Teams: The Fundamental Unit

of Twenty-First Century Organizational Performance

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Michael K Kuppinger

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Gus Gustafson, Ph.D.
Chair

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Committee Members
Amy C. Edmondson, Ph.D. Harvard University
Ruth Wageman, Ph.D. Harvard University
Kate Allen, P.E. Professional Services

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Abstract

Never doubt that a small group of thoughtful citizens can change the world. Indeed, it is the only thing that ever has. ¹

~Margaret Mead

Around the end of WWII, academic researchers discovered the value of teams. Like Margaret Mead, academics realized that the teams people associate with profoundly impact individuals and society. This dissertation addresses the growing gap between what is known about teams and the limited ways practitioners apply that knowledge. I argue that teams are the starting point for individual flourishing and organizational sustainability, rather than a byproduct of individual effort. I begin with stories that highlight the team paradox and then build the case for research at the team level of analysis. An overview of literature of the past century creates a framework from two perspectives: an academic lens to explore the gap between the knowledge of team effectiveness and its application and a practitioner lens to consider the significant business and social factors in opposition to teaming. The synergy of academic and practitioner perspectives leads to a hypothesis that the twenty-first century will see a shift away from individualism and toward interdependency. My dissertation will further support the reframing of teams as complex and loosely-coupled systems, enabling nonlinear performance and organizational adaptability. The research builds

¹ (Mead, n.d.)
on the foundation of conditions and context of team environments, and then draws from several different thought leaders across the fields of psychology, sociology, organizational development, and leadership. My data collection is uniquely focused on engineering teams, and it is both enhanced and biased by my 30 years of engineering leadership and operational experience. My methodological approach follows a multicase study of replication logic, deploying mixed methods: qualitative first-order interview data and second-order quantitative data on high-performance team differentiators. A team model I originally developed as a practitioner will be updated with findings from this research.

The findings from my first-order empirical research is that engineering team performance mediates individual and firm performance through interdependence, cultural norms for continuous learning, and team-centric goals and reward systems. I pay special attention to team size and boundaries as engineering firms compete in a global environment. This dissertation further contributes to the work done at the Center for Values Driven Leadership, Benedictine University and their return on values (ROV) project.
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Chapter 1: Introduction

Quotations from Irving Goffman, Richard Hackman, Jon Katzenbach and Douglas Smith discussed later in this chapter were guiding principles for this dissertation, as well as an inspiration for the creation of the following statement: “Teams, as opposed to an individual or the organization, are the fundamental units of performance.” This statement was developed for a class paper, issued on November 16, 2015, and has become the title of my dissertation.

This introduction will provide the background and context for my research and establish the business case need for further action. This introduction has been written as an expanded executive summary for the other chapters; therefore, will include an overview of the multiple streams of literature, thought leadership discussions, and methodological approach. An important goal of this dissertation is to draw from a wide breath of resources, such as literature from multiple academic fields of psychology, sociology, communications, systems, and leadership; practitioner-based experience and consulting expertise; interviews of academic professors, engineering leaders, and field experts; quantitative industry data previously collected along with future trends within the engineering industry; and first-order interviews of engineering teams. Several stories and inspirational statements are included to bridge the various sources explored during my journey in writing this document. The conclusion of this chapter presents the purpose and logical structure of my research,
ending with a simple research question and specific test variables integrated into three hypothesis statements.

**Teams—The Fundamental Unit of Performance**

If winning the World Series is the performance goal for major league baseball teams, and player salaries are a measure of team player value, then one would assume that investing the money to hire the best players will result in the best team. In other words, if team value is simply the sum total of individual player value, then we would expect that teams with the highest salary caps would dominate the list of World Series winners. Agree? The interesting fact regarding major league baseball is that over the last ten years, the World Series winners were most often teams with only half of the total team salary (Orinick, 2015).

Erving Goffman was considered “the most influential American sociologist of the twentieth century” (Fine & Manning, 2003, p. 34), and in his book, *The Presentation of Self in Everyday Life* (Goffman, 1959), he drew attention to the causational influence of groups on individual members and organization. Goffman suggests that specific influences such as identity, expression, and perspective of performing, give consideration for groups and teams having the greater reciprocal influence to both an individual and the organization:

An emergent team impression arises which can conveniently be treated as a fact in its own right. . . . The team and the team performance may well be the best units to take as the fundamental point of reference.
The use of the team (as opposed to the performer) as the fundamental unit (p. 80).

Katzenbach and Smith (1993) made a similar statement over 30 years later:

The potential impact of single teams, as well as, the collective impact of many teams, is woefully underexploited—despite the rapid growing recognition of the need for what teams have to offer. (2015, p. 5) We continue to believe that a real team—appropriately focused and rigorously disciplined—is the most versatile units organizations have for meeting both performance and change challenges in today’s complex world. (p. xiii)

The guiding principal of this research stated at the start of this chapter was created from the Goffman (1959), Katzenbach and Smith (1993), and my own experience as a practitioner. I formulated my statement that “the team, as opposed to an individual or the organization, is the fundamental unit of performance” (Kuppinger, 2014, p. 7) in a Benedictine class. I discovered two similar statements during my research as reassurance of its validity. Hackman (2002) in a domestic airline case study noted that “from then on, teams rather than individuals were the primary units for performing customer service” (p. 15). Similarly, Katzenbach and Smith republished their 1993 book in 2006 and again in 2015, with the same title The Wisdom of Teams: Creating the High-Performance Organization, to continue supporting this idea. The following statement is taken from their most current publication: “The team is the fundamental unit of performance for most organizations” (Katzenbach & Smith, 2015, p. 21). The critical message here is that the team unit must take priority over the organization and at times over the individual, for the benefit of both. After three years of academic
study on leadership, I found these statements so profound, yet one of the most paradoxical discoveries of my entire PhD program. Practitioners pay strong voice to the value of teams while seldom embracing their potential as a priority.

**Learning in a complex society**

Edgar Schein is recognized as one of the most prominent psychologists in the field of organizational development by Famous Psychologist Organization (Schein, 2014). Edmondson (2012) says Schein argues that teaming and learning are vital for organizations as society evolves to higher states of complexity:

> To get anything accomplished in a technologically complex society requires the input of information and processing sophistication from many fields. That, in turn means that managers as individuals no longer know enough to make decisions and get things done. . . . The mindset of teaming has to be focused on . . . and that inevitably is a learning process. (“Edgar Schein,” p. xii)

Organizations dynamically learn and adapt to the continuously changing marketplace through the empowerment of teams, which is both a theme for this dissertation and the fundamental message in Edmondson’s 2012 book *Teaming: How Organizations Learn, Innovate, and Compete in the Knowledge Economy*. Edmondson states that “learning in small groups—is regarded as the primary vehicle for organizational learning” (p. 1). Continuous learning and dynamic adaptability in our complex society requires leaders need to think about their roles differently. Rather than being the most technically advanced as to provide answers, “they need to ask the right questions” (Edmondson, 2012, p. 4). Developing competence as well as continuous
learning of both technical and socio-cultural skills is essential for engineers (Joyner, Derek, Mann, & Harris, 2012).

LaFasto and Larson (2001) studied 6,000 teams, where their very first observation made in the prologue of book, *When Teams Work Best*, is that a “social transformation from individual work to teamwork” (xviii) that began 50 years ago is occurring. They further suggest this transformation toward teams is a result of “increased complexity and social evolution” (p. xviii). In 30 years of practitioner consulting working with small firms to most of the Fortune 500 companies, I have witnessed many examples where firms develop and even measure team-level performance, yet cannot recall a single occurrence when team metrics were a primary indicator of either company success or individual performance. My anecdotal experience suggests that team metrics and analysis are dwarfed by both organizational and individual analysis and is supported by research (Dinh et al., 2014; Edmondson, 2014; Katzenbach & Smith, 2015), and discussed in detail within the literature review chapter of this dissertation. Strategic and tactical goals of most companies are too complex to be separated into individual goals; therefore, the sum total of all individual goals will always leave gaps. These gaps between company and individuals will be dependent on shared responsibilities as will be demonstrated in the following example. I can recall several firms where the senior leadership would explain that each person in their firm was doing well and received a rating of
excellent or at least satisfactory on their individual performance ratings, yet the firm was not doing well. If each person is doing their assigned job, then why does this not guarantee the firm’s performance? I propose two basic reasons, first is that people were focusing on their independent goals and at times generating internal competition, rather than looking for ways to share diverse skills. A second reason for this difference between individual and firm performance is that individual performance ratings were written by supervisors who could not determine where in the process the ball was dropped and who had the responsibility, since each person reported successful completion of their task(s). Both of these gaps can be bridged by teams. Teams are typically created as a functional unit containing the necessary skills and resources to complete a specific task; therefore members must take on a primary role, as well as a secondary role filling the gaps. During my years as a general manager of nearly 300 engineers, I would often use the metaphor of a baseball team to help explain the balance between individual and team goals, ensuring that each player understood both their primary role along with their backup role. (I apologize to the non-sports advocates.) Each player on a baseball team has a specific assignment plus a backup assignment on defense and each also has position in the batting lineup based on their individual skills. The team goal is winning the game and no matter how well an individual plays, the team only gets to the World Series by winning games. The important point in this metaphor is to relate it to an individual, so I might first ask the team leader: Do you have the correct roster of players with each critical
position filled? I often would start by discussing the position of the second baseman, stating that he has a clear primary assignment to field the ball when it is hit to the right side of second base, but also to cover second base if the ball is hit left of second base. The second baseman also has backup responsibilities to the first baseman, pitcher, and shortstop. I’d ask engineers: Do you know your primary and secondary roles? As a leader, I find it important to also provide examples of what not to do. Therefore, I would close by saying that if the second baseman runs out into left field, then he is not playing his position nor fulfilling his responsibility to his teammates.

If teams are truly the fundamental unit of performance, then why are organizations not focusing on team performance as a primary metric? Katzenbach and Smith (2006) provide a summary of findings as to what companies are doing and not doing to measure performance. “Organizations cultivate activity-based goals, rather than outcome-based performance goals . . . [and developed] a singular focus on short term financial results” (p. xvi). Teams are complex systems requiring a new framework of metrics rather than the metrics we have learned looked through old lenses. An example of this is the significant investment companies have made to improve interpersonal relationships with questionable results. Research has shown that interpersonal relationships will be a positive mediator of task focus and work effectiveness; yet interpersonal skills are not an independent factor to improve performance. Figure 1 illustrates this correlation along with this statement:
No research shows that focusing on interpersonal relationships alone increases performance. Focusing on tasks with a compelling purpose is the window to accessing interpersonal relations . . . that build the interdependence which will improve performance. (Edmondson personal communication, July 17, 2015.)

Academic research has not found a direct correlation between interpersonal skills and performance, which is supported by the experience of consultants Katzenbach and Smith (2015), who noted that “focusing on becoming a team seldom works” (p. xiv).

Now consider the difference in society’s influence from today compared to the time after World War II. The discussion in Chapter 2 will present empirical data supporting a change in society from a more collective mindset toward a more individualist perspective, while the following examples are noted in this introduction chapter to prove intuitive consideration for the change. John F. Kennedy received an enthusiastic response from his speech, “Ask not what your country can do for you,” delivered on January 20, 1961, where he asked citizens to think of others before
themselves. Likewise, Martin Luther-King’s “I Have a Dream” speech which powerfully united people toward a shared vision on August 28th, 1963. These famous speeches were focused on prosperity of the collective nation and received overwhelming support. Note the era of these three references: Kennedy in 1961, King in 1963, along with Goffman in 1959. Would there be the same reaction today?

