2013) hypothesized that "transformational leadership behavior of portfolio managers positively influences project performance" (p. 487). Study results offered support for this hypothesis as follows: "transformational leadership [has] a significant and positive relationship with project performance ($\beta = 0.328$, ρ b 0.001) and explains 10% of the variance in project performance" (p. 491). Thus, the linkage exists between TL and project success. Andreas et al. (2013) went a step further in defining the linkage between project leadership and project performance hypothesizing that, "transformational leadership behavior will be especially effective in projects that have strong goal clarity rather than path-goal uncertainty [and that such leadership] will be especially effective in short project durations" (p. 4). However, despite apparent literature based support offered for the propositions, the authors also stated, "we have not yet empirically confirmed these findings...we thus advocate the empirical testing of our propositions" (p. 7). To this point, the literature review has, for the most part, focused on the project manager and, as such, assumptions have been made regarding the team. Haung et al. (2011) built on this thinking specifically addressing the relationship between leadership style, teamwork and project success. They hypothesized that "the project manager's leadership and teamwork (in terms of team communication, collaboration and cohesiveness) are correlated [that] teamwork (including team communication, collaboration, and cohesiveness) and overall project success are correlated [and that] project type may act as a moderator between teamwork and overall project success" (p. 260). Reflecting on these hypotheses, it would appear logical that the more unified the

team the greater the chances are for success. Accordingly, Haung et al. (2011), referring to their study results, found that "the results from this analysis suggest that all three composite measures (project manger's leadership, teamwork, and overall project performance), are highly correlated" (p. 263). Thus, these comments might suggest that while leadership style plays a very critical role in project success, it is the team's reception of that style which serves as the impetus for such success. Building on the importance of the team's view and acceptance of project manager leadership style, Bennet (2009) hypothesized that "there is a relationship between the subordinate's perception of leadership style of IT managers and the subordinate's perception of IT managers to inspire extra effort" (p. 11). Not only was a strong correlation identified between TL and extra effort, the study also found that "transformational leadership subscales of idealized influence (attributed), idealized influence (behavior), inspirational motivation, intellectual stimulation and individualized consideration also had strong correlations" (p. 11). Despite that apparent and logical linkage between leadership style and project success, and as a sort of moderating factor, Muller and Turner (2005), "were commissioned by the Project Management Institute to determine: 1) whether the competence, including personality and leadership style, of the project manager is a success factor for projects; and 2) if different competence profiles are appropriate for different project types" (p. 49). Among the study findings were the following comments, "it is conceivable that the leadership style and competence of the project manager have no impact on project success, and the unique, novel, and transient nature of projects (as well as the risk involved) means the leader has less of an impact on performance. But that question can only be answered if it is directly measured" (p. 59). Thus, while the

preponderance of the literature reviewed does point to a potential linkage between TL and project leadership, it does not provide clear categorical evidence regarding the role that engineering education plays in leadership style exhibition nor does it address the project manager credentials. These two opportunity areas will therefore be addressed by the current research.

In the spirit of implementing research that contributes to the body of knowledge, an additional literature review was conducted considering the expanded sample population (managers without PMI certifications). Databases interrogated were Google Scholar and EBSCO Discovery Service. Employing grouped keywords such as "transformational leadership and engineering education" or "leadership style and engineering education" or "transformational leadership and engineers," as well as similar keyword terms, no relevant existing literature was identified on the topic. The author was successful in locating articles that focused on TL and the education sector as well as one article (supplied by Sibel, Olga, Alabart, & Medir, 2013) which focused on allowing fourth year engineering students who were enrolled in a "project management course, the opportunity to develop their team leadership competencies" (p. 66). Another article authored by Collado, Laglera, and Montes (2013) conducted structural equation model testing to assess the "effects of leadership style on engineers" (p.7). However, this Spain based study did not assess the leadership style of the engineers themselves. Instead, it assessed the effect of the engineers' superior's leadership style on the engineer's attitudes as subordinates. Consequently, the current research, even considering the expanded sample population, addresses a gap in the literature regarding the relationship, if any, between engineering education and leadership style.

CHAPTER 3

METHODOLOGY

A quantitative method was employed in the current study. And, as mentioned previously, Likeret based survey instruments were employed to collect data for population of the two category distributions (managers with and without engineering degrees). Survey Monkey, an on line survey company, was enlisted to identify participants belonging to the categories of interest. The survey was "cross-sectional with the data collected at one point in time" as espoused by Creswell (2009, p. 146). During the initial planning, the author considered various tools associated with the qualitative method (e.g. interviews) for collecting category data. And, while interviews would certainly allow for researcher insertion and possibly add context to data collected, such an approach can be quite protracted and cost and time prohibitive. For example, assuming an n = 100 per category, such would require as many one-on-one interviews. This also assumes, of course, that the author is able to secure time with each of the interviewees across varying corporate and possibly geographic environments. There is also the potential issue of noise inherent with in person interviews. For example, were the author to conduct such interviews, interpretations of responses would be tied to the author's views of the world which may not necessarily be aligned with the views of those being interviewed. This perspective is shared somewhat by Noonan (2013) in the following comments regarding disadvantages of interviews, "the researcher's views can influence the participant's responses by expressing surprise or disapproval" (p. 29).

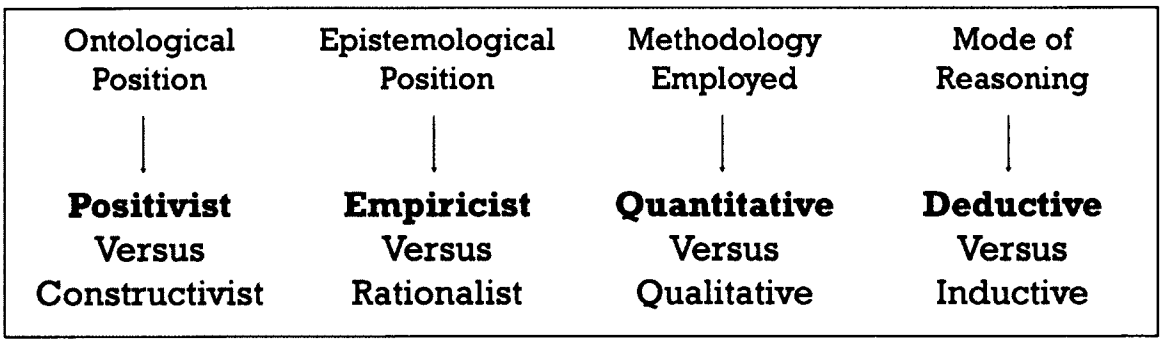
Thus, the author elected to implement a purely quantitative methods approach in conducting the current research.

3.1 Literature Review - Research Paradigm

Figure 8 below models the selected research paradigm for the current study to include the worldview or ontological position as well as the epistemological stance, the method employed and the mode of reasoning selected. Creswell (2009) talked about the need for positivists to identify and assess causes that influence outcomes which aligns with the current research plan relative to engineering education and leadership style. This, of course, can only occur empirically through others' observation of leadership style as was the case employing the MLQ. Although some may argue the objectivity of results predicated on individual observation and suggest that such more closely aligns with a qualitative methodology, that the current research quantifies the survey results begins to shift the plan to the quantitative method. Many scholarly writings support this perspective including Leedy and Ormond (2013) who stated that, "a quantitative researcher typically tries to measure variables in some numerical way [including] tests, questionnaires [and] rating scales" (p. 95). Creswell (2009) regards this approach as residing in the quantitative space as well stating, "a survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (p. 145). Likewise, Hathaway (1995) also sanctioned the use of surveys in quantitative research by stating, "a quantitative approach [includes] surveys and statistical analysis of responses [versus] qualitative approach (e.g., transcription analysis of interviews)" (p. 536).

Because the current research was not seeking to develop a theory of leadership but, instead, test an existing theory, the mode of reasoning was clearly deductive versus inductive. Support for this position was offer by Popper (1992) as cited by Siangchokyoo and Sousa-Poza (2012), stating "during the deductive research process, the researcher stipulates and idea (hypothesis), performs some form of experimentation, and collects data to verify if the results are consistent with the postulated hypothesis" (p. 718).

Figure 8: Research Paradigm.



Consistent with the above referenced positivist world view, four basic rules, or cannons, were also selected for the current research. First, there must be internal validity such that the author is able to draw accurate conclusions regarding any of the relationships presented in the data. Second, the study must also have good external validity which, in turn, would allow the results to be generalizable to the broader context. Implementation of this second cannon is supported by Leedy and Ormond (2009) who stated, "researchers contribute more to humanity's knowledge about the world when they conduct research that has implications that extend far beyond the situation being studied" (p. 103). Third,

particularly as it relates to the measuring instrument, in this case a survey questionnaire which will be discussed in detail later, the research has to provide reliable results.

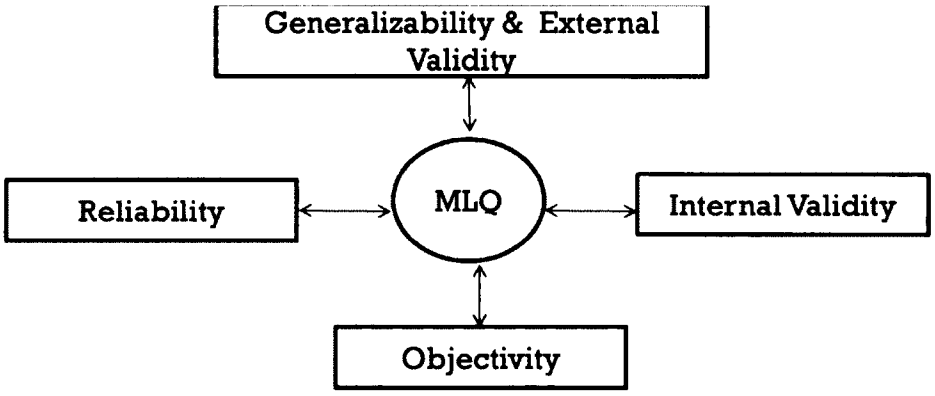
And finally, the research must provide objectivity. Thus, as mentioned above, the positivist position was taken with the current research resulting in the development of data consistent with mind independent review and neutrality. Enabling the objectivity platform on which the positivist approach is founded, is the objectivity of findings predicated on implementation of a measuring instrument with proven validity and reliability as will be discussed in the next section.

3.2 Measuring Instrument

Indeed, as previously discussed, there are many instruments (e.g. FFM) that may be used to measure leadership style. Critical to the instrument chosen, however, is its reliability and validity. Leedy and Ormond (2013), offered support for this perspective stating, "regardless of the type of scale a measurement instrument involves, it must have both validity and reliability for its purpose" (p. 89). Likewise, "although individuals may have different views in terms of what constitutes psychometric adequacy, most people can agree that a measurement is only useful to the extent that it provides meaningful information about individuals" (Briesch, Chafouleas & Swaminathan, 2014, p.14). Creswell (2009) added to the discourse stating, "to use an existing instrument [the author should] describe the established validity and reliability of the instrument [which includes] reporting efforts by authors to establish validity" (p. 149). Figure 9 below, reflects the

interconnectedness of the relationships between and among the instrument of choice and the critical components of validity, reliability and objectivity.

Figure 9: Instrument Reliability and Validity.



Prior to initiating discussions regarding instrument validity and reliability, it is appropriate to first visit the MLQ in the context of Full Range Leadership Theory (FRLT). Pioneering authors of leadership theory such as Bass and Avolio determined that more was needed than leaders simply providing rewards for subordinate behavior characterized by XL. They also identified the need to understand how leaders influence followers to set aside self-interests for the good of their organizations through optimal levels of performance. Early expansions in leadership theory included five TL factors, three XL factors, and one non-transactional Laissez-faire leadership component (Antonakis et al, p. 264). The contemporary FRLT model maintains the five (5) TL factors as discussed previously: idealized influence, idealized behaviors, inspirational motivation, intellectual stimulation and individualized consideration. However, the XL factors total to two (2) and are defined as contingent reward (CR) and management-by-exception: Active (MBEA) versus one (1). The final leadership style, Passive Avoidant,

is also comprised of two (2) attributes (Management-by-exception: Passive (MBEP) and Laissez-Faire (LF)). The MLQ questionnaire (see Appendix B) is designed to assess each of the three leadership styles through select questions that are subsequently combined via the MLQ5X form (see Appendix C) for determination of applicable descriptive statistics.