**Mindset change on teams**
High performing firms are the ones who inspire employees with a simple and inspiring message; firms that create conditions where a compelling direction, a well-designed team structure, and supportive organization enable teams the freedom to learn and uniquely respond to their clients. One such example where teams were provided these enabling conditions, along with the freedom to uniquely service their clients, emerged from a case study conducted by Hackman (2002) within the airline industry. Traditional airline flight crews were provided detailed scripts to follow and flight assignments were designed to have attendants work with different crew members on each set of trips. This design was used to maximize uniformity of service delivery on each flight, while being typical to how I have witnessed engineering firms move people. A domestic airline challenged this tradition by training their flight crews in teams. Teams were provided the mandatory FAA rules, along with company guidelines, yet each crew was allowed to change their style of delivery based on the unique skills of crew members and the specific type of customers on each flight. The founder and CEO of this domestic airline considered their team-focused approach, a
key feature of the firm’s highly successful years, while stating that, “teams rather than individuals were the primary units for performing customer service work” (Hackman, 2002, p. 15).

Consider the following four statements that might be used to describe high-performing teams:

1. Teams with members who harmoniously work together will outperform teams who generate lots of conflict regarding the means and methods of the work.

2. The primary cause of team performance is the team leader’s behavior, especially in the case where the leader is a technical expert with more answers than questions.

3. Larger project teams with 10 or more members have both more resources and more diversity of skills among the members, therefore will perform better than small teams with four to six members.

4. Team performance peaks shortly after new teams are assembled, then deteriorates over long periods of time as members become careless and overlook mistakes of others.

These four statements have two important attributes in common. First is that they are seen as things seem to be in teams and the second is that they are each wrong. Hackman (2002) used these types of questions to demonstrate a most critical mindset
difference between causation of performance verses the contextual conditions of team effectiveness. He further argued that “evidence from both social science research and organizational practice, provide a new set of s . . . that correct commonly held views of teams that are more illusory than real” (p. xii). These four statements will briefly be commented on here and then further unpacked in Chapter 2.

The first statement regarding teams whose members work together harmoniously simply feels better than teams in conflict, yet constructive conflict is where learning occurs. Teams quite often resist confrontation and create social norms of getting along and going along, as opposed to challenging the status quo with new ideas. One of the most recognized and accepted team models indicates four sequential phases of development, which all working teams must progress through: Forming, Storming, Norming, and Performing (Tuckman, 1965). Therefore, what happens with teams who avoid conflict? They get stuck in the “forming” stage, never reaching their performance potential. Members then operate very independently of each other because social norms discourage even new members from offering their unique skills or knowledge to others. I have seen engineering and architectural teams get stuck in the first phase of forming, where members do not fully engage cognitively in the design process; consequently, they often become dissatisfied and many times leave the firm.
The second statement claims that the behavior of the team leader is the primary cause of team dynamics. While the leader’s behavior will exert influence on the team, Hackman (1987) discovered that the conditions under which the teams operate often greatly influence team performance. According to Doolen, Hacker, and Van Aken (2006), team processes, such as collaboration between team members and the type of activities used by teams to achieve their objectives, mitigate the external factors such as a leader’s influence. Research over the past several decades has produced volumes of articles and books focused on the leader as the primary factor in team performance. Articles from 2002 through 2012 indicate a clear shift toward a teaming and share-leadership type mindset (Dinh et al., 2014). Where we discover high-performing teams with a poor leader, we also find evidence of shared leadership emerging from within the team.

The third statement suggests that larger teams perform better. The most effective team size across various types of work products ranges from four to seven members, with a maximum around twelve members (Gibb 1951; Hackman & Vidmar 1970; Kameda, Stasson, Davis, Parks, & Zimmerman, 1992; Wheelan & McKeage 1993; Katzenbach & Smith, 1993, 2006, 2015; Wageman, 1995, 2001a). The absolute best size of any specific working group or team is dependent on the context, type of task, and skills required. Teams with innovative or complex operations have been shown to be most effective in the four- to seven-member range (Wageman, 1995), where
working groups and the tasks are primarily independent and routine, and can be
effective with more members. The number of pairing relationships is an important
factor in team size. A small team of four members has only six pairing relationships,
where a team of eight members has twenty-eight pairing relationships, as seen in
Figure 2.

![Figure 2. Team Pairings]

While adding more resources and member knowledge diversity are two positive
factors of performance, research has shown a diminishing return on performance due
to less interdependence among members. More specifically, “large numbers of people
usually cannot develop the common purpose, goals, and approach, and mutual
accountability of a real team . . . where team members beyond 10 to 12 members
seldom achieve high-performance” (Katzenbach & Smith, 2006, p. 47).
The last statement, suggesting that performance of teams will deteriorate over a long period of time, may intuitively feel accurate, possibly because we naturally place our individual lens on teams. An individual’s performance may peak midcareer and then deteriorate over time, yet the ability to enable others continues to strengthen over long periods of time. Take for example this sports example: The Chicago Blackhawks started to build their high-performance team in 2003, with the drafting of goalkeeper Corey Crawford and Brent Seabrook. Then the team developed homegrown top skaters—like Patrick Kane and Jonathan Toews—over many years. The average age of the 2015 Blackhawks was many years older than most other teams and evident when several veterans could be outskated by younger and faster opponents. I believe that the many years of playing together provided a critical edge for the Chicago Blackhawks to continue to demonstrate higher levels of team performance, by bringing home the Stanley Cup three of the past 6 years: 2010, 2013, and 2015.

**Study Importance to Practitioners**
The first intuitive goal listed in my search for a topic was to find something meaningful and applicable to current industry, as noted in Appendix A. This study is important to managers and leaders for five simple reasons. Each of these reasons is compelling, while I believe that combining the five results in a criticality for teaming to all of society. I believe that the better we practitioners understand team dynamics and are able to apply teaming practices within our families, business, and communities, the better all of society will rise together. The first justification for
importance is that the demand to hire Science, Engineering, Technology, and Math (STEM) knowledge is escalating beyond projected capacities. Teaming of STEM resources will help to fill this gap by more effectively deploying available resources. The second reason is that our global economy and disruptive innovations, such as the explosion of mobile technology, will greatly increase the complexity of the twenty-first century. This dissertation argues that constant change and complexity requires a dynamically adaptive approach of continuous learning, and then further suggests teams as the most effective method for organizational adaptability. The third justification for the importance of this study is to help accelerate the use of team-centric operational metrics. Academic research on teams and teaming has significantly outpaced practitioner adaption. As a practitioner of the past 30 years and now full-time research student, I hope to expedite a mindset change in practitioners to more aggressively apply academic theories and tools to associated business operations. Fourth is that the most significant challenge for the engineering design industry: ownership transition and the generational gap. Teaming and shared leadership models can greatly assist with these issues. The fifth reason that this study is important to that it demonstrates the importance of context. This study is uniquely focused on the challenges faced by engineers within their contextual environment. Engineers are problem solvers with strong logical and analytical reasoning, yet they can be challenged by the emotional skills required to build relationship and teams. Each of these five drivers of importance to society will be explored in this paper.
Supply and demand for STEM knowledge
Practitioners and recruiting agencies are keenly aware of the growing shortage of engineering talent. For example, Forbes magazine (Wright, 2014) reported that several engineering occupations had actually grown as much as 30%, while overall engineering positions grew 7%. As the demand has increased, the supply of new graduate engineers had been flat until 2007, at which time the number of engineering graduates jumped 33%, with non-U.S. citizens filling most of the growth by 2013 (Wright, 2014). The American Society for Engineering Education (ASEE) confirmed the 20 year gap in engineering graduates, yet reported that full-time student growth started in 2008, with 2014 graduation levels up 26 percent for Bachelor and 35% for Doctoral degrees (Yoder, 2012, p.1). Professional Services Management Journal (PSMJ), focuses specifically on the architectural and engineering construction industry. PSMJ reported similar findings during their December 2014 Summit, where engineering graduates dropped by approximately 30% from 1985 until 2005, before seeing a significant increase (Burstein, 2014, slide 129). In addition to the 20 years gap in graduates, Burstein reported that “approximately 175,000 or 12% of the engineering work force left the field during the 2009–2010 recession” (slide 129), and Wright (2014) reported that 25% of the engineering work force is above 55 years of age.

The gap in the supply of engineering resources becomes more evident when looking at workforce age groups. The 20 year decline started with engineers approximately 50
years old, which is why 25% of the workforce is over 55. The engineering students in 2007–2008 would now be near 30 years of age as of 2016; therefore 25% of the workforce is anticipated to retire in the next decade at a rate faster than they are back filled. Therefore if the growth for STEM resources continues to rise during this inevitable gap in supply, engineers will be in high demand for the next 20 years, which makes the benefits of engineering teams immense.

Growing complexity and adaptability
This dissertation will argue that the successful companies of the twenty-first century will see complexity as an opportunity, while unsuccessful companies will avoid the issue of complexity. A recent *Harvard Business Review* (HBR) study determined that public companies are failing at six times the rate at which they were failing in the 1980s, where they suggest, companies are dying younger because they are failing to adapt to the growing complexity of their environment (Reeves, Levin, & Ueda, 2016). Joyner et al. (2012) point out that “globalization has created hyper-diverse organizations, magnifying the possibility for both generative creativity and destructive conflict” (p. 1). This study will look at organization from a systems perspective, where teams operate as loosely coupled systems and each team has sufficient autonomy to adapt to changing market conditions, yet their loose connection to the corporation enables teams to be change agents. Industry thought leaders “Richard Hackman and Amy Edmondson have promoted teams as the best organizational change agents” (Edmondson, 2012, p. 58). For practitioners to
leverage teams as change agents, they will require learning from history and embracing the fundamentals about what is working and not working in the team context. Historically, managers have considered the technical task-related knowledge and skills required when assembling teams, yet they consistently make the following three biggest mistakes:

1. They assemble too large of teams, assuming more is better.
2. Their teams are too homogeneous, assuming that similar members get along and that homogeneous teams reduce conflict, and are therefore more effective.
3. They assume that people know how to work in groups, allowing natural norms to form driven by interpersonal norms not bounded by effectiveness norms.

(Hackman, 2002, p. 115)

This dissertation will explore the multiple factors associated with team size, composition, and operational norms to address these mistakes. Research will be presented to greatly assist practitioners in matching their contextual need with the appropriate team size and composition, along with discussions regarding team norms, which naturally form verses norms that need to be actively established.

**Accelerate team-centric operational metrics**
An important goal of my research, which is especially applicable to the engineering services industry, is to further accelerate practitioner mindset toward a systems and team perspective, where team-centric metrics are used to manage firm performance.
Shifting operational metrics from an individual basis to a collective basis requires the traditional linear style management approach to mature into a more complex nonlinear style leadership approach. This has already become evident within companies—like Microsoft®, PricewaterhouseCoopers (PwC), Deloitte, and Juniper Networks®—who realize that people have become their largest asset and that team’s impact performance. These companies are moving away from employee rankings and individual performance reviews, toward a more contextual framework of collective skills and results (Cappelli, 2015, p. 59).

A simple example of shifting from an individual to a team-centric metric can be seen when considering the traditional delivery of consulting services with a typical focus on individual hours as the primary metric. In this traditional consulting services approach, individuals join a work group to meet the immediate workload demands and then exit the group. This dynamic occurs because the primary performance metric on these traditional projects is hours charged by individuals then summed into total hours. The effectiveness of each individual and each hour they work might be considered by the project manager, yet seldom is effectively empirically measured and effectiveness is assumed to be equal for accounting purposes. The time that individuals have during the transition between leaving one group and joining the next group is often misallocated, resulting in loss of accuracy for project performance and/or company performance. As an engineering general manager and practitioner, I
have seen this overemphasis on counting hours at the individual level, along with the lack of understanding of the value of interdependencies at the team level, result in unintended consequences. The underlying fallacy with this logic is the assumption that each hour has an equal and linear value and that no duty is paid for the labor of changing teams. Using team-centric metrics along with team-based rewards will be shown to mediate the dynamic demands of project workloads, leading to higher levels of effectiveness and performance.

**Trends driving higher teaming in the A/E/C market**

I conducted many informal interviews and discussions during the year prior to starting my research to ensure that I gained full industry perspective as to both the current issues and the probable future concerns within the Architectural, Engineering, and Construction (A/E/C) industry. A few of these organizations include the PSMJ, American Council of Engineering Companies (ACEC), Zweig White Group Inc., and industry journals further explained in the methodology section regarding topic selection. The issues discovered were related to the shifting economic trends within each industry, such as the decline of the oil and gas industry, or the recovery of the residential market. Other key indicators in the design and construction marketplace can be addressed through a teaming framework, including the pressure against raising design fees over the last decade, eroded profit margin, and added complexity of software modeling tools. Firms must look for more efficient processes and take a more macro view of value creation.
The most pressing and urgent concern emerging in the engineering community this past few years was the leadership transition of firms to the next generation. Many of the engineering firms are led and often owned by baby boomers, making them between the ages of 52 and 72 in 2016. Many of these leaders and owners are looking to retire over the next decade or sooner. I attended several seminar discussions and spoke informally with many owners to better understand the situation, realizing that the firm where I was the General Manager was experiencing a very similar situation—a gap in the next generation of leaders. This complex issue contained two primary interdependent components. First, most of these firm leaders want to transfer the firm’s legacy to the next generation with hopes that their tradition would continue, a concept beyond the scope of this research. Second, the number of engineers from the X generation, born from approximately 1965 through 1985, is significantly less than from the baby boomer years. I believe that this shortage of engineers and the general decline in U.S. births in the 1970 and 1980s will increase the demand for people and teams; this gap is discussed in Chapter 2 as an important factor related to the teaming business case. I hope my research helps engineering firm leaders create stronger teams within their firm. These stronger teams will provide higher effectiveness, as well as open the opportunity for shared-leadership approaches.
Why is teaming critical in engineering?
This dissertation is written for engineers, by an engineer, and I hope that fellow engineering leaders will find my research informational, thought provoking, and directly applicable to their roles as both leaders and team members. The need for teaming on the surface appears to be obvious, yet as discussed in the introduction, teaming is not always as it seems and can be difficult to operationalize; exploration of teaming to reveal a new depth of understanding is worthy of discussion. If we are to create high-performing teams, then we need to create both the logical business case and an emotional motivation. We can start with the realization that learning is best achieved when both logic and emotion are engaged through stories. Logic is what engineers usually do well. We calculate the abiding laws of physics, and then sum the variations of each option to find a best solution. A logic-based analysis of options will result in one of three clear outcomes: option A is greater, less than, or equal to option B. Emotion takes on a different dimension and that is why it is a good companion to logic. Emotions emerge from our creative selves, where values and character take measure. Our underling values create our character and become the final arbiter influencing the choices we make. Our values are applied, often without consciousness, and are not comparable to logic. Therefore, emotionally based decisions are not comparable by common units of measure in the same way as logical decisions. Logical decisions can often be compared in terms of absolutes such as a yes or no responses. Research has shown several general traits trends are associated engineers and will be further discussed in the development, learning, and reward
section of this paper. In brief summary, a few such engineers’ traits include high emotional stability and low neuroticism, which indicates an ability to control anger and anxiety under stressful situations. These traits will assist in the continuous learning process and to create a psychologically safe environment. Other traits common to engineers, include traits autonomy and less agreeableness, which can become challenges during team development, therefore increasing the potential for getting stuck in early development stages.

**Study Importance to Academia**

The importance of my research from the perspective of an academia is to use the tools of scholarly theory and research to build upon existing and emerging team-centric literature. Research at the team level of analysis has been minimal compared with the primary research focused at the individual level over the past 50 years. My literature review indicates a significant increase in theory development shared leadership and similar models (Dinh, Lord, Gardner, Meuser, Liden, & Hu, 2014, p. 41; Northouse, 2012, p. 298). My research will also contribute to scholarly knowledge by linking various academic streams of literature together, while integrating multiple sources of practitioner experience. I believe what is most unique to this dissertation is that the author’s experience has been as a practitioner for over 30 years and can bring new perspective to existing theories. The stream of literature emerged from Harvard University Business School professors, including Dr. Richard Hackman, Dr. Amy Edmondson, Dr. Ruth Wageman, and others as referenced; Benedictine University
Center for Values-Driven Leadership (CVDL) topics such as appreciative inquiry and social responsibility and professors Dr. Gus Gustafson, Dr. James Ludema, Dr. Michael Manning and others; Western Michigan University Communications and visiting professor Dr. Peter Northouse; Dr. Paul Yelsma; and the work of Frank LaFastos and Carl Larson. I also consulted the classical literature of the 1950s and 1960s, including authors such as Warren Bennis, Wilfred Bion, Erving Goffman, Richard Mann, and Bruce Tuckman. The practitioner influence comes from PSMJ’s Kate Allen, David Burstein, and over 100 member A/E/C Executives whom I informally interviewed over the past 3 years; the consulting experience of Jon Katzenbach and Douglas Smith; and my own experience and the experience of industry peers, whom I consulted with during my research.

Academic purpose and rational
The academic purpose of this study is to gain a better understanding of how team performance relates to both individual flourishing and company performance. The foci of analysis will therefore be at the team level. Individual level data will be collected through interviews of team members across multiple firms, then analyzed and viewed through a team lens. After both intrafirm and interfirm findings are developed, these findings will be compared to organizational performance, which was held blind to me as a researcher. My prediction is that firm performance and individual flourishing are antecedents of team performance. I further anticipate finding systems theory, and most specifically the concepts associated with loosely
coupled systems, to apply to high-performance teams. Individuals in a team operate as tightly coupled systems, yet loosely coupled at the organization level. I hope to contribute to increased productivity in engineering firms by providing awareness and understanding of the most critical factors of team performance variance through differentiating the highest-performing engineering firms from baseline performing firms. Baseline firms will have demonstrated sustainable solid performance in the middle range between the high and low performing firms. High-performance firms will have continually exceeded the baseline firms as a condition of selection, while having similar external market-place conditions. This analysis requires an understanding of how to build, lead, and maintain high-performance teams. The intended area of research concentration will be to better understand the interdependence and interoperability within high-performance teams that enable nonlinear achievement, where team performance continually exceeds the more predicted performance of traditional teams using linear thinking. The intended outcome is to develop a high-performance team model defining the moderating variables driving nonlinear team achievement, and then positively mediating individual and firm wide performance. I believe answers for team-level achievement will emerge as the conditions that enable interdependence of team members, as well as in the alignment of individual cognitive belief systems and dyadic relationships. Dyadic relationships in a sociological context is defined as interpersonal relationships
uniquely developed between two people. Analysis at the individual, dyadic, group or
team, and firm level will require a compilational or multilevel analysis.

**Research question and hypothesis**

An important goal for this study is to conduct an empirically based field study on
team performance, which contributes to both academic knowledge base and
operational use of the practitioner. Then, through emerging theories discovered from
my research data, I create a new integrated model of HPTs in a service-based
engineering firm. This model could be extended to other service industries through
appropriate and unique metrics associated within that industry. This model will be
based on the following four sources of experience:

1. A century of research discovered in literature from the classical theories to the
   most recent experts in the fields of team development and systems theory.
2. The amazing doctoral committee with the expertise of industries’ top team-
   focus experts: Dr. Edmondson and Dr. Wageman; my dissertation chair, Dr.
   Gustafson an expert in social responsibility leadership and whose career and
   dissertation journey is remarkably like mine; and the tremendous assistance
   and guidance of PSMJ’s Director of Research Kate Allen.
3. Emerging theories, findings, and conclusions drawn from my interviews and
   comparison to existing literature.
4. My 30 years of leadership experience starting with IBM and ending as the
   general manager of a global engineering firm.
My research question is to test if team-level relationships and activities positively mediate both individuals and performance. The following statement and three supporting hypothesis statements are the basis for my study.

Teams, as opposed to an individual or the organization, are the fundamental units of performance, therefore:

1. Firm structures where members develop interdependence, with small stable teams and dynamically managed support to obtain sufficient skills and capacity, perform better than firms with project teams where members work more independently with less team boundary definition.

2. Firms that establish norms of a Just Culture, where psychological safety enables cognitive space for developing new ideas and a continuous learning environment at all staff levels, and where conflict and failure become an integral part of innovation and accountability, achieve better firm performance.

3. Firms that clearly define team goals that are in harmony with both individual and firm wide achievement goals, then recognize and reward collective team performance, achieve better firm performance than firms that emphasize only individual and/or firm metrics and rewards.
Chapter 2: Literature Review

Introduction and Alignment of Literature to Hypothesis

This literature review chapter has been prepared as part of my dissertation proposal and revised from its original creation to align with my most current hypothesis statements and research questions. I anticipate this literature review section to further evolve during my research, based on the additional literature review and data comparisons as defined by my methodology. The original research direction was set after comparing my personal areas of interest with the initial literature review. This direction was shared with my dissertation committee, which lead to a narrowing and refinement of my topic and additional literature exploration to complete this proposal. My qualitatively based methodology uses both grounded theory (Glaser & Strauss, 1967) and generative theory (Gergen, 1978), which enable new theories to be developed. These emerging theories necessitate a continuous and iterative cycle of data collection and literature comparison. Therefore, this literature review section will continue to dynamically evolve to remain connected to the data and support theories developed. Refer to Figure 9 and “Methodological Flow Chart” on page 132 for a discussion of my process of topic narrowing and hypothesis creation.

This research is intended to support my overarching concept that teams are the fundamental unit of performance, rather than the individual or the firm. The three hypothesis statements were developed with the general sequential assumption that teams are first created by defining boundaries of who is on the team and what their
mission is. After teams are created, they operate in cultures that are open and enabling or closed and suppressing. Finally the team’s work success is influenced through a clear understanding of their objectives along with the associated reward system. These sequence generalities are further defined by the following key concepts, which become the research independent variables. The first concept to be tested is that task interdependence is believed to be a fundamental condition for high performance. Interdependence of team member tasks is an element of the boundary conditions of the size and stability that provide basic team definition. The second concept to be tested is establishment of norms associated with a Just Culture defined by psychological safety and accountability. The third testable concept will be the influence associated with recognition and rewards for collective team performance. My literature review sections have been aligned with these key concepts and independent variables as follows.

**Section 1. Shift from individual toward teams, a century in the making**
This section establishes the paradoxical dilemma associated with team performance and urgency to expedite the slow migration away from individualism. This paradox will become evident through the review the academic research history on team performance, compared with the lack of implementation. Social and economic drivers during the past century are presented to assist in understanding contextual resistances of the past, then contextual accelerators toward teaming. The goal in this section is to
build a business case for practitioners to realize team performance as the organization’s primary unit of performance.

Section 2. Defining working groups verses real teams
This section draws clear distinctions between a group and a team, then suggests that both groups and teams are necessary within organizations. A universal definition is established by comparing group and team definitions spanning the 50 plus years of research.