3.2.1 Measuring Instrument Validity

We begin with discussions of instrument external validity. Leedy and Ormond (2013) characterized external validity as "the extent to which the research study's results apply to situations beyond the study itself" (p. 103). According to Avolio and Bass (2004), "in numerous studies, transformational leaders were found to generate higher commitment in their followers" (p. 36). Thus, what is being measured by the MLQ can be traced to a valid form of real world effective leadership. Likewise, testing conducted by Bogler (2001) determined "that teachers' satisfaction increases as they perceive their principals' leadership style as more transformational and less transactional" (p. 677). Fuller et al (1996), as cited by Avolio and Bass (2004), reported in a meta-analysis greater follower compliance if their leaders were more transformational than transactional (Avolio & Bass, 2004, p. 36). The list of scholarly writings substantiating the external validity of the MLQ is far reaching. Thus, discussions in this section will shift to construct validity.

"The extent to which an instrument measures a characteristic that cannot be directly observed but assumed to exist based on patterns in people's behavior [is termed construct validity]" (Leedy & Ormond, 2013, p.90). Creswell (2009) addressed the topic of construct validity by asking, "do items measure hypothetical constructs or concepts"

(p. 149)? According to Barge and Schlueter (1991), "the MLQ possesses good construct validity...as seen in the previous studies, transformational versus transactional leadership was found to be more highly correlated with a variety of outcomes" (p. 551).

Armstrong and Nuttawuth (2008), following the implementation of tests including confirmatory factor analysis, modification indices and chi square testing of the nine factor model (i.e. the MLQ version used in the current research) concluded, "after acknowledging the MLQ criticisms by refining several versions of the instruments, the version of the MLQ, Form 5X (Bass and Avolio, 1997), is successful in adequately capturing the full leadership factor constructs of transformational leadership theory" (p. 10). In the end, there appears to be significant support for the MLQ's construct validation.

Regarding predictive validity, according to Barge and Schlueter (1991) "the MLQ demonstrates good predictive validity. Bass and Avolio (1990) report transformational leadership scores were strongly correlated with the extra effort of followers, satisfaction, and the effectiveness of the organization" (p. 550).

3.2.2 Measurement Instrument Reliability

Leedy and Ormond (2013) defined reliability as "the consistency with which a measuring instrument yields a certain, consistent result when the entity being measured hasn't changed" (p. 91). Bass and Avolio (1991), as cited by Barge and Schlueter (1991), concluded that although "the alpha reliability coefficients for the self-rating form were consistently lower than those for the rater form, with reliabilities ranging from .60 to .92 [however] reliability of the two forms existed" (p. 550). (It should be noted that the

current research utilizes the rater form for data collection.) Bass and Avolio (2004) concluded that "reliabilities for the total items and for each leadership factor scale ranged from .74 to .94...all of the scales' reliabilities were generally high, exceeding standard cut - offs for internal consistency recommended in the literature" (p. 49). Barge and Schlueter (1991), also "report[ed] the MLQ Rater Form demonstrated good internal reliability with all factors above an alpha of .82, with the exception of management-by-exception (.79) and laissez-faire leadership" (p. 549). Also in this area, Bennett (2009) cited research conducted by Lowe, Kroech and Sivasubramaniam (1996) which assessed five factors of the MLQ which were charisma, individualized consideration, intellectual stimulation, contingent reward, and management by exception. The resulting "mean Cronbach scale obtained for the five scales tested were 0.92, 0.88, 0.86, 8.82 and 0.65 respectively" (p. 6). Bennett (2009) also cited work by Dumdum, Lower and Avolio (2002) which assessed "twelve scales" of the MLQ concluding that "internal reliability was good as the mean Cronbach...for eleven of the twelve scales was above 0.7 and the final one was 0.69" (p. 7).

There is another reliability measure termed Test Re-Test Reliability, and according to Bass and Avolio (1990), cited by Barge and Schlueter (1991), "test-retest reliabilities were provided by a study using the ratings by 193 followers and 33 leaders measured 6 months apart...the rater form test-retest reliabilities ranged from .52 to .82 and from .44 to .74 for the self-rating form" (p. 550).

CHAPTER 4

RESULTS

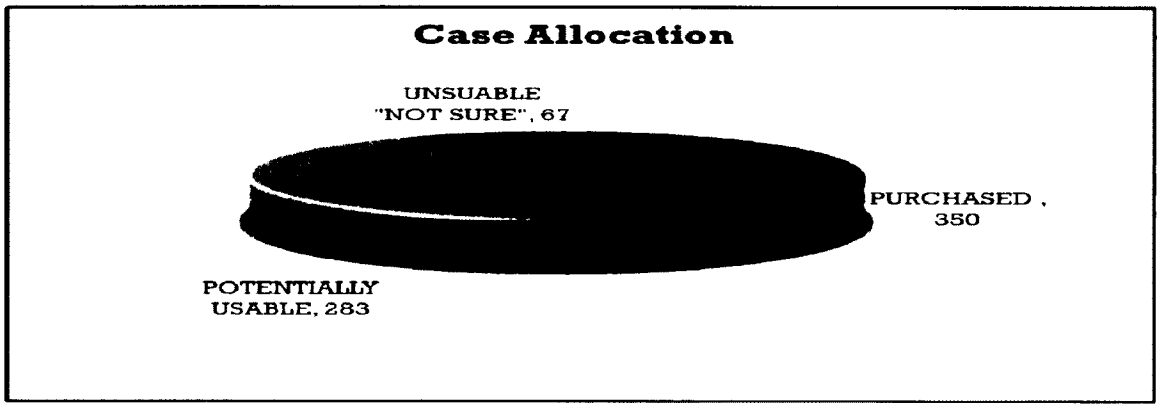
As discussed in Section 2.1.1, the original aim of the current research was to specifically test the previously discussed hypotheses with respect to CPMs alone. Thus, the sample population was to only include CPMs with engineering degrees and those without engineering degrees. In practice, however, economic constraints limited the total sample population of this category to 67 (48 with engineering degrees and 15 without). Employing SPSS Sample Power 3, based on the pilot testing for CPMs, 113 subjects per group (with and without engineering degrees – totaling 226) would be required to yield a power of 80%, and of the 350 received completed surveys received, CPMs meeting the desired criteria accounted for only 63 (18%) of the total number of rated organizational leaders. Consequently, while all testing included the CPM group, the scope was expanded to also include managers with and without PMI certifications as well as managers with and without engineering degrees. However, all managers were responsible for providing the day-to-day work activities for one or more reports (direct or matrix). As previously discussed, this population, inclusive of CPMs, was termed the "integrated population." Based on this population pilot testing, 116 subjects per group (with and without engineering degrees – totaling 232) would yield a power of 90%. Expanding the scope of the current research to include the integrated population not only increased the statistical power of the testing due to increased cases available, it also remained true to the fundamental research goal to determine the relationship, if any,

between engineering education and leadership style by assessing leader styles of those with engineering degrees and those without.

4.1 Population and Demographics

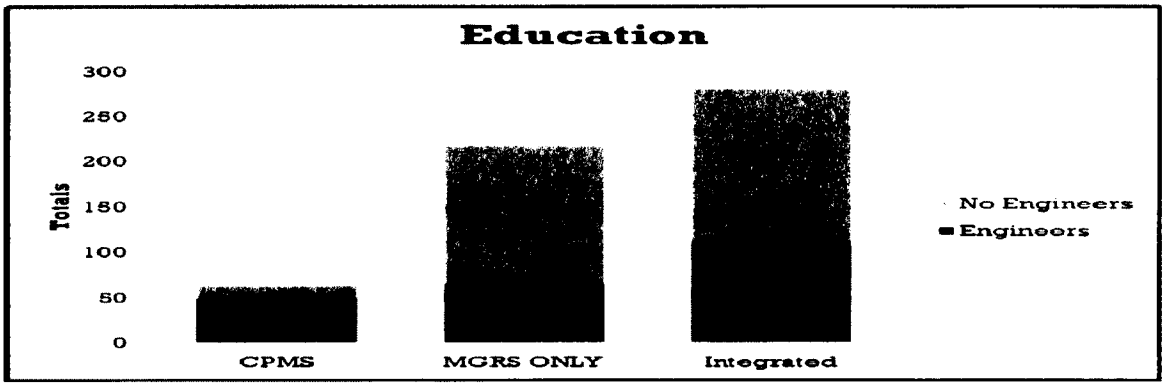
Those employed in the domestic manufacturing sector comprised the sample group. Based on information supplied by Survey Monkey, roughly 500 prospective participants visited the site for potential survey completion. Of those, only 350 actually completed the survey (this should not suggest a 70% conversion rate as it is not known to the researcher how many individuals were actually asked to complete the survey and elected not follow the link to the survey). Figure 10 below reflects the number of total cases (completed surveys) received as well as the group allocation for those cases. As previously indicated, of the 350 cases, close to 20% were not usable due to the "not sure" response provided by the raters under the questions regarding engineering education. Consequently, only 283 cases were potentially usable for testing the research hypotheses.

Figure 10: Database.



Results of the researcher question regarding engineering education are shown in Figure 11 below. Accordingly, the terms "No Engineers" and "Engineers" refers to whether or not the individual being rated possessed an engineering degree. In the CPM population, 48 individuals being rated possessed engineering degrees while 15 did not. MGRS (managers without PMI certifications) and integrated managers (the combined groups of CPMs and MGRS) were 64 and 154 and 112 and 169 respectively.

Figure 11: Education Data.



Because the largest sample population was in the integrated population, demographic data will be reviewed in that context. The first bit of demographic data has to do with gender as shown in Figure 12 below. Among the integrated population, there were 34 females with engineering degrees and 76 without. The same for males was 76 and 91 respectively.

Figure 12: Gender.

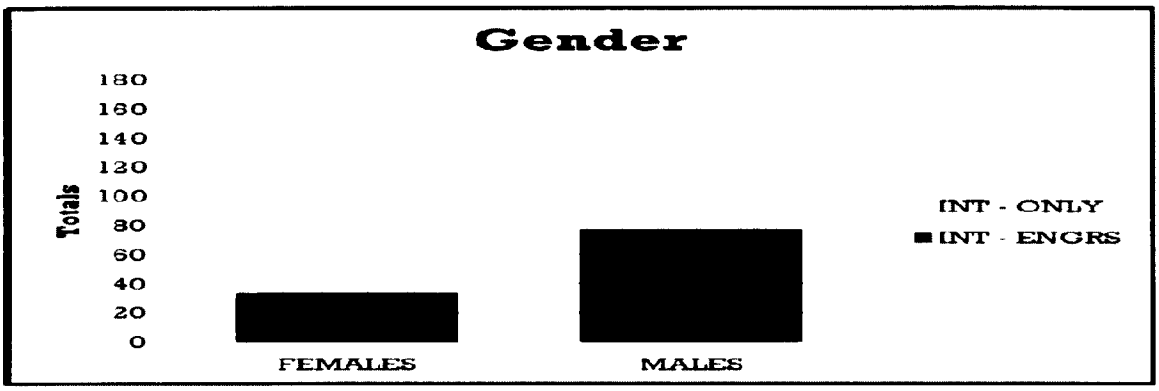


Figure 13 below reflects the experience level of the individuals being rated. Among the integrated population with engineering degrees, there were 14 with 0 – 4 years of experience, 37 with 4+ to 10 years of experience and 60 with 10+ years of experience. The same data for those without engineering degrees was 61, 33 and 74 respectively.

Figure 13: Experience Level for Those Rated.