Section 3. Conditions and context associated with team performance
This section discusses the mindset shift from the traditional cause-and-effect view of performance to a conditions-and-context perspective. The conditions associated with team performance from four models are compared to indicate a practitioner and academic convergence. Then the conditions are ranked against practitioner experience to determine the narrow focus of conditions used in my interviews. The influence of organizational context on team performance along with the various internal team level processes which can mediate external factors are explored.

Section 4. Systems view of nonlinear performance and complex adaptive systems
This section explores teams through the lens of a system and makes the case that team level variables, such as reciprocal task interdependence, enable a team to outperform the aggregate linear sum of its individuals. Determining the correlation between teams, its members, and the organization requires multilevel analysis makes a case for
leaders to embrace complexity in order to create organizations of loosely coupled teams who respond and dynamically adapt to market changes.

Section 5. Team size, stability, and identity
This section discusses the associated differences between team size and stability, as well as both individual and team identity related to performance. Maintaining correct team size and stability can be especially challenging in the fast-paced engineering design industry with continuously changing project demands. These team composition factors are further complicated by the paradox of individuals maintaining their own identity in harmony with team identity, which significantly influences performance.

Section 6. Generative group norms
This section presents the benefits of a psychologically safe environment and generative group norms, such as a positive organizational culture, while maintaining accountability. This paradoxical concept of holding people accountable while being committed to positive and psychologically safe work conditions creates cognitive and emotional space for generative thinking. When psychologically safe environments enable generative thinking, conflict and failure will be celebrated as an integral antecedent for innovation and long term effectiveness.

Section 7. Development, learning, and reward to drive performance
This section unpacks fundamental theories on how groups develop into teams and teams learn to add skills and improve performance. This final section in my current
literature review includes the need for benchmarking, setting goals, and then reinforcing these goals through various recognition and reward systems.

The most influential impact during my literature review of several thousand articles and books came primarily through four streams of connected research. The first and most impactful stream of literature emerged from Harvard University and Dr. Richard Hackman and includes Dr. Amy Edmondson, Dr. Ruth Wageman, and a few others as referenced. The second stream of influence is from Benedictine University’s CVDL program and Professors Dr. Gus Gustafson, Dr. James Ludema, Dr. Michael Manning, and 26 others visiting professors. The third literature stream came from Jon Katzenbach, Douglas Smith, and the consulting industry such as McKinsey & Company and Strategy& (formerly Booz & Company), where they practiced. The fourth stream of literature came through Western Michigan University and a visiting professor Dr. Peter Northouse, who connected me with Dr. Paul Yelsma, and the work of Frank LaFastos and Carl Larson. The fifth stream of literature set a foundation and was derived from the classical literature of the 1950s and 1960s, including authors such as Warren Bennis, Wilfred Bion, Erving Goffman, Richard Mann, and Bruce Tuckman.
Shift from Individual Toward Teams, a Century in the Making

Renewed academic interest in teams
During my literature review, I discovered a growing demand for team-centric research, yet also found a significant gap in the empirically based studies at the team level of analysis. Similarly, I discovered a high importance called for by practice, yet a resistance to team-centric goals and metrics. My first inclination regarding this paradox was to study and implement teams came during our Qual 1 assignment to review over 5,000 articles across 25 top-tier journals. This inclination was validated during my dissertation literature review, when I noticed two key points. First, most of the foundational literature relating to groups comes from the 1950s and 1960s, through classical authors such as Warren Bennis, Wilfred Bion, Erving Goffman, Richard Mann, and Bruce Tuckman. The second point is that most people have a resistance toward team concepts such as shared responsibility and “biases to individualism,” resulting from the ways “our culture emphasizes individual accomplishments and makes us uncomfortable trusting our career aspirations to outcomes dependent on the performance of others” (Katzenbach & Smith, 2015, pp. 7, xvi).

Compelling statements regarding the importance of teams are found in the classical literature from Erving Goffman, who was considered “the most influential American sociologist in the twentieth century” (Fine & Manning, 2003, p. 34). Goffman drew specific attention to how groups and teams create a unique identity and how this
collective identity influences the identity of both individual members and the organization as a whole. He used theatrical metaphors to explain how individuals perform and give off expressions associated with group norms which can be contrary to their expressions outside the group. According to Goffman (1959):

An emergent team impression arises which can conveniently be treated as a fact in its own right. . . . The team and the team performance may well be the best units to take as the fundamental point of reference. The use of the team (as opposed to the performer) . . . [as the fundamental unit.] (p. 80)

These findings associated with team value appear to be forgotten through the 1970s and 1980’s, until Richard Hackman was credited with rescuing group-centric research from the state of stagnation (Wageman & Amabile, 2013). Over 30 years later, Katzenbach and Smith (1993) made a similar statement:

We continue to believe that a real team—appropriately focused and rigorously disciplined—is the most versatile unit organizations have for meeting both performance and change challenges in today’s complex world. (1993, p. xiii)

I have integrated these statements, along with my own 30 years of experience as a practitioner, to create the guiding affirmation that the team, as opposed to an individual or the organization, is the fundamental unit of performance.

The contrasting literature finding came from Dinh, Lord, Gardner, Meuser, Liden, and Hu (2014), who analyzed all 989 leadership articles written in the 10 top-tier
publication journals from January 2000 through September 2012, where team-centric articles were dwarfed by articles at the individual level of analysis.

Leadership researchers are beginning to appreciate the social context in which the leader operates and his or her effect on the team as a whole, addressing a global short coming. . . . Team leadership has seen a significant increase in the quantity of resent research. (p.41)

These findings are supported by Northouse (2012), who explores theories on leadership and provides insight into both gaps and trends, then states that “much of the early work on teams has focused on the traditional role of the formally appointed leader on the team: future research needs to focus more on the distributed or shared leadership within the team” (p. 289). A research dilemma was created. I found empirical evidence that academic interest and research focused on individual behaviors of the leader or follower, and only recently was there an increase in team-centric literature toward teams and member interdependence. A simple question begs to be asked: If the most influential American sociologist states that teams are the fundamental unit of performance, then why after 50 years do leaders and managers remain more individual-centric than team-centric focused? Katzenbach and Smith (2015) refer to this dilemma as “the strange paradox of application,” where “many people simply do not apply what they already know about teams” (p. xiv).

A century in the making
A brief review of the past century may help understand this paradoxical situation. Scientific management dominated the first half of the twentieth century, at a time
when Frederick Taylor and Henry Ford were two industrialists who revolutionized manufacturing through a top-down, or command-and-control, style of management. This style of management was based on fear, where supervisors would oversee large numbers of worker with tightly specified tasks. Any production worker could be quickly trained to fill any position and supervisors could and would fire employees at will. Taylor (1911) in *Shop Management* and *The Principals of Scientific Management*, defined how time and materials were tracked to continually manage incremental improvements. Large-volume production efficiency was gained and resulted in the growth of many corporations, while creating distrust in workers and the loss of workers having any ability to contribute intellectually. Scientific management remained dominant into the 1980s and team performance was focused on group process loss, until Richard Hackman was credited with rescuing group-centric research from the state of stagnation, by shifting his focus toward the work itself (Wageman & Amabile, 2013). During this time, most research on worker motivation concentrated on individual pay and rewards, where Hackman shifted his research toward motivating people through meaningful contributions and a sense of accomplishment. His mindset change from researching individual behaviors as the causation created a more systematic view of the work environment which gave early rise to his research on conditions, context, and process, which remain active topics of research today, 25 years later. This complex and multidimensional view was supported by Uhl-Bien and Marion’s (2009) research, stating that “leadership is a
multilevel, contextual, and interactive” (p. 631). Likewise Day, Harrison, and Halpin (2009) determined that the environmental conditions beyond an individual’s control will typically determine when people perform. Systems view and compilational or multilevel analysis will be discussed further in other sections of the document.

Many industries continued to deploy the Taylor and Ford style of management through the twenty-first century as evident by Hackman’s (2002) reference to working teams as an innovation of the last decade in 2002. Hackman noted their growth (p. 233), citing surveys in the late 1990s, which found that 40% of firms were now using teams (Osterman 1994; Devine, Clayton, Philips, Dunford, & Melner, 1999), which came over a decade after Hackman’s initial focus. Interest in the creation of teams grew. Hackman (2002) says the Work in America Institute reported that “95% of respondents gave the highest priority to teamwork” (p. 233). Osburn, Moran, Musselwhite, and Zenger (1990) indicated that manufacturing was an early adopting industry with examples such as Xerox, where “plants using teams are 30 percent more productive” (pp. 5–6); Tektronix, which reported a 467% improvement in production from 14 to 3 days; and Federal Express, which cut errors by 13%.

The prime mortgage crisis of 2007 through 2009 and associated Great Recession were defined in popular culture by four factors: high interest rates, inflation, reduced customer confidence, and reduced wages (Great Recession in the United States,
This recession is more specifically defined by many economists as two consecutive down quarters. The primary difference with the recovery that started in 2009 is that employment is a lagging factor, verses a leading factor. According to Cappelli (2015), economic growth can be expected to be tied to the increasing employment rates and critical gaps in many markets. This makes understanding the effectiveness of levering teams uniquely critical in the twenty-first century.

The study of groups begun in the 1920s focused on the human relations movement and shifted to T-groups and laboratory experiments by the 1950s, which usually ignored the environmental context (Porter & Beyerlein, 2000). Figure 3 provides an overview of four major social and economic influences that over the past century contributed to the shift from individualism toward collective teaming. I believe that these influences help explain both the void in team-centric research during the 1970s and 1980s and individualism as discussed at the beginning of this section. I am including this historical perspective as comparison to current times, because I see contextual similarities as society moves toward a higher state of complexity and individuals are driven more by meaning and purpose.
The thriving economy and shortage of workers in the 1920s gave birth to human resources (HR), and required supervisors to start treating people well. The great depression of the 1930s and early 1940s reversed much of the previous progress with a return to the harsher scientific management approaches of Taylor and Ford until after World War II. The U.S. industry experienced a talent shortage as World War II ended, with unemployment dropping to near zero from an all-time historical high of over 20%, which gave rise to revolutionary hiring and development programs (Cappelli, 2015). The employment surge and revolutionary hiring and development programs in industry coincide with the academic research from the 1950s and early
1960s. The economy slowed in the 1970s and the U.S went into a deep recession in the early 1980s, coinciding with the decades of limited funding of HR initiatives (Cappelli, 2015, p. 59) before team-centric research was reignited by Hackman in the mid 1980s and others, with short periods of economic surges, such as the dot-com era.

**Why human capital and collectivism will flourish in the twenty-first century**

Each surge in the economy and employment presents a driving asset. The driving asset associated with the Taylor and Ford era was based on financial capital to build manufacturing assembly facilities. Hardware-type technology became the critical asset for surges in the 1990s like the dot-com era, and then was greatly commoditized as the critical asset became software-type technology. As software applications become commoditized, the next revolution placing people and teams as the critical resource becomes evident. “Human capital is practically the only major asset of tech companies: Google, Microsoft, and Apple, and talent is in short supply” (Cappelli, 2015, p. 61). This increasing demand for specialized talent supports the increased research activity on leadership and teaming (Dinh et al., 2014). In my early years as an engineer with IBM in the 1980s, the asset was computer hardware and the additional services were provided to assist the sale. In the early 1990s, services became a primary source of IBM’s profit and our consulting business was growing to fill the commoditized hardware sales. From 1994 until 2014, I was a principal with an engineering design and consulting firm, where our assets were only our employees,
and during discussion regarding our firm’s value or net worth, I would remind my partners: “Our assets walk out the door each night, so let’s remember that as we make decisions, which will help ensure their return in the morning.”

Individualism continues to generally increase in the United States during the past century as predicted by modernization theory, where according to Hamamura (2012), “past research is generally consistent with this theory, but there [are] also . . . diverging patterns of cultural changes” (p. 3). A few of the diverging indicators among young adults include the “agreement with unconditional love (p. 12). Further, Hamamura says that “respect for parents increased and, the perceived importance of effort for success increased” (p. 12). Hamamura notes that the divorce rate doubled from 1950 through 1980, to a peak of 5.2 out of every 1,000 Americans, then has gradually decreased since to approximately 3.8 in 2010 (p.12).

Two important observations can be made as to changes with this trend. First, the millennial generation is reversing some of the historical indicators and second, the 2008 through 2010 Great Recession of Greenfield’s theory of social change (2009) and human development predicted that adolescents’ values, behaviors, and self-assessments would become more collectivistic and less individualistic, thereby reversing long-term trends from the 1970s. Research conducted by McGlynn (2005) likewise discovered that the millennial generation is reversing the trends of
individualism and moving society toward a more collaborative, inclusive culture, accepting of diversity and more naturally engaged in teaming:

Millennial students gravitate toward group activity. They identify with their parents' values and feel close to their parents. They are both racially and ethnically diverse. Millennials seem to prefer and then discuss what makes the most sense from a cognitive learning perspective. Millennials want to learn by working collaboratively, and many of them enjoy the activity of teamwork. (p. 5)

Baby boomer and gen Xers are more “me” centric and materialistic, feeding the heavy focus on the individual, where millennials are more focused on being very connected to others and also require more meaning and purpose. Additionally, in 2015, millennial’s became the largest generation in the work force and in ten years, and by 2015, will make up 75% of the work force (Griffin, 2015).

This generational change will also influence the shift from individualism toward a more team-centric society. The Great Man theory of leadership developed in the nineteenth century and written about by historian Thomas Carlyle, supported the industrial era of hieratical leadership and still considered relevant is some areas of sociology well into the twenty-first century (Borgatta, Bales, & Couch, 1954). The Great Man theory of leadership bases effective leadership on trait-like characteristics such as achievement motivation, energy, dominance, honesty and integrity, self-confidence, creativity, and charisma. These cause-and-effect type theories of team leadership were rejected in the late 1980s and 1990s (Hackman, 1987), with a shift
toward “the role of affect, behavioral, and cognitive processes in team success” (Northouse, 2012, p. 287). Contemporary studies continue to look at traits (interpersonal skills, oral communication, written communication, administrative/management skills, problem-solving skills, and decision making) verses states as predictors of effective leadership (Hoffman, Woehr, Maldagen-Youngjohn, & Lyons, 2011). Both streams of thought remain: the cause-and-effect theories that continue to support a bias toward individualism, and the conditions theory from Hackman (1987). This debate clearly adds to the confusion and resistance to more rigorously applying teaming.

The following statement is Peter Drucker’s vision of the twenty-first century toward a more people-centric society focused on the community, which supports my belief that society is moving away from individualism and toward teaming:

The 21st century will be the century of the social sector organization. The more economy, money, and information become global, the more community will matter. And only the social sector nonprofit organization performs in the community, exploits its opportunities, mobilizes its local resources, (and) solves its problems. The leadership, competence, and management of the social sector nonprofit organization will thus largely determine the values, the vision, the cohesion, and the performance of the 21st century society. (as cited in LeadershipNow, 2005)

Research has been concentrated at the individual level of analysis, which assumes too simplistic of a perspective, often ignoring the contextual influences. Dinh et al. (2014) point out that “leadership scholars have more often focused on the isolated
effects of leaders or followers at one or another level . . . etc. This approach ignores the cumulative effects” (p.37). According to Kelley (1973), “leader-centric theories overemphasize the role of the leaders by attributing the success and failure of the organization to the agency of specific individuals” (p. 50). Team-centric research has increased, especially on theory development. Note that 66 leadership domain theories were found, where 26 of them emerged over the last decade (Dinh et al., 2014). Academic work usually leads practitioner application; therefore this increased theory development will inevitably lead to increased field studies, and then ultimately to practitioner application.

Practitioners likewise discovered that the application of these individually focused theories often ignore the context of team influences, and are therefore difficult to put into practice. Operationalization of individual theories is difficult because most individuals do not operate independent from others in the organization, but rather as an interdependent part of a system. Imagine a mechanical system where one could remove a single component, then optimize it to a set of criteria. When that component is returned to the system, the system may not be optimized because the performance of the component has interdependence with the other components within its subsystem. Applying a systems view suggests that individual performance must be viewed as interdependent with others and the environment. I believe that the over emphasis at the individual level, is a direct cause as to why companies often fail to
follow standard practices that unite individuals into a cohesive team. Examples of such standard practices include goal setting, communicating clear performance measurements, working to attract talented people, rewarding high performance, and removing poor performers (Bromiley & Rau, 2014, p. 1250). Measuring individual performance just does not easily translate into overall team or firm effectiveness due to the systematic interdependence discussed above and also because in isolation, people typically perform below their individual potential (Fischer & Kenny, 1986).

**Defining Working Groups Versus Real Teams**

Organizations are created and grow through the addition of employees, who are then grouped together for logistical and managerial reasons, such as job function, task, or geography. All of these groups within organizations start out as working groups and many transition into teams over time. Therefore, organizations are filled with groups of people which could range from dysfunctional working groups to high-performance teams, and leaders must make conscious decisions as to when a working group verses a team is justified. Creating a universal definition for groups and teams is critical for the communication in both academic, as well as practitioner settings. After reading literally hundreds of definitions, I will compare and integrate three definitions. One definition will come from the early years of group research, a second from a most current definition, and a third definition after a wide review of literature as I have done. These definitions will show significant similarity, so that a universal definition for the various types of groups and teams appears realistic.
The most modern definition for working groups verses teams comes from Katzenbach and Smith (2015), in their book *The Wisdom of Teams: Creating the High-Performance Organization*, where they suggested that discipline and time are the two metrics which differentiate working groups from real teams. As a practitioner, it is important to realize that working groups can become effective at executing independent tasks and investing the time, and instituting discipline within group members is not always a wise business decision. The higher the level of synergy, cooperation, and interdependence of team members, the greater gain will be seen from creating real teams. The definition of a team therefore emerges from the need for interdependence, and the definition for a team chosen for this dissertation is as follows: “A team is a small group of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable” (Katzenbach & Smith, 2015, p.41). Compare this definition of a team to Goffman (1959), who represents a classical perspective over 50 years early: “A team may then be defined as a set of individuals whose intimate co-operation is required if a given projected definition of the situation is to be maintained” (p. 104). We find significant similarity, especially when realizing a sociological perspective and connectedness. Both definitions speak of a common purpose or projected situational objective and mutual accountability or intimate cooperation. Goffman also provides a simple test of a real team: “If they co-operate,
giving impression as a means to achieve a collective end” (Goffman, 1959, p. 84). As one more comparison for a definition of teams that provides wide industry perspective, I will refer to Northouse (2012), whose book *Leadership, Theory and Practice* provides a wide perspective on team leadership. Northouse used over 50 references to create his definition: “A team is a specific type of group composed of members who are interdependent, who share common goals, and who must coordinate their activities to accomplish their goals” (p.287).

**Summary of team defining words on interdependence**
The selection of cornerstone-type words is an important theme to carry throughout this document and the following summary contains the key words used in these definitions, yet the single most critical word that defines teams and differentiates them from groups is the state of interdependence. Interdependence between members can incorporate several of the other key words, while being realized through the interdependence of skills and tasks, as well as a social interdependence such as shared responsibilities and dyadic relationships.

Katzenbach & Smith (2015)
- Complementary skills:

- Common purpose

- Performance goals

- Mutually accountable
• Katzenbach & Smith key differentiators:
  • Time together
  • Member discipline

**Goffman (1959)**
• Set of individuals
• Intimate
• Cooperation
• Projected definition
• Maintained situation
• Goffman test:
  • Individuals cooperate
  • Giving impression as means
  • Achieve a collective end

**Northouse (2012)**
• Interdependent
• Members
• Share common goals
• Must coordinate their activities
• Accomplish their goals
Noteworthy in this definition of teams is that team development requires time to create interdependence and will often regress in their early stages of formation, at which point teams get stuck and fall back into working groups. I have witnessed managers who quickly dissolve a newly formed team at the first sign of this regression. A very common mistake leaders make is to move a project manager from a high-performing team to a poor performing team, expecting the former team to continue high performance and see immediate improvements in the poor-performing team. This mistake ignores the time element for team development and is based on the assumption that the project manager was the cause of the team’s performance. Leaders and managers need to understand this time factor and encourage newly formed teams to start by discovering interdependence tasks and aligning purpose.

Another common mistake made by managers and leaders is to focus on team building independent from a work product. “Team leaders are best distinguished by their attitude and what they do not do; and focusing on becoming a team seldom works” (Katzenbach & Smith, 2015, p. xiv). More specifically, the team building workshops which were created to develop interpersonal skills has not proved to be effective. According to A. C. Edmondson:

No research shows that focusing on interpersonal relationships alone increases performance. Focusing on tasks with a compelling purpose is the window to accessing interpersonal relations that build the interdependence which will improve performance. (personal communication, July 17, 2015)
Interpersonal relationships can be a positive mediator between a compelling task and the team’s performance and when the compelling task does not precede development of interpersonal skills, the performance is not improved. Doolen, Hacker, and Van Aken (2006), professors of industrial, manufacturing, and systems engineering, conducted a study of 16 engineering teams within two Fortune 500 high-technology companies with the expressed goal of understanding how the unique contextual environment associated with engineering teams influences their effectiveness. This study is particularly interesting for my research due to similarities of both variables of team effectiveness and the contextual setting of engineering teams. The most significant finding related to my research is that internally controlled team processes can mediate external forces of the organization. Doolen et al. point out:

Internal TP (team processes) have the potential to directly influence measures of team effectiveness as well as the potential to mediate the impact of organizational context factors that are external to the team. Based on previous research, TP may have a mediating effect on the relationship between organizational context and team effectiveness. (p. 141)

Team processes were defined as both the level of collaboration between team members and the type of activities used by teams to achieve their objectives: conflict management, decision-making processes, idea generation, and problem solving. Team process directly relates to the conditions of interdependence and norms of conduct. Leaders and managers also need to set realistic expectations of performance, based on
this development process, realizing that working groups will usually become more
effective from the start, while the initial attempt to creation a real teams will
commonly result in a decline of immediate performance. Working group
effectiveness is based on individual and independent processes, where improvement
is only realized at the individual level yet more quickly. Real teams must work out
their interdependence at the task and social levels with the anticipated goal that the
collective process gains will far exceed the individual working group gains. Several
concepts noted in this section, including the time domain and phased development
theories, will be further discussed in the development and learning section of this
literature review.

Katzenbach and Smith (2006) used their determining metrics of time and discipline to
separate real teams into subcategories of performance units. The four subcategories
are important to be noted as part of the definition for teams, while realizing that each
subcategory is associated with stages of development. Figure 4 pictorially indicates
working groups on the left with vertical steps indicating possible performance
changes without the necessity of time. Then four stages of teams develop
(Katzenbach & Smith, 2006, p.84).
Small working groups, where incremental performance improvement is optional and the sum of individual best efforts is sufficient, created the highest potential for becoming a real-team (Katzenbach and Smith, 2006, p. 91–92). Pseudo-teams are then groups who have a need and opportunity for increased performance, yet the members lack the collective focused effort to capitalize on the opportunity. These pseudo-teams represent teams that get stuck and are unable to develop task-level interdependence. Potential teams are then defined as teams where effort is made to improve performance; however, they suffer from a lack of discipline, purposeful goals, and/or skills. Similarly, a small group that comes together not to further the collective interest and make progress, but rather for a sense of protection, is referred
to as a clique. Real teams are then small groups of people who are equally committed to a common purpose, goals, and working approach with a shared accountability.