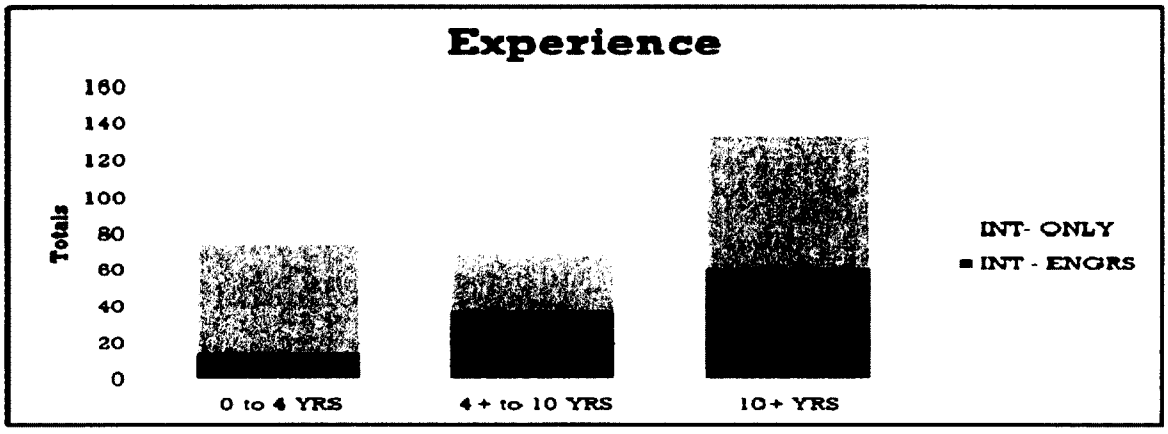
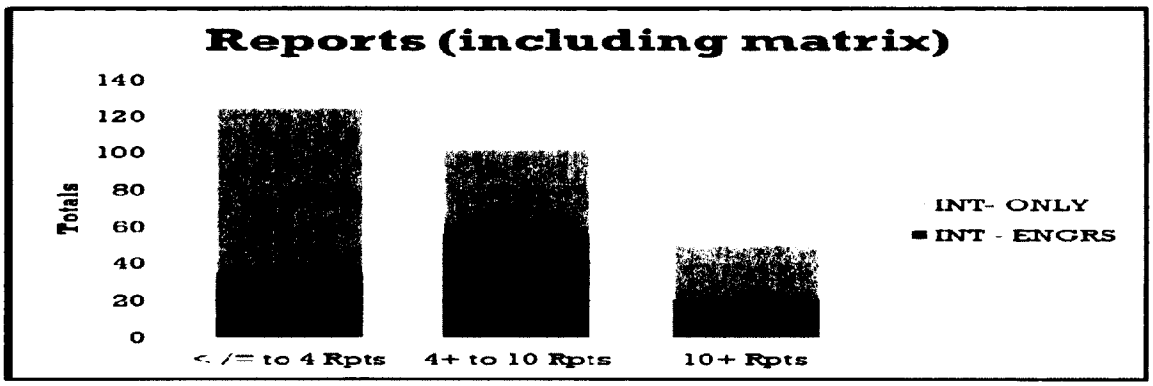


Figure 14 below reflects the number of persons for whom the individual has day to day work assignment responsibility. Accordingly, among the group with engineering

degrees, there were 35 with </= 4 organizational reports, 56 with 4+ to 10 organizational reports and 20 with more than 10 organizational reports. The same for the group without engineering degrees was 90, 46 and 30 respectively.

Figure 14: Organizational Reports (direct or matrix).



4.2 Data Analysis

The SPSS statistical software package was used to facilitate data analysis. The first research hypothesis, H0a: There is no relationship between engineering education and Transformational Leadership (TL), was restated to accommodate the appropriate statistical testing. Restated, we have: Ho: $\mu TLW = \mu TLWO$ (the population means for TL styles of CPMs with and without engineering degrees are the same), and Ha: $\mu TLW \neq \mu TLWO$ (the population means for TL styles of CPMs with and without engineering degrees are different). Accordingly, this first test focused on the CPM groups with and without engineering degrees. Given that the groups are independent, the "independent samples t-test" was implemented. One of the assumptions that should be tested before applying the t-test is an assessment of the data in search of outliers.

Following the initial box plot run two outliers (lines 42 and 23 – not shown) were identified. In looking at the data, it appeared that a couple of the respondents sort of flat lined the survey entering a "0" (not at all observed) for at least twenty-two of forty-five MLQ questions for CPM's with engineering degrees for line 42. Likewise, for outlier 23 a similar pattern was observed. Both outliers were eliminated; the box plot was then re-run revealing another outlier – line 15 – that was also removed for the same reason yielding the box plot shown in Figure 15 below.

Figure 15: Adjusted Box Plot.

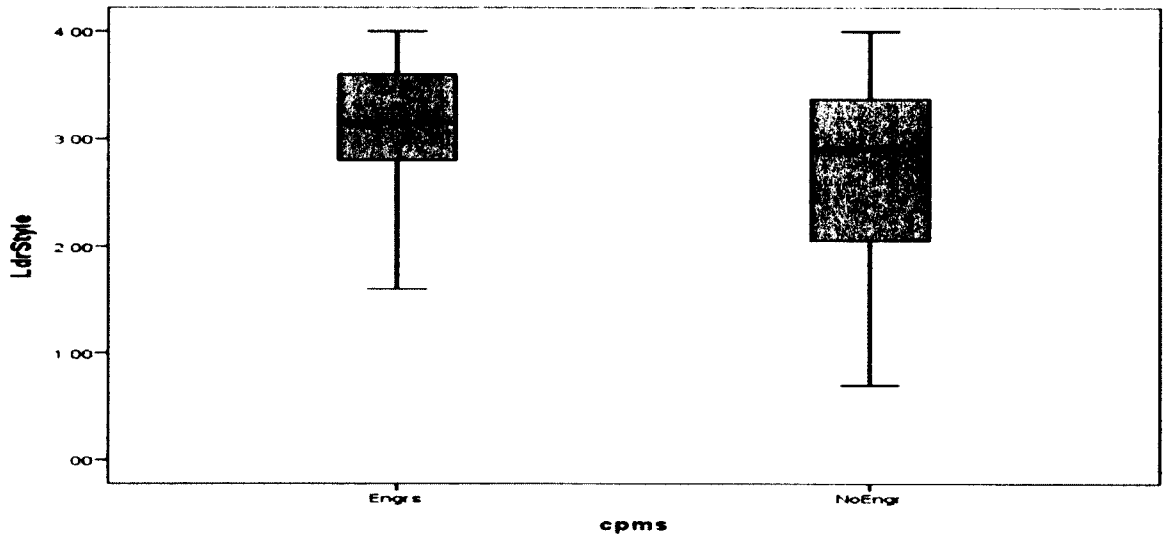


Table 3 below reflects the results from the test for normality. As indicated, the Shapiro-Wilk test generated p-values (located in the Sig columns) suggesting that while the distribution for the CPMs with no engineering degrees is normal, given by the Sig of 0.480, the same for CPMs with engineering degrees was only 0.011 thus suggesting a non-normal distribution .

Table 3: CPM Normality Test.

	cpms	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
LdrStyle	Engrs	.107	45	.200*	.932	45	.011
	NoEngr	.122	15	.200*	.947	15	.480

*. This is a lower bound of the true sign ficance.

a. Lilliefors Significance Correction

Regarding use of the t-test and the consequences of outliers or failed tests for normality, Elliott and Woodward (2007), cite "rules of thumb" offered by Moore and McCabe (2006), among which is: "if the sample size is large (at least 40), then the one-sample t-test can be safely used without regard to skewness or outliers" (p. 49). Although the current study also leverages the two sample t-test and ANOVA, Elliot & Woodward refers the reader back to these guidelines for both of these tests as well. From the t-test see Table 4 shown below; the significance value is .026. Consequently, the assumption of homogeneity of variances was not met. Thus, the "Equal variances not assumed" row was used for decision making. Because the t-test at t(18) degrees of freedom returned "Sig" or p = .164, which is greater than .05, it cannot be concluded that a statistically significant difference exists between the two perceived TL style mean scores for CPMs with and without engineering degrees. Consequently, possibly driven by the low power of the test which was less than 80%, the null hypothesis cannot be rejected.

Table 4: CPM Independent Samples t-test.

		Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interval of the Difference	
									Lower	Upper
LdrStyle	Equal variances assumed	6.199	.026	1.797	58	.078	.39889	.22200	-.04549	.84327
	Equal variances not assumed			1.461	18.027	.161	.39889	.27296	-.17370	.97147

Although the first research hypothesis was limited to TL, given the availability of information offered by the MLQ regarding the full range of leadership, the same tests were implemented for transactional and Passive Avoidant (PA) leadership styles. Again, restating the hypothesis to accommodate this test, we have: Ho: μLdrstylei = μLdrstylej and, conversely, Ha: μLdrstylei $\neq$ μLdrstylej. In the lexical sense, the general restated hypothesis is that there is no difference in leader style with "i" and "j" serving as a surrogate for the respective styles with and without engineering degrees.

Summarizing the analysis, due to unequal variances for XL, the "Equal Variances not Assumed" column was once again used for statistical decision making and, despite degreed CPMs having a perceived mean score of 0.48 higher, because t(18) degrees of freedom returned a "Sig" or p = .083, it cannot be concluded that a statistically significant difference exists between the two XL style means for CPMs with and without engineering degrees. Thus the null cannot be rejected. Similarly for PA, although the degreed CPM's perceived mean PA leadership style was 0.41 higher than the PA Leadership style for Non-degreed CPM's, because at t(60) degrees of freedom "Sig" = .180, it cannot be concluded that a statistically significant difference exists between the two PA style means and, once again, the null hypothesis cannot be rejected. In an effort

to simplify the presentation of statistical testing, Table 5 below (Summary Statistics) lists the results of each test (normality, equality of variances, and significance testing) as well as reporting the mean difference between the respective groups with engineering degrees versus those without. For example, referring to the managers group and the TL style, it is evident that the normality assumption was not met for either distribution but the equality of variance assumption was met. It is also evident that the mean difference between the TL style of the two groups was 0.47 with a confidence interval of (0.18 to 0.76) and that the sample sizes were N1 = 64 and N2 = 154 for managers with engineering degrees and the same without respectively. Finally, it is evident that "t" at 216 degrees of freedom was 3.24 and with a two tailed "p" value of 0.001, the means were statistically different.

Table 5: Composite Summary Statistics.

		Normality (p > 0.05)		Equality of Variance (p > 0.05)	Mean Diff + CI	T-test Result Diff if p < 0.05		
Style Tested	Group	Engrs N1	NoEngrs N2			t	df	2 tail Sig
TL	MGRS	0.007	0.001	0.063	0.47 (0.18, 0.76) 64 154	3.24	216	0.001
TX	MGRS	0.786	0.007	0.006	0.43 (0.22, 0.64) 63 154	4.06	173	0.0005
PA	MGRS	0.165	0.006	0.296	0.10 (-0.15, 0.35) 64 149	0.79	211	0.432
TL	INTGR	0.0005	0.0005	0.001	0.63 (0.42, 0.85) 110 169	5.72	270	0.005
TX	INTGR	0.293	0.007	0.006	0.55 (0. 36, 0.74) 111 169	5.68	273	0.005
PA	INTGR	0.038	0.012	0.046	0.15 (-0.07, 0.37) 112 162	1.37	217	0.172

Indicates statistically significant differences

Summarizing the Table 5 findings, no statistically significant differences were found in the CPM groups with or without engineering degrees for TL. However, in both the manager and integrated population, TL and XL were statistically different and higher for those with engineering degrees versus those without. Likewise, no statistically significant differences were found in the CPM groups with or without engineering degrees for XL, yet in both the manager and integrated population, TL and XL were statistically different and higher for those with engineering degrees versus those without. No differences were detected in any of the groups for PA. Returning once again to TL theory, recall that Intellectual Stimulation (IS) is one of its five constituent elements. And, according to Avolio and Bass (2004) leaders demonstrating this attribute stimulate innovation and creativity by questioning assumptions, reframing problems, and approaching old situations in new ways. They also solicit new solutions to problems and include followers in the problem solving process (p. 102). Considering the academic lesson's learned by engineers, especially in the area of problem solving, the current research also considered whether or not statistically significant differences existed in the perceived demonstration of the IS attribute when comparing those with engineering degrees to those without. These results are summarized in Table 6 below. Restating the hypothesis to accommodate this test we have, Ho: $\mu IS = \mu IS$ (the population means for IS in groups with and without engineering degrees are the same) and conversely Ha: $\mu IS \neq \mu IS$ (the population means for IS in groups with and without engineering degrees are different).

Table 6: Summary Statistics for IS.