Only after becoming a real team and developing interdependence can real teams develop into extraordinary real teams, where incremental performance is achieved, exceeding the sum of individual best efforts (Katzenbach & Smith, 2006, pp. 91–92). Achievement exceeding the linear sum of its parts will be further explored in a later section on nonlinear systems. High-performance teams (HPTs) are real teams with a deep commitment to the success of the team, as well as the personal growth and success of each member. This definition of HPTs has direct alignment with servant leadership theory, where the first priority is the service of others to enable others to grow; through the act of service, the servant finds personal growth (Greenleaf, 1977, p. 21).

**Conditions and Context Associated with Team Performance**

**Conditions of high performance**

Leading teams through the more indirect approach of creating environment conditions and support systems, rather than taking the more direct approach, is counterintuitive. Leaders can unintentionally have a negative influence on team performance by taking a command-and-control approach, as discussed in the previous section, or pointing out mistakes and suggesting corrective action, as will be discussed later in this section. Leaders who create conditions that enable each team member to be actively
engaged and feel empowered to contribute will be the differentiator for companies of
the twenty-first century. The comparison of four team models in this section will
show convergence of both academic and practitioner agreement as to the creation of
conditions as the most significant factors of team performance. The following
inspirational quote directed toward leaders will set the stage for unpacking four
models of team effectiveness.

When leaders empower, rather than control; when they ask the right
questions, rather than provide the answers; and when they focus on
flexibility, rather than insist on adherence, they will move to a higher
execution. (Edmondson, 2012, p. 8)

The criticality of conditions was discovered by Hackman (1987) as the most
determinant factor for team performance, rather than the traditional belief in cause-
and-effect type factors such as the leader’s individual skills. This discovery and
creation of his five conditions model became a turning point within the field of team
research (Wageman & Amabile, 2013). Jon Katzenbach has been recognized as a
global leader and expert in teaming culture since the 1980s, and he continues to
support Hackman’s finding of the importance of conditions as stated in the prologue
of his most recent book, where he states; “We have gained both knowledge and
conviction by observing how consistently the conditions for team performance
emerge across such a wide variety of business conditions and organizational settings”
(Katzenbach & Smith, 2015, p. xiv). Hackman (1987) created his model through
several decades of academic field research. Katzenbach and Smith (2015)
independently created six basic elements of effective teams, which emerged from their consulting experience and summarized as follows:

1. Small enough in number to convene, communicate, and understand roles
2. Complimentary skills: technical, problem solving, and interpersonal
3. Meaningful purposes that are deeper in aspiration, memorable, and exciting
4. Specific goals that are clear, measurable, and realistic
5. Clear approach, capitalizing on skills of all members and improving over time
6. Mutual accountability with individual and joint responsibilities

*Source:* Adapted from Katzenbach and Smith, 2015, pp. 58–61.

The Gallup Group’s Rath and Conchie (2008) describe the strengths revolution as a positive framework for building the skills based synergy of teams. Gallup’s original studies used a foundation of individual strengths, which then lead to a leadership and collective team framework outlined in Rath and Conchie’s *Strengths-based leadership: Great leaders, teams, and why people follow.* This team-centric research continued to use the four domains used at the individual level of analysis: executing, influencing, relationship building, and strategic thinking. The five common themes discovered through their empirical surveys are deeply relationship based and result in strong teams:

1. Conflict does not destroy strong teams as they focus on results.
2. They prioritize based on what is best for the whole and then act.
3. They are equally committed to their personal lives.

4. They embrace diversity.

5. They are a magnet for talent.

This study further discovered four basic needs of strong-team members that directly correspond to performance:

1. Trust: honesty, integrity, and respect
2. Compassion: Leaders who care, followers who engage and stay
4. Hope: direction, faith, and guidance

Source: Adapted from Rath and Conchie (2008), pp. 71–76

The fourth model to be compared was developed by LaFasto and Larson (2001). The LaFasto and Larson model is based on first-order data they gathered from “15,000 assessments of team members from their fellow teammates across a wide range of organization” (p. 1). Their findings of a team collective voice include the following five conditions.

1. Team members can either be collaborative or dysfunctional.
2. Good teams are highly dependent on and sustain good relationships.
3. What matters is processes for making the right and fast decisions.
4. Team leaders can either help or get in the way of team performance.
5. Organizations can either encourage or discourage working together. (p. xii)
LaFasto and Larson (2001) also found “eight characteristics to be particularly true of high-performance teams” (p. xxii). These characteristics are summarized here:

1. Clear elevating goals.
2. Results-driven structure.
3. Competent team members.
4. Unified commitment.
5. Collaborative climate.
7. External support and recognition.
8. Principled leadership.

These five conditions are noted in Table 1 as CN and characteristics are noted as N, where N indicates the number.

Hackman’s discovery in 1987 of conditions for team effectiveness, discussed in Chapter 1 and in the previous literature review section, is summarized in Table 1 and compared to the five themes and four basic needs from Gallup’s findings reported by Rath and Conchie (2008) and the six basic elements as defined above. Gallup’s themes are designated with a T and needs are designated with an N in the table (Example: T1 refers to theme number one and N1 refers to need number one.).
Table 1. Conditions for Team Performance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition 1. Real Team</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Clear boundaries of members and nonmembers.</td>
<td>3. Meaningful purpose, deeper aspiration, memorable, and exciting</td>
<td>4. Unified commitment</td>
<td>T2. They prioritize on what is best for the whole and then act.</td>
</tr>
<tr>
<td>1.2 Members are interdependent for a common purpose.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Condition 2. Compelling direction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Challenging (to energize), clear (for orientation to purpose), and consequential (engaging full range of talents).</td>
<td>4. Specific goals that is clear, measurable, and realistic.</td>
<td>1. Clear elevating goal</td>
<td>N4. Hope: direction, faith, and guidance.</td>
</tr>
<tr>
<td>2.2 Defined start and end, while leaving the means and methods for team development.</td>
<td>C3. Team decisions and processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Condition 3. Enabling structure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Well designed task; whole and meaningful work enabling team autonomy and judgment to effect knowledge results.</td>
<td>5. Clear approach, capitalizing on skills of all members and improves over time.</td>
<td>2. Results-driven structure</td>
<td>N2. Compassion: Leaders who care, followers who engage and stay.</td>
</tr>
</tbody>
</table>
| **5 Conditions Model**  
(Hackman, 1987) | **Basic Elements**  
(Katzenbach & Smith, 2015) | **LaFasto & Larson (2001)** | **Gallup’s Strong Teams**  
(Rath & Conchie, 2008) |
|---|---|---|---|
| 3.2 Team composition; small group with sufficient collective skills to achieve their purpose. | 1. Small enough to convene, communicate, and understand roles.  
2. Complimentary skills: technical, problem solving | 3. Competent team members | T4. They embrace diversity  
T5. They are a magnet for talent. |
| **Condition 4. Supportive organization** | | | |
| 3.3 Core norms of conducts are established to determine what is and is not acceptable behavior. | 2. Complimentary skills: interpersonal | C1. Members are collaborative  
5. Collaborative climate | T1. Conflict did not destroy strong teams as they focus on results. |
<p>| <strong>Condition 5. Available expert coaching</strong> | | | |
| 4.1 Team based rewards for collective achievement, while not in conflict or competition with individual development and recognition. | 7. Support and recognition | | |
| 4.2 Educational systems available at the team’s initiative. | | | |
| 4.3 Information appropriate for the team’s task and situation. | | | |
| <strong>Condition 4. Supportive organization</strong> | C5. Organization environment | | |</p>
<table>
<thead>
<tr>
<th>5.1 Motivational at start, strategic near middle, and feedback; including technical and operational.</th>
<th>C4. Team leaders help or get in the way.</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

Hackman (1987) derived his conditions of effectiveness from many years of experience and are heavily qualitative due to his direct interaction with companies for case studies and as an advisor. Katzenbach and Smith (2015) similarly collected information through their consulting practice, yet Hackman’s work was more closely connected to scholarly research with a stronger building and testing of theories. The LaFasto and Larson (2001) conditions and characteristics were derived from a large number of surveys and interviews capturing the perspectives and beliefs of teammates as to their effectiveness or non-effectiveness. This is different from Hackman’s iterative approach, which focused on longer term observations of specific teams, and therefore deeper investigation into fewer numbers of teams. The Gallup model data collection was again quite different from these four other studies as it “comes from over 25 years of Gallup studies evaluating leaders and their strengths” and “from over 20,000 personal interviews conducted by Donald Clifton” (Luffy, 2011, p. 5). These four models are uniquely independent: Hackman’s inquiry came from an external academic lens of observation and inquiry; Katzenbach and Smith’s research came
from a more practitioner based consulting perspective; LaFasto and Larson’s findings represent the perspective of other teammates; and the Gallup surveys (Luffy, 2011) provide a more individualistic perspective of self-examination and reflection.

While there are clear differences between these findings, there is a clear synergy among the models, with Hackman (1987) reporting conditions creating a more holistic model, while the other models leave critical gaps. The other models each provide one important contribution. The Katzenbach and Smith (2015) model adds mutual accountability, the LaFasto and Larson (2001) model adds a principal-based leader, and the Gallup findings reported in Luffy (2011) include an important point regarding the commitment to their personal lives. The most interesting point is that these four sets of findings are completely independent, span a very significant sample set, and emerge from as diverse a context setting as one could imagine, yet they have a strong synergy and commonality. The first interesting point of similarity is the condition that members are interdependent for a common purpose and the Gallup finding that strong teams prioritize based on what is best for the whole and then act. Possibly the strongest similarity is that both models include a need for stability. Hackman’s findings were more focused on learning and improvement, while the Gallup findings included more individual emotions of strength and support, and future security, as would be expected from individual reflection. The second condition of direction, likewise is quite similar, where Hackman’s directional
conditions include challenging, energizing, and consequential tasks and Gallup again captures an emotional response of hope, faith, and guidance. The condition of an enabling team structure spans from task design, team skills diversity, and meaningful work. A critical similarity is the creation of group norms of conduct, such that conflict is embraced for learning and results, not destruction of the team. The most significant difference is that Hackman’s model includes organizational support and external coaching, which again is consistent with observation and Gallup included more individually reflective needs such as trust, integrity, and a work-life balance.

The first published testing of Hackman’s (1987) five conditions of team effectiveness was conducted by Wageman (2001a) at Xerox Corporation, using both qualitative interviews and qualitative surveys. This study found that higher team performance is, “principally due to: clear direction, task interdependence, and group rewards, respectively” (p 568). Another important finding is that coaching can have both a positive and negative effect on team performance. More specifically and “perhaps the most fascinating finding of the Wageman study turned up when she compared the effects on team self-management of ‘good’ coaching with those of ‘bad’ coaching” (Hackman, 2002, p. 209). Good coaching significantly helped well designed teams and marginally helped poorly designed team performance, whereas bad coaching significantly compromised poorly designed team’s ability to self-manage, and then marginally hindered well designed teams. Good coaching was defined as helping a
team develop task-appropriate performance strategy. Bad coaching was defined as identifying team problems and telling members what corrective actions to take.

Wageman developed and tested a method of inquiry during this study, which became the *Team Diagnostic Survey* developed by Wageman, Hackman, and Lehman (2005). The Team Diagnostic Survey (TDS) developed three dimensional concepts which define an effective team:

1. The deliverable or output of the team meets or exceeds the standards and quality as defined by the team’s client.

2. The social process of the team enhances member capabilities to work interdependent, such that they are more capable after completion of work.

3. The work contributes positively to the learning and well-being of individual team members. (Wageman et al., 2005, p. 376)

These three dimensions will be integrated into my methodology as further discussed in the methods section of this paper. The TDS instrument questions were tested with a wide range of organizational settings for use in “any type of team that operates in an organizational context” (Wageman et al., 2005). Most instruments developed to measure performance are too narrowly focused on anticipated findings, as a result of designer bias, as noted by Wageman et al.

Instruments intended for use in helping teams perform better must focus on variables that are known to effect performance, can be manipulated, and are applicable across a variety of team types and settings so that norms can be developed for use in interpreting a team’s
score. Numerous instruments exist that meet either one or the other of these aspirations. Typically, these instruments ask members to assess their teams on those dimensions that their developers assume to be most consequential for performance and most amenable to improve through consequential interventions outside the context in which they are developed. (p. 374)

Dr. Wageman provided me with a copy of her inquiry questions and interviewer notes as well as design guidance for the creation of my research. This information has greatly influenced the development of my interview questions and ensured that my interview instrument uses variables known to affect performance, be manipulated, and be applicable across a variety of team types and settings.

**Context of high performance**

The conditions noted above were derived over the last several decades as a universal understanding of teams without consideration for operational context. Contemporary research suggests that operational context is a significant factor as noted by the multiple references through this paper, listed here and hereafter by citation years (Cappelli, 2015; Katzenbach & Smith, 2015; Dinh et al. 2014; Edmondson, 2012; Uhl-Bien & Marion, 2009; Day, Harrison, & Halpin, 2009; Hacker, & Van Aken, 2006; Wageman, 2005; Porter & Beyerlein, 2000; Guzzo & Shea, 1992). While many authors agree that organizational context has a significant influence on team and organizational performance, there is very little written to define contextual frame works. The best operational context model of teams discovered during my literature review was created by Edmondson (2012), where she defines three over-lapping
operational zones. These three zones are based on the knowledge of the process, where knowledge is gained as the process matures. Early developments of new processes require innovation to collect knowledge, then move to the complex stage where further knowledge gain occurs, and finally to a routine process. These three areas associated with significantly different knowledge levels naturally determine the amount of team learning and adaption required to be successful in their environment. Edmondson (2012) has developed the Process Knowledge Spectrum, shown in Figure 5.

![Process Knowledge Spectrum](image)

**Figure 5 Process Knowledge Spectrum**

*Source: Adapted from Edmondson, 2012, p. 33*

Organizations will have groups of people working in all three areas of knowledge and must consciously recognize the difference and apply different leadership and management practices. The application of tightly defined process for routine process will typically enable high performance of routine operations, while stagnate innovative operation. On the other hand, the creative processes which enable innovation and acceptance of failures as a form of fast learning will be clearly detrimental to routine operations. While it sounds simple to understand, the
implementation is more difficult as companies try to create a universal culture across the firm. As a practitioner I’ve experienced many examples, with the simplest example being work hours. Clients expect to see a receptionist upon arrival or reach a person by phone in accounting during strict business hours. Clients realize that a firm’s service personnel are often out of the office during these hours and not available, yet expect services often outside of normal working hours. The operational conflict and cultural concerns arise when the service team is granted flexible work hours to accommodate their process needs, while the receptionist and accounting staff process requires minimal flexibility.

Engineering firms are the focus of this study and will have teams operating in all three of these knowledge areas. Individual members of the firm will then operate in a group or on a team that engages all three operational areas. Examples of engineering firm routine operations include non-engineering function such as time card and accounting functions, as well as many engineering related activities typically in the production processes. Job functions such as using traditional CADD systems are an example of routine operation, involving highly repetitive steps and most importantly the outcome of CADD efforts are anticipated by other members to have basically no variation or errors. Quite different are the design and production activities using various new 3D modeling tools, which are considered more complex and the knowledge base of how best to create these models continues to develop. The
outcome of 3D modeling is less predictable by the other members; therefore, a norm is created to anticipate higher levels of coordination. Most of the engineering design activities have levels of uncertainty and require both continuous learning and coordination with other team members. Design activities are usually based on proven processes and previous success of a project and product design, therefore will fit into the complex operations area. Examples of complex operations include assisting a client develop project requirements and creating a schedule that integrates multiple design disciplines. Engineering design includes innovative operations where experimental efforts are conducted with the goal of generating new possibilities. Innovative operations will predominantly require multiple attempts where failures are expected as part of the learning process. Examples of innovation in an engineering firm include testing of a product for use beyond its intended design, then modifying it and retesting until acceptable results are discovered. Another example of innovative operations includes designing for the future, then following up with modifications and adjustments over time. Note that a single design effort to predict the future would most likely fall into the complex operation since innovation requires the integration of knowledge gained during the process, which was not available at the start of the design activities. The Process Knowledge Spectrum is further operationalized in Table 2, which has been modified for this paper by including only portions of the original table from Edmondson (2012).
### Table 2 Differing Operational Context

<table>
<thead>
<tr>
<th></th>
<th><strong>Routine Operations</strong></th>
<th><strong>Complex Operations</strong></th>
<th><strong>Innovative Operations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Design</td>
<td>Well-established processes</td>
<td>Mix of established and dynamic processes</td>
<td>Consistent guidelines, unique process</td>
</tr>
<tr>
<td>Uncertainty / failure frequency</td>
<td>Low &amp; highly predictable / avoid failure</td>
<td>Medium &amp; general predictability / expected failures</td>
<td>Low predictability / high failure rates for fast learning</td>
</tr>
<tr>
<td>Managerial focus</td>
<td>Control and measure</td>
<td>Culture of openness and vigilance.</td>
<td>Inspiring and actively explorative</td>
</tr>
<tr>
<td>Learning goals</td>
<td>Continuous improvement</td>
<td>Problem solving, psychologically safe culture</td>
<td>Cross disciplinary and discovery</td>
</tr>
</tbody>
</table>

*Source: Edmondson, 2012, p. 231*

This study of engineering activities has the primary interest in the complex and innovative activities; therefore my interviews will be testing for several of the items in Table 2, such as a mix of established and dynamic processes and guidelines; acceptability and expectation of failures for learning; a psychologically safe culture of openness, vigilance, inspiring, and actively explorative; and cross-disciplinary teaming.
In previous sections there have been many citations and statements from academic scholars and practitioners suggesting that society is becoming too complex for a single mind. The complexity of teams requires a systems view. To assist in realizing the correlation between team and systems, we will start this view of linear and nonlinear performance using the example of Major League Baseball (MLB). Consider each team as a performance-based system and each player as a component within each system. The simplest way to estimate the value of any one system, or team, might be to linearly add the value established for each player. Each player’s salary is a measure of their individual value; therefore the team’s value is the linear sum of all player salaries on the team. The interesting fact noted in the introduction of this dissertation is that the World Series winners are seldom teams with the highest total team salary. Over the past 10 years, the team with the highest salary only won the World Series one time, while the World Series team winner averaged in the eighth position for total salary, per Orinick (2015) in his list of MLB opening day payrolls. The fact I find most interesting is that in the five years, from 2010–2014, the winning team’s total salary averaged $125 MM compared to the highest team’s average of $234 MM, or only 53% of the highest paid team. In other words, hiring the most talented players and paying them the highest salaries seldom resulted in creating the best team. A correlation was found between total team salary and number of winning games throughout the season, in the Bradbury (2008) article “Salary to Winning
Correlation for Baseball Teams.” This correlation is supported by my finding that World Series winners averaged a ranking of eight, out of 30 total MLB teams. This simple example illustrates that team performance is a nonlinear and complex function, where value is created by the synergy and interdependence of the team members.

**Linear and nonlinear performance**

My literature research discovered that the classical team performance theories and models were based on linear and sequential team progress (Bennis & Shepard, 1956; Bion, 1961; Mann, Gibbard, & Hartman, 1967; Slater, 1966; Tuckman, 1965). This classical literature supported the industrial era of Ford and Taylor where team performance is the net sum of the individual team members. This classical literature, based on linear application, remains foundational for the basic understanding of groups, while not usually being accurate for practitioner application and also not sufficient for the complexity of modern-day business. Edmondson (2012) points out that “in this dynamic environment, successful organizations need to be managed as complex adaptive systems” (p. 23). Research started this shift in the 1990s, according to Lumley (1997): “Much of today’s literature on high-performance teams seeks explanations … in terms of nonlinear casual relationships” (pp. 14–15).

Unfortunately, managers still over emphasize individual performance as a linear metric adding up to firm performance, as Edmondson (2012) notes:

The assumption that firm performance was the cumulative result of thousands and thousands of well-designed and well-executed tasks
dominated managerial theory. Even today, when it comes to efficiency and productivity, most managers and corporate leaders are driven by taken-for-granted beliefs that were first promulgated by Ford and Taylor. (p. 16)

Linear performance by definition is the simple sum of the expected parts. Nonlinear performance is defined as performance that either exceeds or falls short of this expectation. Deviation from these expectations can occur at the individual level with an example like the Pygmalion effect, where studies indicated that people can be motivated beyond their apparent normal or anticipated capacities (Livingston, 1969/2003, p. 98). The other way performance will deviate from expectations is a result of the interactions and interdependencies of individuals working together for a common goal. These interactions and interdependencies are the focus of this dissertation. The punctuated equilibrium model of group development is an example of nonlinear progress, where group progress contains discrete periods of high performance triggered more by external group factors, followed by longer periods of lower performance (Gersick 1988). Extraordinary real teams were defined as small groups where “incremental performance is achieved, exceeding the sum of individual best efforts” (Katzenbach & Smith, 2006, pp. 91–92). Table 3 illustrates nonlinear achievement using the Katzenbach and Smith (2006) model, then adding a simple mathematical example for illustration purposes.
Table 3. Performance Net Sum

<table>
<thead>
<tr>
<th>Group /Team</th>
<th>Performance Net Sum</th>
<th>Mathematical Example</th>
<th>Linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working group</td>
<td>Might reach sum of individual best</td>
<td>$1 + 1 + 1 = 3.0$ (or less)</td>
<td>Linear</td>
</tr>
<tr>
<td>Pseudo-team</td>
<td>Less than sum of individual potential</td>
<td>$1 + 1 + 1 = 2.5$</td>
<td>Nonlinear</td>
</tr>
<tr>
<td>Real teams</td>
<td>Start to exceed the sum of individuals</td>
<td>$1 + 1 + 1 = 3.2$</td>
<td>Nonlinear</td>
</tr>
<tr>
<td>High-performance teams</td>
<td>Continually exceeds at team &amp; individual level</td>
<td>$1 + 1 + 1 = 4.0$ (or more)  + individual growth</td>
<td>Nonlinear</td>
</tr>
</tbody>
</table>

Source for first column: Katzenbach & Smith, 2006

A more operationalized way to view team performance is through process gains and losses, where the gains and losses define any variance from the expected norm.