		Normality (p > 0.05)		Equality of Variance (p > 0.05)	Mean Diff + CI N1 N2	T-test Result Diff if p < 0.05		
Style Tested	Group	Engrs N1	NoEngrs N2			t	df	2 tail Sig
IS	CPMS	0.006	0.44	0.425	0.234 (-0.26, 0.73) 46 14	0.951	58	0.345
IS	MGRS	0.172	0.002	0.016	0.56 (0.302, 0.83) 62 154	4.2	142	0.0005
IS	INTGR	0.003	0.002	0.0005	0.74 (0.53, 0.94) 121 169	6.9	288	0.0005

Indicates statistically significant differences

From the above table, it is evident, as might be expected due to the low sample size, the null hypothesis stating that there is no difference between the mean perceived IS styles for CPMs with and without engineering degrees cannot be rejected. However, for the group of managers and the integrated population, the null hypothesis can be rejected suggesting that those with engineering degrees may be perceived to demonstrate more of the IS style as evidenced by the two tail Sig" values. As mentioned previously, given the rigor of training in the academic setting this finding is also somewhat intuitive.

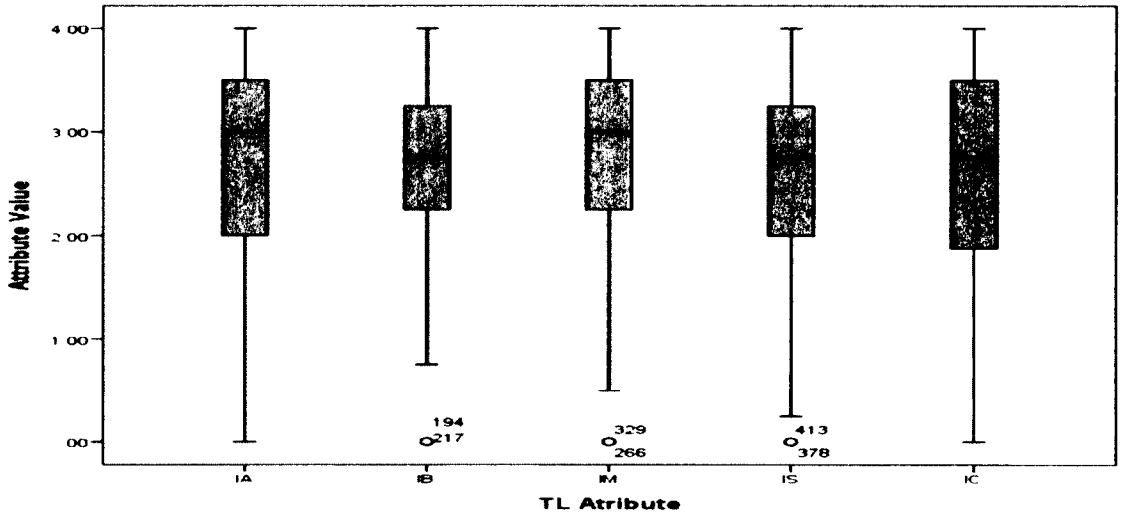
At this point we will shift to discuss the approach taken to test the remaining research hypothesis: H0b: There is no predominant style of leadership among actors with and without engineering degrees. Unlike the first hypothesis, here we are not looking to determine the extent to which the leadership styles differ when comparing the two groups (with and without engineering degrees). Instead, the aim is to identify whether or not a predominant style emerges within each group. In order to attempt this, three parametric statistical approaches were taken. First, each of the five constituent items for each of the

TL leadership styles previously discussed were compared against one another to determine if a difference existed in the mean perceptions for each group. Second, each of the perceived means for each overall leadership style (TL, XL and PA) was compared with each other for differences in mean perceptions of the respective styles. Lastly, each of the Leadership style scores for (TL, XL and PA) were compared to the MLQ "Norm" tables, to be discussed later, and the extent that the scored style was, or was not, different from a given norm percentile was determined. This three pronged approach is appropriate because, unlike the first hypothesis, the focus here is on the full range of leadership to include XL and PA.

Regarding the five constituent test, restated we have Ho: $\mu TL1 = \mu TL2 = \mu TL3 = \mu TL2 = \mu TL5$ (the population means for all TL constituents with and without engineering degrees are the same) and conversely Ha: $\mu TLconsi \neq \mu TLconsj$ for some "$i \neq j$" (the population means for at least two TL constituents with and without engineering degrees are different). ANOVA was employed to assess the first portion of this hypothesis regarding TL. And to allow for the maximum power, all TL constituent tests were conducted using the integrated data. As was the case with the t-test, the first step in the ANOVA analysis included review of a box plot to identify any outliers for the integrated sample population with engineering degrees. And, as indicated in Figure 16 below, there were some outliers present. However, as mentioned previously, Elliot and Woodward had a similar view relative to ANOVA as with the t-test to which the author defers. More specifically, Elliot and Woodward (2007) cited Glass, Peckham & Sanders and stated that, "studies have shown the one-way ANOVA to be robust against some departures from assumptions...if the sample size is large (at least 40) then the one sample t-test [or

ANOVA] can be used without regard to skewness or outliers." Additionally, it was stated that "generally, non-normality of the data is not a concern unless you have small sample sizes or your data are highly non-normal...if you have equal or near equal sample sizes, in each group, the equal variance assumption becomes less important" (p. 167). As mentioned previously, the author defers to these comments and proceeds with statistical testing employing ANOVA.

Figure 16: Five TL Constituent Means.



Referring to Table 7 below, in terms of normality none of the five constituent distributions met this criterion. However, as also indicated, the case size equaled 112. Also note that the "Sig" values are 0.000 (this value is actually truncated at 0.000 but is equivalent to 0.0005).

Table 7: Tests for Normality – TL Constituents.

	TL Atribute	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Attribute Value	IA	.137	112	.000	.931	112	.000
	IB	.135	112	.000	.938	112	.000
	IM	.146	112	.000	.916	112	.000
	IS	.112	112	.001	.950	112	.000
	IC	.153	112	.000	.946	112	.000

a. Lilliefors Significance Correction

Referring to Table 8 below, the numerically highest perceived mean score is in the area of Inspirational Motivation (IM) with a mean of 2.82 and a confidence interval of 2.64 to 2.99.

Table 8: TL Constituent Descriptive Statistics.

Attribute Value

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
IA	112	2.7768	.95822	.09054	2.5974	2.9562	.00	4.00
IB	112	2.7478	.88563	.08368	2.5819	2.9136	.00	4.00
IM	112	2.8192	.95520	.09026	2.6403	2.9980	.00	4.00
IS	112	2.6451	.93279	.08814	2.4704	2.8197	.00	4.00
IC	112	2.6161	.97371	.09201	2.4338	2.7984	.00	4.00
Total	560	2.7210	.94146	.03978	2.6428	2.7991	.00	4.00

Referring to Table 9 below, you see that the Test of Homogeneity of Variances yields a "Sig" value of 0.430. Because p = .430, which is greater than p = 0.05, Levene's test is not statistically significant and the assumption of homogeneity of variances is therefore not violated. Referring now to the ANOVA result (shown in Table 10 below), if the ANOVA is statistically significant (meaning, $p < .05$), it can be concluded that not all group means are equal in the population (i.e., at least one group mean is different from another group mean). Alternatively, if $p > .05$, no statistically significant differences exists between the group means. From the ANOVA, although numerical differences in means are evident, it may be concluded that there is no statistically significant differences between the group means at $F(4, 555) = 0.955$, and $p = 0.432$.

Table 9: Homogeneity of Variances Test.

Attribute Value

Levene Statistic	df1	df2	Sig.
.959	4	555	.430

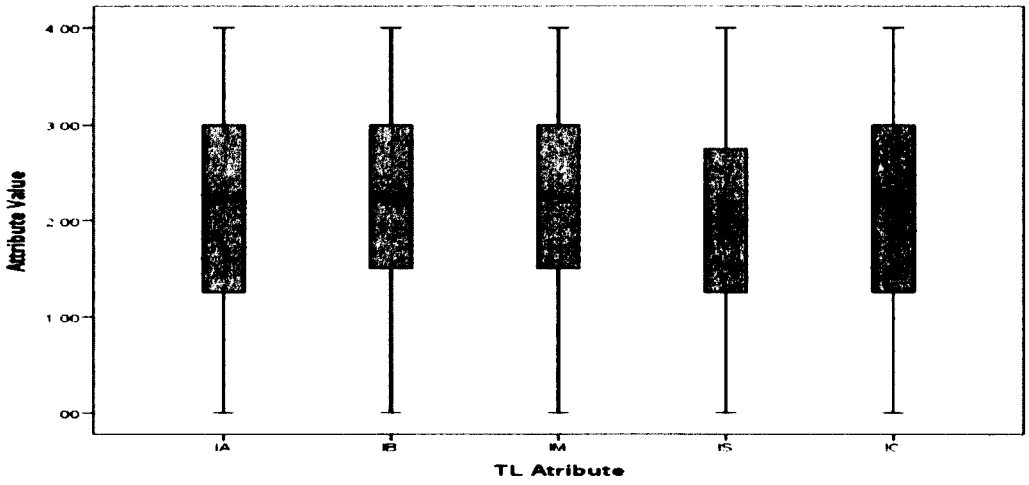
Table 10: Constituent ANOVA Results.

Attribute Value

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.387	4	.847	.955	.432
Within Groups	492.079	555	.887		
Total	495.466	559			

Figure 17 below shows the box plot for the integrated population without engineering degrees. As evident here, there are no outliers.

Figure 17: Integrated Box Plot Non-engineers.



In terms of normality, as was the case with the integrated population with engineering degrees, those without engineering degrees are not normal (see Table 11 below). However, as will be shown in the descriptive statistics (see Table 12 below), 169 cases comprised the sample set.

Table 11: Tests of Normality Non-engineers.

	TL Atribute	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Attribute Value	IA	.089	169	.002	.948	169	.000
	IB	.097	169	.001	.959	169	.000
	IM	.097	169	.001	.956	169	.000
	IS	.078	169	.013	.972	169	.002
	IC	.111	169	.000	.962	169	.000

a. Lilliefors Significance Correction

Table 12: Descriptive Statistics for Non-engineers.

Attribute Value

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
IA	169	2.1331	1.19212	.09170	1.9521	2.3142	.00	4.00
IB	169	2.1938	1.09270	.08405	2.0278	2.3597	.00	4.00
IM	169	2.2086	1.10251	.08481	2.0412	2.3760	.00	4.00
IS	169	2.0370	1.04285	.08022	1.8786	2.1953	.00	4.00
IC	169	2.0769	1.09823	.08448	1.9101	2.2437	.00	4.00
Total	845	2.1299	1.10608	.03805	2.0552	2.2046	.00	4.00

The numerically highest perceived mean score is, once again, in the area of Inspirational Motivation (IM) with a mean of 2.20 and a confidence interval of 2.04 to 2.37. Referring to Table 13 below, it is evident that the test of homogeneity of variances yields a "Sig" value of 0.484. Consequently, Levene's test is not statistically significant and the assumption of homogeneity of variances was not violated.

Table 13: Variances Test for Non-engineers.

Attribute Value

Levene Statistic	df1	df2	Sig.
.867	4	840	.484

From the ANOVA (Table 14 below) it may be concluded that there are no statistically significant differences between the group means with engineering degrees at $F(4, 840) = 0.749$, and $p = 0.559$.

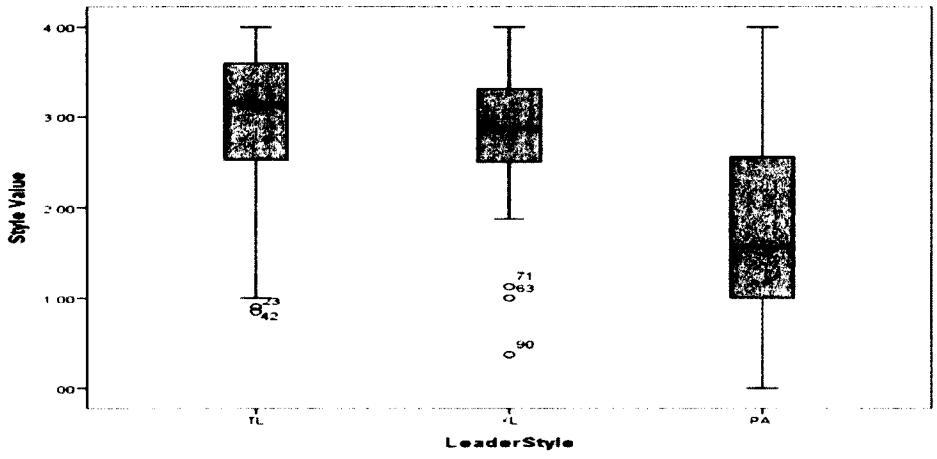
Table 14: ANOVA for Non-engineers.

Attribute Value

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.671	4	.918	.749	.559
Within Groups	1028.887	840	1.225		
Total	1032.558	844			

Refer once again to the predominant leadership style hypothesis (H0b: There is no predominant style of leadership among actors with and without engineering degrees). For this second test, we are going to look at each of the three leadership styles, TL, XL and PA, and seek to identify statistically significant differences within each group (those with engineering degrees versus those without). This approach is reflected by the following restated hypotheses. Ho: $\mu TL = \mu XL = \mu PA$ (the population means for each leadership style are equal) and, conversely, Ha: $\mu TL \neq \mu XL \neq \mu PA$ (the population means for each leadership style are not equal). Figure 18 below reflects the box plot for the population means.

Figure 18: Style Means Box Plot.



As indicated in Table 15 below, because all "p" values in the "Wilk Sig" column are less than 0.05 except PA = 0.237, the style values are not all normally distributed.

Table 15: Normality Test for Leader Styles.

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	LeaderStyle	Statistic	df	Sig.	Statistic	df	Sig.
Style Value	TL	0.13	48	0.042	0.899	48	0.001
	XL	0.127	48	0.052	0.937	48	0.013
	PA	0.091	48	.200*	0.969	48	0.237

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Referring to Table 16, test of homogeneity of variances, because p = .042, which is less than 0.05, the Levene's test for homogeneity is statistically significant. Consequently, the assumption of homogeneity of variances was also violated.

Table 16: Leader Style Variances Test.

Style Value			
Levene Sta	df1	df2	Sig.
3.248	2	141	0.042

Because homogeneity of variance was not met the output (Table 17 below) must be used for decision making. And, as p < .05, actually =.0005, it can be concluded that there is a statistically significant difference in Style Value scores for the different levels of style applications (e.g. TL, XL & PA). The question, however, is which leadership styles are different from which other ones?

Table 17: Robust Means Test of Leader Style Means.

Style Value

	Statistic[a]	df1	df2	Sig.
Welch	24.321	2	92.695	0.0005

a. Asymptotically F distributed.

SPSS offers "Post Hoc" multiple comparisons to allow for the investigation of the differences pointed out in Table 17 above. Referring now to Table 18 (Post Hoc Testing), as the "Sig." value OR (p-value) for TL compared to XL is greater than .05, the difference between these two group means is not statistically significant. As the "Sig." value for TL compared to PA is less than .05, the difference between these two group means is statistically significant. And as the "Sig." value (p-value) for XL compared to PA is less than .05 (it is p = .0005), the difference between these two group means is also statistically significant.

Table 18: Post Hoc Testing.

Multiple Comparisons

Dependent Style Value — H2: CPMS WITH

(I) LeaderStyle		(J) LeaderStyle	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Tukey HSD	TL	XL	.13698	.18102	.730	-.2918	.5658
		PA	1.26198*	.18102	.000	.8332	1.6908
	XL	TL	-.13698	.18102	.730	-.5658	.2918
		PA	1.12500*	.18102	.000	.6962	1.5538
	PA	TL	-1.26198*	.18102	.000	-1.6908	-.8332
		XL	-1.12500*	.18102	.000	-1.5538	-.6962
Games-Howell	TL	XL	.13698	.16259	.678	-.2502	.5242
		PA	1.26198*	.19165	.000	.8052	1.7188
	XL	TL	-.13698	.16259	.678	-.5242	.2502
		PA	1.12500*	.18744	.000	.6780	1.5720
	PA	TL	-1.26198*	.19165	.000	-1.7188	-.8052
		XL	-1.12500*	.18744	.000	-1.5720	-.6780

* The mean difference is significant at the .05 level.

Having run the same battery of tests for each of the leadership styles and for each of the subject groups with and without engineering degrees, Tables 19, 20 and 21 summarize the resulting findings for those as well as for the CPM groups with and without engineering degrees. As indicated in Table 18, there was a statistically significant difference between TL and PA and XL and PA in the CPM Group with engineering degrees, but statistically significant differences were not detected between TL & XL in both groups. Note that in the CPM group Without Engineering degrees, shown on the right hand side of Table 19, the same pattern exists with a statistically significant difference occurring between TL and PA as well as XL and PA but no difference was detected between TL and XL.

Table 19: Post Hoc CPM Means Comparison.

CPMS With & W/O Engineering Degrees

Leader Styles	WITH	WITHOUT
TL	2.96	2.7
XL	2.83	2.48
PA	1.81	1.47

Taking a look at the manager results (see Table 20 below), note the same pattern whereby in both groups, with and without engineering degrees, statistically significant differences occurred between TL and PA as well as XL and PA, but no difference was detected between TL and XL.

Table 20: Post Hoc Manager Means Comparison.

MANAGERS With & W/O Engineering Degrees

Leader Styles	WITH	WITHOUT
TL	2.54	2.07
XL	2.43	2.03
PA	1.6	1.6

Taking a look at the integrated results (Table 21 below), note the same pattern once more whereby in both groups, with and without engineering degrees, statistically significant differences occurred between TL and PA as well as XL and PA, but no difference was detected between TL and XL.

Table 21: Post Hoc Integrated Means Comparison.

INTEGRATED With & W/O Engineering Degrees

Leader Styles	WITH	WITHOUT
TL	2.72	2.13
XL	2.6	2.07
PA	1.64	1.59

To summarize this second test of the H0b hypothesis regarding a predominant leadership style, based on the foregoing analysis, the restated Ho: must be rejected due to

statistically significant differences in PA versus TL & XL among those with or without engineering degrees. However, because TL & XL were not statistically significantly different, the overarching hypothesis regarding evidence of a predominant leadership style cannot be rejected.

For the third test, referring once again to the predominant leadership style hypothesis, using the MLQ "Norm tables" the aim in this final test is to determine whether or not any perceived leadership style (TL, TX or PA) is at a higher percentile level than any one of the remaining styles. This would be determined by comparing each of the population mean values to the "Gold standard" value located in the "Norm Tables" (See Appendix E). To explain how these tables are to be interpreted, the author refers to the specific MLQ score assessment recommendations offered by Mind Garden, the survey supplier. The first step is to group the like constituent items on the MLQ 5X (see Appendix D) which simply sums their respective ratings and then divides them by the total number of items to get an average style constituent value. With this information at hand, Mind Garden suggests that the individual then be labeled more transformational or more transactional versus simply stating that the individual being rated either transformational or transactional. The averages for each style constituent, and for the styles themselves, are then compared to the "Norm Tables." Referring to Table 22 (see below) as a point of clarification, recall that TL contains five constituent elements, while XL and PA contain only two items each respectively. And, as previously mentioned, the Items listed are to be summed and then divided by the total number of items to arrive at the constituent average. Accordingly, for each of the Leadership styles (TL, XL and PA) there are five (5), two (2) and two (2) constituent elements respectively.

Table 22: Constituent Elements.

Characteristic	Scale Name	Scale Abbrev	Items
Transformational	Idealized Attributes or Idealized Influence (Attributes)	IA or II(A)	10,18,21,25
Transformational	Idealized Behaviors or Idealized Influence (Behaviors)	IB or II(B)	6,14,23,34
Transformational	Inspirational Motivation	IM	9,13,26,36
Transformational	Intellectual Stimulation	IS	2,8,30,32
Transformational	Individual Consideration	IC	15,19,29,31
Transactional	Contingent Reward	CR	1,11,16,35
Transactional	Mgmt by Exception (Active)	MBEA	4,22,24,27
Passive Avoidant	Mgmt by Exception (Passive)	MBEP	3,12,17,20
Passive Avoidant	Laissez-Faire	LF	5,7,28,33

Table 23 (see below) is the norm table reflecting percentiles for subordinates ratings of higher levels with N= just over 12,000 cases. To ensure understanding, if a leader has a perceived IM (Inspirational Motivation) average rating of 3.00, he or she is operating in the 50th percentile. Likewise, if each of the five constituent elements of TL are averaged together, the overall perceived leader score can be determined on a percentile level. For example, if the 50th percentile scores for TL are all averaged, the mean TL score would then be 2.90. This 2.90 could be referred to as the "Gold Standard" for the 50th percentile TL rating based on the norming table.

Table 23: Subordinates Rating Higher Levels Norm Table.

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF
N =	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118
%tile	MLQ Scores								
5	1.25	1.25	1.50	1.50	1.00	1.29	.25	.00	.00
10	1.75	1.75	2.00	1.75	1.50	1.75	.50	.00	.00
20	2.25	2.21	2.25	2.25	2.00	2.25	.75	.25	.00
30	2.50	2.50	2.75	2.50	2.50	2.50	1.11	.50	.25
40	2.75	2.54	3.00	2.75	2.75	2.75	1.37	.75	.25
50	3.00	2.75	3.00	2.75	3.00	3.00	1.62	1.00	.50
60	3.25	3.00	3.25	3.00	3.17	3.13	1.87	1.00	.75
70	3.50	3.25	3.50	3.25	3.25	3.25	2.25	1.25	.93
80	3.75	3.46	3.75	3.50	3.50	3.50	2.50	1.70	1.25
90	4.00	3.75	4.00	3.75	3.75	3.75	3.00	2.00	1.75
95	4.00	3.75	4.00	4.00	4.00	4.00	3.25	2.50	2.00

Table 24 (see below) reflects the survey reported mean scores for each of the 3 leadership styles from the perspective of subordinates as well as the respective percentiles for each of the row scores.

Table 24: Survey Reported Mean Scores.

%tile	TL Mean	XL Mean	Pass Mean
5	1.3	0.77	0
10	1.75	1.13	0
20	2.19	1.5	0.13
30	2.55	1.81	0.38
40	2.76	2.06	0.5
50	2.9	2.31	0.75
60	3.13	2.5	0.88
70	3.35	2.75	1.09
80	3.59	3	1.48
90	3.85	3.38	1.88
95	3.95	3.63	2.25

Table 25 (see below) indicates the average scores from the received survey for the perceived leadership styles of CPMs with and without engineering degrees. Based on the

reported averages, the closest matching average leadership scores in the Mind Garden supplied "Norm Tables" (that were numerically less than the received scores) is then identified for each of the style scores as shown in Table 24 above. As an example, the average perceived TL score for the CPM's with an engineering degree was 2.96 and the closest matching "Norm Table" mean score was found in the 50th percentile to be 2.90. However, although the average PA score for this same group was only 1.70, the closest corresponding "Norm Table" percentile, that was also less than the received survey PA score, is 1.48 which was located at the 80^{th} percentile.

Table 25: CPM Percentile Levels.

	CPMs W&WO			
	Subjects	**TL**	**XL**	**PA**
	CPMW	2.96	2.83	1.70
% Tile	50	2.90		
% Tile	**70**		2.75	
% Tile	80			1.48
	CPMW/O	2.70	2.48	1.47
% Tile	30	2.55		
% Tile	50		2.31	
% Tile	80			1.48

The process, then, is to statistically compare the survey reported average leadership style score to the closest not to exceed "Norm Table" match at an alpha of .05. If the survey reported score is not statistically different from the "Norm Table" mean score, then the reported operating percentile level may also be assumed. However, if the survey reported score is statistically different and numerically greater than the norm score, the operating percentile may be higher than the "Norm Table" percentile. The one sample t-test was employed to implement the necessary comparisons. The first test was for the CPM

groups and TL. For simplicity of presentation, the box plots will not be shown. As indicated in Table 26 (see below), based on the "Wilk Sig" test, given that the p value = 0.001 which is less than 0.05, the reported TL data for CPMs with engineering degrees are not normally distributed.

Table 26: CPM Normality Test.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LdrStyle	.130	48	.042	.899	48	.001

a. Lilliefors Significance Correction

As reflected in Table 27 (see below) the mean TL score (2.96 ± 0.82) was numerically higher than the population 50thpercentile TL score of 2.90 as demonstrated previously.

Table 27: TL Mean Score.

	N	Mean	Std. Deviation	Std. Error Mean
LdrStyle	48	2.9625	.82019	.11838

However, referring to Table 28 (see below) the TL score was not statistically significantly different from the population 50th percentile score, t(47) = .528, and p = .600. Because the reported score was not statistically different from the percentile score, there is no statistical basis for rejecting the theory that the perceived demonstration of TL was not equal to the Norm table 50th percentile level.

Table 28: One Sample "t" Test Results.

	Test Value = 2.90					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
LdrStyle	.528	47	.600	.06250	-.1757	.3007

The results discussed in Tables 26, 27 and 28, as well as the results for the remaining tests for the two CPM Groups (with and without engineering degrees) are shown in Table 29 below. In all cases, application of the one sample t-test did not identify statistically significant differences between the "Norm Table" percentile and the perceived operating level of the CPMS with or without engineering degrees. Consequently, in both groups, the highest operating percentile scores were related to the PA leadership style.

Table 29: CPM Percentile Results.

CPMs W&WO				
	Subjects	TL	XL	PA
	CPMW	2.96	2.83	1.7
% Tile	50	2.9		
% Tile	70		2.75	
% Tile	80			1.48
	CPMW/O	2.7	2.48	1.47
% Tile	30	2.55		
% Tile	50		2.31	
% Tile	80			1.48

Referring to Table 30 below, while no statistically significant differences were revealed for managers with engineering degrees versus the "Norm Table" in the TL, XL and PA styles, statistically significant differences were identified for managers without engineering degrees for TL and XL but not for PA. In both cases, the differences point to the managers operating above the selected norm percentile.

Table 30: Manager Percentile Results.

Managers W&WO				
	Subjects	TL	XL	PA
	MgrW	2.54	2.43	1.6
% Tile	30	2.55		
% Tile	50		2.31	
% Tile	80			1.48
	MgrW/O	2.07	2.03	1.6
% Tile	10	1.75		
% Tile	30		1.81	
% Tile	80			1.48

Referring to Table 31 below, although no statistically significant differences were revealed for the integrated population, compared to the norm, with engineering degrees in the XL and PA styles, a statistically significant difference was identified for this group in the TL style. Likewise, in the integrated population without engineering degrees, both the PA and XL leadership styles were not statistically significantly different from the norm table while the TL style was statistically different from the norm table in this group. In both cases, the TL differences point to the integrated population operating above the selected norm percentile.

Table 31: Integrated Percentile Results.

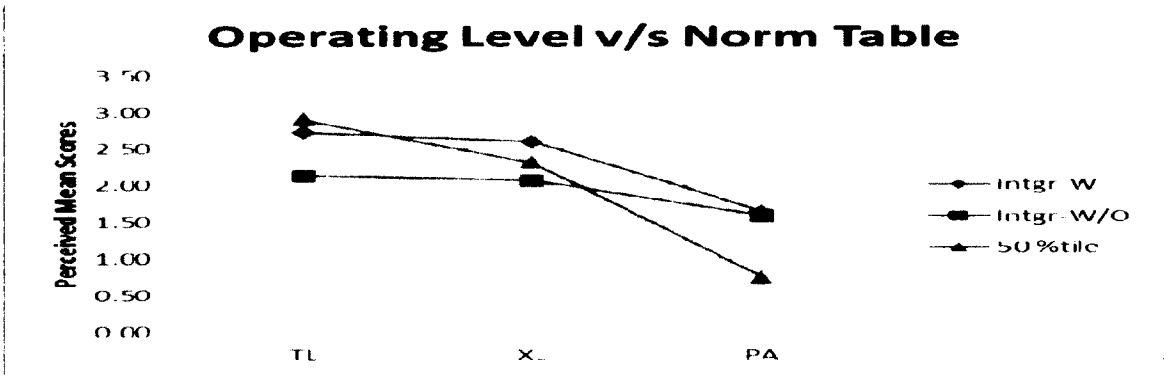
IntegratedW&WO				
Subjects	TL	XL	PA	
Intgr W		2.72	2.6	1.64
% Tile	30	2.56		
% Tile	60		2.5	
% Tile	80			1.48
Intgr W/O		2.13	2.07	1.59
% Tile	10	1.75		
% Tile	40		2.06	
% Tile	80			1.48

Summarizing the above findings regarding CPMs, the one sample t-test did not identify statistically significant differences between the "Norm Table" and reported perceived mean leadership style scores (with and without engineering degrees). Regarding managers, the one sample t-test identified differences only in this group without engineering degrees and for the TL and XL styles. Regarding the integrated population, the one sample t-test revealed differences in this group regarding TL (with engineering degrees) and TL (without) engineering degrees. The differences suggested higher percentile operating levels versus the norm.

Refer to Figure 19 below which compared the integrated population (including CPM's and non-CPM managers) to the 50th percentile norm score. A key observation here, as was identified in the second test above, is that the integrated population with engineering degrees appears to be operating at an overall higher percentile level than those without engineering degrees. There is also a slight, yet obvious, downward trend in both integrated population with and without engineering degrees from TL to XL and then more decelerated to PA. And, although the trend might suggest both groups (with and without engineering degrees) operate at a higher level of TL when compared to the other

leadership styles, there is still insufficient evidence to reject the hypothesis that there is no predominant leadership style among those with or without engineering degrees. This, of course, is due to the lack of statistical significance between TL & XL. Although there were statistically significant differences identified for the mean PA leadership style when compared to TL or XL, it is just not practical to conclude that a predominant style exists as, inherently, the PA scores are also very different from TL and XL in the "Norm Tables." In both comparisons, the mean PA scores are significantly and numerically lower than either TL or XL

Figure 19: Reported Scores and the 50th Percentile Norm.



Summarizing all testing for the second hypothesis, for the first test the ANOVA test did not identify statistically significant differences at the 95% confidence level between the five TL constituents (IA, IB, IM, IS & IC). For the second test the ANOVA test identified statistically significant differences at a 95% confidence level between TL and PA as well as XL and PA. However, TL and XL were not statistically different. For the third and final test the one sample t-test confirmed that for all groups, with and without

engineering degrees, at the 95% confidence level, varying %tile levels of "in-group" demonstration of full range leadership styles (TL, XL & PA) were perceived to be present.

CHAPTER 5

CONCLUSIONS

The first research hypothesis was H0a: There is no relationship between engineering education and Transformational Leadership (TL). Based on the evidence presented, this hypothesis should be rejected when considering the manager and integrated sample populations with engineering degrees versus those without. This, of course, suggests that those with engineering degrees are more transformational. However, perhaps due to the reduced power of the test, analysis of the CPM groups did not identify statistically significant differences at an alpha of 0.05. Another statistically significant difference, occurring in the manager and integrated populations with engineering degrees is a higher perceived level of XL style versus the same for those without engineering degrees. This difference, on the surface, may appear to undermine the significance of the TL findings for the same group. This should not be the case, however, when considering a couple of key mitigating factors. First, it is incumbent upon leaders to make clear the expectations (e.g. goals and objectives) for subordinates which may also be viewed in the context of providing what to do. How and why subordinates achieve the goals and objectives may be linked to, among other things, motivation and inspiration provided by the leader. According to Avolio and Bass (2004) some of the qualities associated with XL include, "provides assistance in exchange for efforts, discusses who is responsible for what, makes clear [the] rewards for efforts, focuses attention on mistakes and attention [is] directed to failure" (p. 102). The same for TL include, "inspire, instill pride, sense of purpose, displays confidence, talks

optimistically, articulates a vision [and] questions assumptions" (p.101). From these comments, it should be clear that effective leaders must provide both what is to be done and, concurrently, offer vision and strategies regarding how such may be accomplished. Supporting this point, Avolio and Bass (2004) stated that, "the transactional process, [contingent reward] in which the leader clarifies what the associates need to do for a reward, is nevertheless viewed ...as an essential component of ...effective leadership" (p. 21). Second, contingent reward is one of only two XL constituents thereby accounting for 50% of the total perceived style rating. The other constituent for XL is management by exception active (MBEA). Bennet (2009) cited works of multiple authors who argued that contingent reward was, in itself, related to TL (p. 6). Thus, it might be concluded that if the reported perceived contingent reward (CR) constituent of XL is, in essence, driving the overall XL mean score, and XL is determined to be statistically different and higher for those in the integrated population versus the same without, such may be consistent with arguments posed above by Avolio, Bass and Bennet. Namely, that CR, in combination with TL, may be required for effective leadership. Table 32 below reflects the mean scores for CR and MBEA.

Table 32: Perceived Mean Scores for CR and MBEA.

Group Statistics

	LDRSTYLE	N	Mean	Std. Deviation	Std. Error Mean
SCORE	INTXLCR	112	2.8058	0.8461	0.07995
	INTXLMBEA	112	2.3884	0.93472	0.08832

To test this theory, an independent sample's t-test was implemented seeking to identify mean differences for both XL constituents (CR and MBEA shown in Table 32 above). Referring to Table 33 below, it can be seen that the normality assumption was not met for either group. The p values of .001 and 0.015 for CR and MBEA respectively, were less than .05.

Table 33: CR and MBEA Means Test.

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	LDRSTYLE	Statistic	df	Sig.	Statistic	df	Sig.
	INTXLCR	0.091	112	0.023	0.952	112	0.001
SCORE	INTXLMBE/	0.081	112	0.069	0.971	112	0.015

a. Lilliefors Significance Correction

Referring now to Table 34 below, because the "sig" value = .280 and this is > p = .05, the variances are equal. Also note the value in the "Sig (2-tailed) column in the Equal Variances Assumed row. Because this value, p = .001 is less than .05, it can therefore be concluded that CR and MBEA do have statistically significantly different mean XL constituent style scores with the CR mean being numerically greater. This difference in CR and MBEA scores may potentially support previously referenced arguments suggesting that the CR component of XL is linked to TL and consequently, effective leadership.

Table 34: Equal Variance Test for CR and MBEA.

		Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
SCORE	Equal variances assumed	1.278	.260	3.504	222	.001	.41741	.11913	.18263	.65219
	Equal variances not assumed			3.504	219.833	.001	.41741	.11913	.18262	.65220

The second research hypothesis was H0b: There is no predominant style of leadership among actors with and without engineering degrees. Efforts to assess this hypothesis required a three pronged statistical approach including ANOVA and the one sample t-test. Based on the evidence presented from the first test, and at an alpha level of .05, no statistically significant constituent differences were detected for TL for the integrated population. Likewise, as determined by the second test, TL and XL were not statistically different when comparing the reported mean leadership styles for all three sample populations (CPMs, managers and integrated). Finally, although a visible trend existed in the integrated population (for those with and without engineering degrees) from the TL style downward to the PA style, there was no statistically significant difference at an alpha level of .05 for the TL and XL perceived mean scores. Due to the lack of statistical significance here, and considering the above practicality discussion regarding PA and its respective inherently low mean scores relative to the remaining style mean values, this hypothesis should not be rejected.

The reader may recall the author's deference to comments and citations offered by Elliot and Woodward (2007) regarding the severity of assumptions (e.g. normality, outliers, etc.). Namely, that the parametric tests employed were robust enough to

accommodate some departures from these assumptions while still providing valid statistical results. In an effort offer further support for this position, two (2) non-parametric tests were run – the Mann-Whitney U and the Kruskal-Wallis. The "Mann-Whitney U (compare[s] two independent groups) [and served as a] nonparametric alternative to a two sample t-test" (Elliot & Woodward, 2007, p. 193). Likewise, the "Kruskal-Wallis (compare[s] two or more independent groups) [and served as a] nonparametric alternative to a one-way analysis of variance" (Elliot & Woodward, 2007, p. 193). The reader may refer to Appendix G to view these applications.

There are limitations with regard to the generalizability of current research which was to determine the relationship, if one existed, between engineering education and leadership style with emphasis on TL. And, while some statistically significant differences were detected, particularly in the larger populations, such should not be interpreted to suggest generalizability to all those with engineering degrees. Indeed, literature abounds regarding the lack of leadership skills, perhaps due to the lack of desire for such positions, inherent with engineering graduates as leaders. What can be said of the generalizability of the results is that predicated on the sampled integrated population, inclusive of those with and without engineering degrees who held leadership positions, raters perceived the group with engineering degrees to be more transformational, and transactional, than those without.

The design of the MLQ5X is also conducive in providing some insight as to the overall leadership effectiveness resulting from the perceived mean style scores. However, although such data was also collected with the current research, addressing this area was not within the research scope.

5.1 Limitations and Areas for Future Research

The current research also identified opportunities for future research. Returning to some of the demographic information reviewed earlier, although any comprehensive analysis was well beyond the scope of the current research, ANOVA and the independent samples t-test were employed, on the integrated Population (with and without engineering degrees), to determine the extent to which experience, gender and the number of organizational reports (direct and/or matrix) may have influenced perceived leadership style of the individual being rated. As is evident from the results in Table 35 below, females were different from males (female mean 2.06 versus male mean 1.57). Otherwise, no statistically significant differences were identified between the various demographic and organizational structure factors for either of the integrated population groups (with or without engineering degrees).

Table 35: Areas for Future Research.

Integrated with engineering degrees	The TL Value was NOT statistically significantly different between experience Levels, $F(2, 109) = 2.538$, $p = 0.084$.
	The TL Value was NOT statistically significantly different between Gender Levels, $T(109) = -.543$, and $p = .588$.
	TL Value was NOT statistically significantly different between Direct Report Levels, $F(2, 109) = 2.2268$, $p = 0.113$.
Integrated without engineering degrees	The TL Value was NOT statistically significantly different between Experience Levels, $F(2, 166) = 3.401$, $p = 0.036$.
	The TL Value WAS statistically significantly different between Gender Levels, $T(137) = 3.119$, and $p = .002$.
	The TL Value was NOT statistically significantly different between Direct Report Levels, $F(2, 172) = 2.526$, $p = 0.083$.

Based on the above preliminary results, the following future research questions may be posed:

1. Is the perception of leadership style of those with engineering degrees influenced by leader gender or experience?
2. Is the perception of leadership style of those with engineering degrees influenced by the number of reports?
3. Does the possession of an engineering degree/experience by the "rater" influence the perception of leadership style?
4. Does the possession of an engineering degree by the "rater" and/or "rater" gender influence the perception of leadership style?

As mentioned in the Research Limitations Section, another future research opportunity is to determine the perceived leadership effectiveness based on data collected while also considering the questions posed above. With answers to the expanded questions, and leadership effectiveness, the generalizability of the current research may be further substantiated.

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APPENDICES

APPENDIX A: DETAILED LITERATURE GAP ANALYSIS

Article No.	Article	Assessment of PM TL	Assessment of PM TZ	Assessment of TL		Assessment of TZ		Engineering Degree
				Certified PM's	Non-Certified PM's	Certified PM's	Non-Certified PM's	
1	TL in a project based environment: a comparative study of the leadership styles of project managers and line managers.	X	contingent reward behavior	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
2	Project Manager Leadership Role in Improving Project Performance	(reference to Hartog & Keegan's TL study)	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
3	The Applicability of TL to Short-term Projects.	in projects not individuals	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
4	Project Manager Leadership Behaviors and Frequency of Use by Female Project Managers	Females	Females	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
5	Leadership competency profiles of successful project managers.	(reference to Hartog & Keegan's TL study)	In projects	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
6	Understanding the Role of Vision in Project Success	Project Vision	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
7	An Empirical Study Reflecting the importance of TL on Project Success Across Twenty-Eight Nations	and project success	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
8	Examining the role of TL of portfolio managers in project performance	Portfolio Managers	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
9	The challenge of TZ and TL in projects.	X	*X*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
10	The association among project manager's leadership style, teamwork and project success.	X	*X*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
11	Matching the project manager's leadership style to project type.	(reference to Hartog & Keegan's TL study)	*for engineering projects*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
12	A Study of the Management Leadership style preferred by IT subordinates.	studied IT managers and subordinates	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*
13	The Project Manager's Leadership Style As a success factor on Projects: A literature Review	(reference to Hartog & Keegan's TL study)	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*	*GAP*

APPENDIX B: MULTIFACTOR LEADERSHIP QUESTIONNAIRE

Multifactor Leadership Questionnaire
Rater Form

Name of Leader: _____ Date: _____

Organization ID #: _____ Leader ID #: _____

This questionnaire is used to describe the leadership style of the above-mentioned individual as you perceive it. Answer all items on this answer sheet. **If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.** Please answer this questionnaire anonymously.

Important (necessary for processing): Which best describes you?

___ I am at a higher organizational level than the person I am rating
___ The person I am rating is at my organizational level.
___ I am at a lower organizational level than the person I am rating.
___ Other than the above.

Forty-five descriptive statements are listed on the following pages. Judge how frequently each statement fits the person you are describing. Use the following rating scale:

Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
0	1	2	3	4

The Person I Am Rating...

1.	*Provides me with assistance in exchange for my efforts*	0	1	2	3	4
2.	*Re-examines critical assumptions to question whether they are appropriate	0	1	2	3	4
3.	Fails to interfere until problems become serious	0	1	2	3	4
4.	Focuses attention on irregularities, mistakes, exceptions, and deviations from standards	0	1	2	3	4
5.	Avoids getting involved when important issues arise	0	1	2	3	4
6.	*Talks about his/her most important values and beliefs	0	1	2	3	4
7.	Is absent when needed	0	1	2	3	4
8.	*Seeks differing perspectives when solving problems	0	1	2	3	4
9.	*Talks optimistically about the future	0	1	2	3	4
10.	*Instills pride in me for being associated with him/her	0	1	2	3	4
11.	Discusses in specific terms who is responsible for achieving performance targets	0	1	2	3	4
12.	Waits for things to go wrong before taking action	0	1	2	3	4
13.	*Talks enthusiastically about what needs to be accomplished	0	1	2	3	4
14.	*Specifies the importance of having a strong sense of purpose	0	1	2	3	4
15.	*Spends time teaching and coaching	0	1	2	3	4

Continued ➔

APPENDIX C: MLQ 5X

MLQ Multifactor Leadership Questionnaire
Scoring Key (5x) Short

My Name: _____ Date: _____

Organization ID #: _____ Leader ID #: _____

Scoring: The MLQ scale scores are average scores for the items on the scale. The score can be derived by summing the items and dividing by the number of items that make up the scale. **If an item is left blank, divide the total for that scale by the number of items answered.** All of the leadership style scales have four items, Extra Effort has three items, Effectiveness has four items, and Satisfaction has two items.

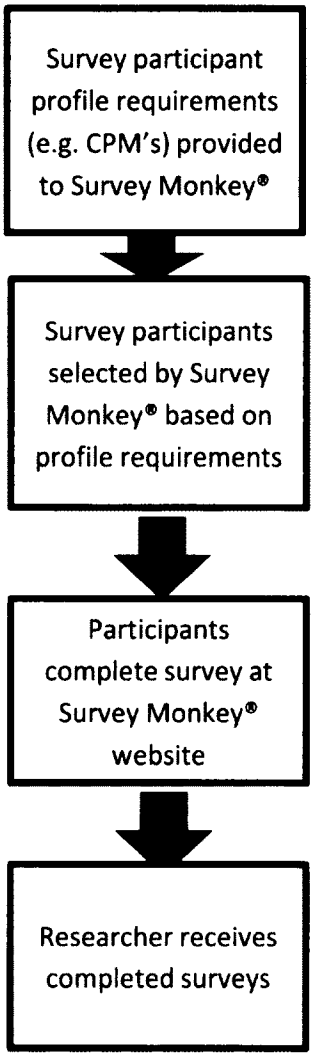
Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
0	1	2	3	4

***Idealized Influence (Attributed) total/4 =**
***Idealized Influence (Behavior) total/4 =**
***Inspirational Motivation total/4 =**
***Intellectual Stimulation total/4 =**
***Individual Consideration total/4 =**
 # Contingent Reward total/4 =
 # Management-by-Exception (Active) total/4 =
+Management-by-Exception (Passive) total/4 =
+Laissez-faire Leadership total/4 =
Extra Effort total/3 =
Effectiveness total/4 =
Satisfaction total/2 =

1.	Contingent Reward	0	1	2	3	4
2.	Intellectual Stimulation	0	1	2	3	4
3.	Management-by-Exception (Passive)	0	1	2	3	4
4.	Management-by-Exception (Active)	0	1	2	3	4
5.	Laissez-faire Leadership	0	1	2	3	4
6.	Idealized Influence (Behavior)	0	1	2	3	4
7.	Laissez-faire Leadership	0	1	2	3	4
8.	Intellectual Stimulation	0	1	2	3	4
9.	Inspirational Motivation	0	1	2	3	4
10.	Idealized Influence (Attributed)	0	1	2	3	4
11.	Contingent Reward	0	1	2	3	4
12.	Management-by-Exception (Passive)	0	1	2	3	4
13.	Inspirational Motivation	0	1	2	3	4
14.	Idealized Influence (Behavior)	0	1	2	3	4
15.	Individual Consideration	0	1	2	3	4

Continued →

APPENDIX D: SURVEY PROCESS



APPENDIX E: NORMATIVE TABLES

Appendix B: Percentiles for Individual Scores (US)

Percentiles for Individual Scores Based Total of all Rating Levels (US)

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF	EE	EFF	SAT	
N =	27,285	27,285	27,285	27,285	27,285	27,285	27,285	27,285	27,285	27,285	27,285	27,285	
%ile	MLQ Scores									Outcomes			%ile
5	1.50	1.50	1.50	1.50	1.25	1.50	.25	.00	.00	1.00	1.75	1.50	5
10	2.00	1.75	2.00	1.75	1.75	2.00	.50	.00	.00	1.67	2.00	2.00	10
20	2.25	2.25	2.25	2.25	2.25	2.25	[illegible]	[illegible]	.00	2.00	2.50	2.50	20
30	2.75	2.50	2.50	2.50	2.50	2.50	1.25	.50	.25	2.33	2.75	3.00	30
40	2.75	2.75	2.75	2.75	2.75	2.75	1.40	.75	.25	2.67	3.00	3.00	40
50	3.00	3.00	3.00	2.75	2.75	3.00	1.67	1.00	.50	2.74	3.25	3.00	50
60	3.25	3.25	3.25	3.00	3.00	[illegible]	1.87	[illegible]	.75	3.00	3.25	3.50	60
70	3.50	3.50	3.43	3.25	3.25	3.25	2.12	1.25	.92	3.33	3.50	3.50	70
80	3.50	3.75	3.50	3.43	3.43	3.50	2.50	1.54	1.23	3.67	3.75	4.00	80
90	3.75	3.75	3.75	3.75	3.75	3.75	2.87	[illegible]	1.50	4.00	4.00	4.00	90
95	4.00	4.00	4.00	3.75	3.75	4.00	3.25	2.50	2.00	4.00	4.00	4.00	95

LEGEND: II(A) = Idealized Influence (Attributes) Key for Frequency: 4.0 = Frequently, if not always
II(B) = Idealized Influence (Behavior) 3.0 = Fairly often
IM = Inspirational Motivation 2.0 = Sometimes
IS = Intellectual Stimulation 1.0 = Once in a while
IC = Individualized Consideration 0 = Not at all
CR = Contingent Reward
MBEA = Management by Exception: Active
MBEP = Management by Exception: Passive
LF = Laissez-Faire
EE = Extra Effort
EFF = Effectiveness
SAT = Satisfaction

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Percentiles for Individual Scores Based on Same Level Ratings (US)

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF	EE	EFF	SAT	
N =	5,185	5,185	5,185	5,185	5,185	5,185	5,185	5,185	5,185	5,185	5,185	5,185	
%ile	MLQ Scores									Outcomes			%ile
5	1.50	1.50	1.50	1.50	1.50	1.75	.25	.00	.00	[illegible]	1.75	1.50	5
10	2.00	1.75	1.75	1.75	1.75	2.00	.50	[illegible]	.00	1.66	2.00	2.00	10
20	2.25	2.25	2.25	2.25	2.25	2.37	1.00	.35	.00	2.00	2.50	2.50	20
30	2.67	2.50	2.50	2.50	2.50	2.60	1.25	.50	.25	2.23	2.75	2.91	30
40	2.75	2.75	2.75	2.75	2.75	2.75	1.50	.75	.25	2.67	3.00	3.00	40
50	3.00	2.75	3.00	2.75	3.00	3.06	1.75	1.00	.50	2.73	[illegible]	3.08	50
60	3.25	3.00	3.00	3.00	3.00	3.25	2.00	1.04	.75	3.00	3.25	3.50	60
70	3.50	3.25	3.25	3.25	3.25	3.25	2.25	1.25	[illegible]	3.33	3.50	3.50	70
80	3.50	3.28	3.28	3.34	3.34	3.50	2.50	1.50	1.17	3.34	3.75	4.00	80
90	3.75	3.75	3.75	3.75	3.75	3.75	2.87	2.00	1.50	3.67	4.00	4.00	90
95	4.00	3.75	4.00	4.00	4.00	[illegible]	3.25	2.50	2.50	4.00	4.00	4.00	95

Percentiles for Individual Scores Based on Lower Level Ratings (US)

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF	EE	EFF	SAT	
N =	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118	12,118	
%ile	MLQ Scores									Outcomes			%ile
5	1.25	1.25	1.50	1.50	1.00	1.29	.25	.00	.00	1.00	1.50	1.00	5
10	1.75	1.75	2.00	1.75	1.50	1.75	.50	.00	.00	1.33	2.00	2.00	10
20	2.25	[illegible]	2.25	2.25	2.00	2.25	.75	.25	.00	2.00	2.00	2.50	20
30	2.50	2.50	2.75	2.50	2.50	2.50	[illegible]	.50	.25	2.33	2.50	3.00	30
40	2.75	2.54	3.00	2.75	2.75	2.75	1.37	.75	.25	2.67	2.75	3.00	40
50	3.00	2.75	3.00	2.75	3.00	3.00	1.62	1.00	.50	3.00	3.00	3.50	50
60	3.25	3.00	3.25	3.00	3.17	3.13	1.87	1.00	.75	3.00	3.25	3.50	60
70	3.50	3.25	3.50	3.25	3.25	3.25	2.25	1.25	.83	3.33	3.50	3.67	70
80	3.75	3.46	3.75	3.50	3.50	3.50	2.50	[illegible]	1.25	3.67	3.52	4.00	80
90	[illegible]	3.75	4.00	3.75	3.75	3.75	[illegible]	[illegible]	1.75	4.00	[illegible]	[illegible]	90
95	4.00	3.75	4.00	4.00	4.00	4.00	3.25	2.50	2.00	4.00	[illegible]	4.00	95

APPENDIX F: IRB APPROVAL

From: Christian Zemlin <czemlin@odu.edu>
Date: Thursday, August 14, 2014 at 10:37 AM
To: EMSE BCET <cbdaniel@odu.edu>
Cc: Stacie Ringleb <SRingleb@odu.edu>, "Audette, Michel A." <maudette@odu.edu>, "Jovanovic, Vukica" <v2jovano@odu.edu>, "Zemlin, Christian W." <czemlin@odu.edu>, Pilar Pazos-Lago <MPazosLa@odu.edu>
Subject: Re: Calloway

Dear Dr. Daniels,

The IRB has approved your application for exemption of the protocol "Project Management and Leadership Style: Is style influenced by engineering education?".

Regards,

Christian Zemlin

On 08/13/2014 11:28 AM, Daniels, Charlie wrote:
Dr. Zemlin:
Any news on the status of Jesse Calloway's IRB application?
Charlie Daniels

Charles B. Daniels, Ph.D.
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APPENDIX G: NONPARAMETRIC TESTING

Employing non-parametric testing, the intent of this appendix is to confirm findings resulting from the use of parametric testing of key aspects of the hypothesis H1: There is no statistically significant difference between leadership styles of managers (CPMs, non-CPM managers or the integrated manager group) with engineering degrees versus the same without engineering degrees.

The first test considers whether or not there is any statistically significant difference in TL as measured by perceived style scores. The Mann-Whitney U Test will be employed using SPSS. Upon running this test, the summary information is indicated in Table 36 below. The Mann-Whitney Test in SPSS automatically restates the hypothesis as indicated below in the "null hypothesis" column. The "Sig" or "p-value" is also given which, based on its level, corresponds to the "Decision" column output. In this case, given that p = 0.397, H1 cannot be rejected which is consistent with the parametric test findings using the two sample t-test.

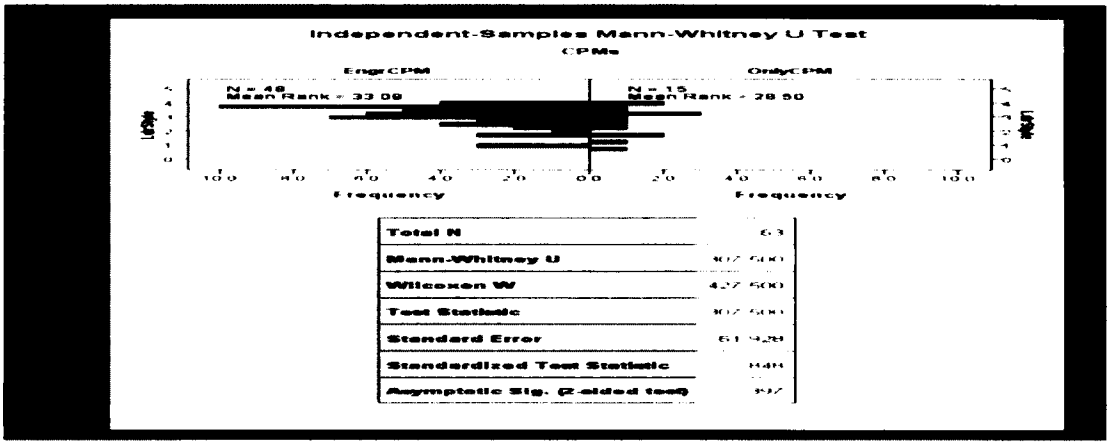
Table 36: CPM Summary Information:

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of LdrStyle is the same across categories of CPMs.	Independent-Samples Mann-Whitney U Test	.397	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 19 below presents the distributions that must also be considered with the Mann-Whitney U application.

Figure 19: Distributions for CPMs



SPSS uses the "population pyramid" method for presenting these distributions. And, as seen in composite Figure 19 above, the distributions for CPM populations appear relatively similar. (Note: whether the reader views the distributions as similar or dissimilar does not change the statistical result.) Table 37 below reflects the medians associated with the CPM populations.

Table 37: CPM Medians

CPMs	LdrStyle
EngrCPM	3.1500
OnlyCPM	2.9000
Total	3.1000

Based on the above data, the aggregated results regarding the CPM populations with and without engineering degrees are expressed as follows:

A Mann-Whitney U test was run to determine if there were differences in LeaderStyle scores between EngrCPMs and OnlyCPMs. Distributions of the LeaderStyle scores for

EngrCPMs and OnlyCPMs were similar, as assessed by visual inspection. LeaderStyle score was not statistically significantly different between EngrCPMs (Mdn = 3.15) and OnlyCPMs (Mdn = 2.90), U = 307.5, z = -0.848, p = .397.
The Mann-Whitney U test was also implemented with the Manager and Integrated populations. As was the case above, see below, both tests confirmed the results achieved employing the parametric t-test.

Managers: A Mann-Whitney U test was run to determine if there were differences in LeaderStyle scores between EngrMgrs and OnlyMgrs. Distributions of the LeaderStyle scores for EngrMgrs and OnlyMgrs were similar, as assessed by visual inspection. LeaderStyle score was statistically significantly higher in EngrMgrs (Mdn = 2.73) than in OnlyMgrs (Mdn = 2.08), U = 3,588, z = -3.161p = .002.

Integrated: A Mann-Whitney U test was run to determine if there were differences in LeaderStyle scores between EngrINTGR and OnlyINTGR. Distributions of the LeaderStyle scores for EngrINTGR and OnlyINTGR were similar, as assessed by visual inspection. Median LeaderStyle scores were statistically significantly higher in EngrINTGR (2.85) than in OnlyINTGR (2.20), U = 6250.5.5, z = -4.8109, p = .0005.

Further parametric testing of the H1 hypothesis included analysis of the five TL constituents aimed at determining whether or not statistically significant differences existed. ANOVA was employed for this parametric testing. The non-parametric test employed in this section is the Kruskal-Wallis H test. Table 38 below provides summary information associated with the Kruskal-Wallis H test results.

Table 38: TL Attribute Summary Data

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Attribute Value is the same across categories of TL Atribute.	Independent-Samples Kruskal-Wallis Test	.313	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05

In addition to Table 38 above, composite Figure 20 below presents the distributions that must also be considered, as well as other necessary statistical data, post implementation of the Kruskal-Wallis H test application.

Unlike the "population pyramid" method mentioned above, SPSS uses "box plots" for presenting the Kruskal-Wallis H test distributions. As seen in composite Figure 20 below, the distributions for perceived TL constituent scores appear relatively similar. As previously discussed, the five constituent categories tested are idealized attributes (IA),

idealized behavior (IB), inspirational motivation (IM), intellectual stimulation (IS) and individualized consideration (IC).

Figure 20: Distribution Data

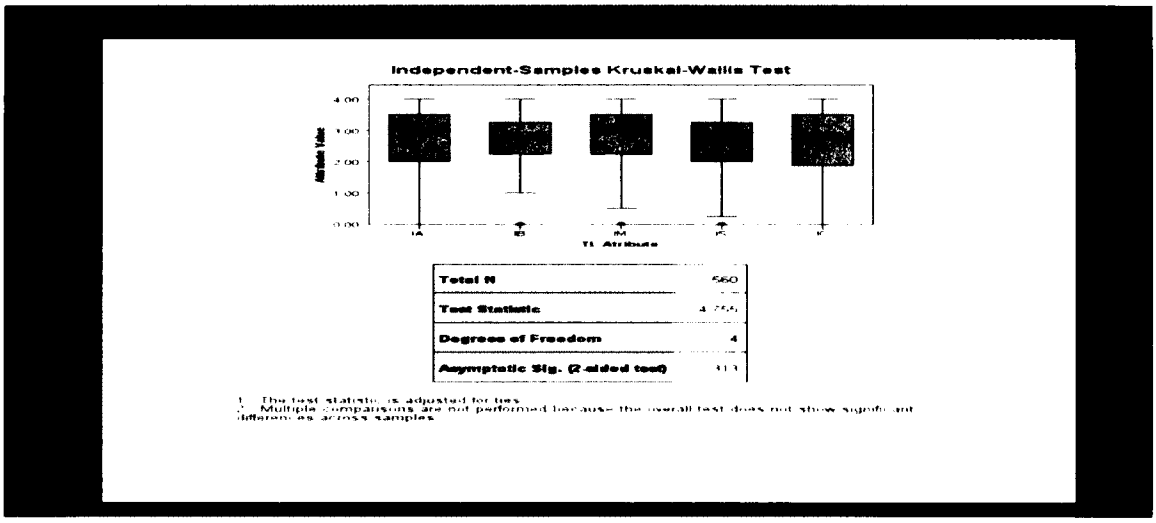


Table 39 below reflects the medians associated with the perceived TL constituent levels.

Table 39: Median Levels for TL Attributes

TL Atribute	N	Median
IA	112	3
IB	112	2.75
IM	112	3
IS	112	2.75
IC	112	2.75
Total	560	3

Referring to composite Figure 20 above, note that the "Test Statistics" row provides the value of the H-statistic (4.755) which approximately follows a χ2-distribution (CHI Square) with k – 1 degrees of freedom.

Considering the resulting test data in aggregate yield the following statements regarding TL attributes:

A Kruskal-Wallis H test was run to determine if there were differences in perceived LeaderStyle score between five groups of scores with different leader style measures: IA,

IB, IM, IS & IC. Distributions of LeaderStyle scores were similar for all groups, as assessed by visual inspection of a boxplot. Median LeaderStyle scores were equal at (Mdn = 2.75), for IB, IS and IC, and likewise for IM & IA (Mdn = 3.0) but the differences were not statistically significant, $\chi 2(4) = 4.755$, $p = .313$.

The above constituent test results confirm the findings from the previously run parametric testing discussed in the results section of this writing.

Summary:

Results from the parametric (two sample independent t-test) aimed at determining whether or not a statistically significant difference in means occurred between each of the CPM, Manager and Integrated populations (with and without engineering degrees), were confirmed employing the nonparametric Mann-Whitney U test.

Likewise, the parametric ANOVA test, implemented to identify statistically significant differences in the five TL constituents for the integrated population (with engineering degrees) was also confirmed employing the Kruskal-Wallis H test.

Thus, despite the lack of conformance to some of the assumptions (e.g. outliers, normality, etc.) evident prior to implementing the parametric testing, the author's position regarding deferring to cited comments offered by Elliot and Woodward (2007, p. 167 & p. 49), remains unchanged and further buttressed by the nonparametric testing results provided above.

VITA

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