Steiner (1972) created a process model of team performance stated that a team’s actual productivity (AP) was a product of a team’s potential productivity (PP) minus process losses (PL): $AP = PP – PL$, where process losses can be external or internal to the team. This model assumed that individuals and teams perform to their expected level, except when there is a negative deviance, while not accounting for any process gain. Hackman (2002) recognized that the model did not include “the synergistic benefits that come from people working together interdependently,” (p. 236), and added process gains ($AP = PP – PL + PG$). Steiner’s model can explain both the working group’s achievement at expectation and the pseudo-team’s failure to meet expectations in Table 3, yet process gain must be added to explain both the real team
and the high-performance team’s achievement. LaFasto and Larson (2001) suggest a simple question to test for process losses. Whenever they encounter a dysfunctional team, they ask: “Where is the energy focused?” (p. 81).

Nonlinear performance is much more difficult to research and analyze due to the multiple variables previously noted. Teams especially complex to analyze because data is collected at three different levels. Compilational, or multilevel, analysis is required to determine the correlation between data sets of individual, team, and organization levels. The difficulty of multilevel analysis becomes clear when realizing that 74% of articles using compilational analysis were theoretical intended to develop emerging theories, while of the remaining articles claiming to be compilational, 30% of them conducted tested at a single level and not actually multilevel (Dinh et al., 2014).

**Complex adaptive systems (CAS)**
The study of systems is naturally complex due to the multiple variables and interdependence of parts within each system, yet research on system complexity has often resulted in developing a new perspective that can provide a more simplistic viewpoint and new thinking. Complexity in society today must be embraced and two quotes from Albert Einstein help us to understand how to deal with complex problems and why dealing with complexity is important. Working on complex problems takes time and in our fast-paced world, and we need to live with problems:
“If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions.” The second question as to why we need to embrace complexity is likewise articulated well by Einstein: “We can't solve problems by using the same kind of thinking we used when we created them” (Albert Einstein quotes, 2015). I refer to the finding of this more simplistic view point as the “other side of complexity.” An example of the other side of complexity came during a discussion with Dr. Edmondson, when she explained that the complexity of teams might best be understood through their activities; therefore view teams as a verb—teaming—rather than in the traditional team perspective as a noun: "You are looking for the silver lining of complexity . . . that provides a new lens—like viewing teaming as a verb, which provides new clarity when framing teams” (personal communication, July 17, 2015).

A second example of finding clarity on the other side of complexity is the concept of loosely coupled systems, where teams are viewed as independent systems with linkages and interconnectedness in alignment with the organization. This concept of loosely coupled systems can have the benefits of higher organizational adaptability and effectiveness and higher employee job satisfaction. When the application of loose coupling is not reduced to a unidimensional variable, “a simplification that should be resisted” (Orton & Weick, 1990, p. 216). Orton and Weick go on to explain that loosely coupled system theory is based on dialectical variables creating a balance.
They choose the five recurring voices of causation, typology, effects, compensations, and outcomes; each corresponds to a condition of team effectiveness. By example Orton and Weick (1990) discuss causal indeterminacy, where loosely coupled systems need to create autonomy from the whole, a shared value as compensation, and a clear means-end connection (pp. 204–212). Where Hackman’s (1987) conditions #1 and #2 similarly suggest that real teams should be bounded, have a common purpose, and a have a clear and compelling direction with a defined start and end. The demand for companies to respond to the increasing pace of business and adapt to a more complex global economy requires leaders to embrace the complexity associated with multiple variables to create dialectic forces in their organizations and enable teams to self-manage. A company’s reward for embracing complexity is adaptability, because “when complexity allows synergy between diverse functions, then organizations are enabled to become more adaptive” (Dinh et al., 2014, pp. 43–44).

The term complexor was created by Losada (1999) to represent a dynamic high performance state, derived from the two terms complex and order. A complexor state is an example of system complexity where systems get stuck in performance states which are less than ideal. All systems naturally seek states of stability, recognizing that not all stable states are healthy or sustainable. The analysis of teams as complex systems requires a nonlinear dynamics model rather than traditional linear modeling.
Losada and Heaphy (2004) note that this was a significant scientific paradigm shift because “social scientists are accustom to seeing a regression coefficient reveling the slope of the line” (p.754) used in linear modeling. Meta learning is an example of CAS. Meta learning is defined as a team’s ability to work through the natural forces associated with negative attractors and to develop possibilities for effective action (Losada, 1999, p.190). Attractors are relatively stable states where systems naturally trend toward and stay without obtaining new knowledge. Exiting these states often requires disruptive learning situations that change many of the underlying norms of operation. According to Losada and Heaphy (2004):

> Once a team or organization settles into the dynamic of point attractors, it is extremely difficult to exit. Organizations and teams where attractors predominate are doomed to die in a chaotically complex world of demands constant adaptation and innovation. (p.761)

Figure 6 includes four attractor states where point A is a fixed-point attractor operating at the most stable point in the system and also the lowest point of performance. Point D represents the attractor state of highest performance and usually the most dynamic and adaptable state that an organization can obtain.
Teams are able to transcend these limiting attractors through meta learning and reach the dynamic chaotic attractor state of operation, referred to by Losada (1999) as a complexor state. Complexors are an example of CAS defined by dynamic, flexible, and innovating conditions, where companies’ systems dynamically adapt to their changing environment.

**Team Size, Stability, and Identity**

**Team size and stability**
The simplest condition—and yet as a practitioner, I would suggest the most violated—is the need for small teams. Many authors have written about team size (Gibb 1951; Hackman & Vidmar 1970; Kameda et al., 1992; Wheelan & McKeage, 1993; Katzenbach & Smith, 1993, 2006, 2015; Wageman, 1995, 2001a), yet with all
this academic agreement on small teams, a paradoxical situation remains. Early
research on groups determined that productivity and efficiency diminish as the group
size increases in a nonlinear function (Gibb, 1951).

Two competing forces are in play regarding team size. The first force is that potential
productivity increases when adding the unique skills of one more member to the
team, while the process losses, as discussed in the system complexity section of this
dissertation. The productivity increases of new skills are strongest with very large
teams, but process losses are also more prevalent in larger team, resulting in an
inverted parabola function or “U” shape (Steiner, 1972, p. 96). Hackman and Vidmar
(1970) extended Steiner’s research on a team’s productivity to determine that member
satisfaction decreases as the group size increases, while finding that productivity
continued to improve through seven members before declining. They conducted a
simple test by asking teams of various sizes if their group was too large or too small
to conclude that the ideal team was approximately 4.6 members (p.48), which
Hackman later clarified as a “not to important study” and for his Harvard courses
limited the team to a maximum of six members (Hackman, 2002, pp.118–119).

Research in the 1990s considered more specific influences affecting team
performance, such as a study focused on team interdependence and group
effectiveness, where the most effective teams were determined to have four to seven
members (Wageman, 1995). Research considering the social-psychological factors studied team member motivation to determine that, “two cognitive tasks peaked at moderate-sized subgroups and showed a nonmonotonic pattern roughly describable as an inverted U,” and “further emphasized the critical role of perception of indispensability in motivation” (Kameda, et al., 1992, p. 47), where the inverted U indicated that teams between four to seven members achieve an optimal balance.

Katzenbach and Smith (2015) discuss the differentiators from working groups to performance teams based on their many years of consulting experience, concluding that: “large numbers of people usually cannot develop the common purpose, goals, approach, and mutual accountability of a real team” (p.47), while suggesting through their book that single team sizes beyond 10 to 12 members seldom achieve high performance. Many of these factors that influence team productivity as the number of members increase are shown in Figure 7. I have included the number of dyad pairings as a representative for the member to member interdependencies such as task coordination, communication, and team development.
Figure 7. Team Member Size

A team with two members has only one dyadic relationship to manage, yet at four members, the numbers of dyadic relationships grow to six, then sixty-six relationships with twelve members. The dyadic relationship in teams who perform mostly routine type activities many not have significant task interdependence and therefore spend minimal time coordinating duties and tending to relationships. At the other extreme, innovative teams require significant task interdependence and spend a significant amount of their time on each dyadic relationship. It becomes quite clear why high-performance teams are limited to a maximum of six members, when realizing that a team of ten members invests 300% of the time and effort that a team of six members will require.
Research comparing the developmental pattern differences between small and large groups supports the higher effectiveness of smaller teams. Small groups generate significantly more dyadic pairing, increase work focus, and have less confrontational flight and fight activity, where larger groups suffered from lower member participation, low team cohesiveness, and reduced productivity (Wheelan & McKeage, 1993). Smaller teams spend less time in the “forming, storming, and norming” stages of development (Tuckman, 1965), and reach the performing phase much quicker. Wheelan and McKeage’s (1993) study further compared group developmental sequencing and determined that smaller groups had more effective team member pairing and task alignment, which was positively associated with higher work performance. They also suggested that both small and larger groups were more similar through the developmental stages of initial member dependency, creation of counter-dependency, and the counter-pairing phase.

Team size and mix are one of the most critical factors to an enabling structure, because each core team requires all the various skills and disciplines mentioned in the previous section on creating a real team. In addition to technical skills, teams also need a mix of experienced and less experienced staff to create a dyadic environment and pragmatically to achieve the lower average cost structure required to compete in the market place. My personal conclusion from this literature as well as my
practitioner experience is that engineering team design efforts tend to have the best results with three to four members and five to seven during production. Large teams with 12 members usually split into two or three subteams on their own.

**Team and member identity**
The identity of an individual member and the associated identity of the team of which they are a member are integral to many sections of this dissertation. This discussion could have been placed in the section discussing a shift in society from individualism toward a more team centric existence, because there is a psychological mindset change in individuals as they see themselves as part of a team rather than as individuals. Goffman (1959) notes that when an individual is acting independently from others, there is a tendency to be “convinced at the moment that the impression of reality which he fosters is the one and only reality,” and then as individuals recognize their participation with others, “an emergent team impression arises which can conveniently be treated as a fact in its own right” (p. 80). A team unifies to give a single presentation such that individuals deny their own identities and cause self-deception. Self-deception can be seen when two different roles are compressed into the same individual” (p.81). This identity paradox causes conflict with the individual’s previous reality and can result in disclosure to others of their individual verses team identity misalignment. Disclosure of conflicting identities can be viewed by society as both positive and negative depending on the contextual conditions:

When a disclosure (of identity) shows that we have been participating with a performer who has a higher status then he had led us to believe,
there is a good Christian precedent for our reacting with wonderment and chagrin rather than with hostility. There are many stories where the villain and the hero both make fraudulent claims that are discredited in the last chapter, the villain proving to not have a high status, the hero proving not to have a low one. (Goffman, 1959, p. 60)

The identity of an individual member and the associated identity of the team could have been also placed in the section the next section on team development and learning. In their article on the theory of group development, Bennis and Shepard (1956) create a frame work where individual team members rationalize their own identity with how they identify within the group. In the article they discuss the internal uncertainty associated with self-deception of identity and the dependency on authority and interdependency with other team members.

Barker and Tompkins (1994) have demonstrated that individuals usually identify more strongly with their working group or team than they do with the organization. Team and member identity appears in this section on team size and stability to connect the preceding and following sections, while strengthening the criticality of small and stable teams. Small teams have the ability to work through the paradox of individual and team identity conflict, where larger teams often get stuck in an early development phase, therefore never reaching the performance stage. Likewise, individuals in an unstable group environment, where they are constantly changing group members, maintain their individual identity, yet never fully align with a team. Possibly the most interesting aspect of teams is that, as its members contribute to the
team-centric identity, their individual identity becomes more salient. Katzenbach and Smith (2015) point out that “when harnessed to a common team purpose and goals, our need to distinguish ourselves becomes the engine for team performance” (p.8). Team identity is created by small teams, over extended periods of time, and noted through this paper as being correlated to both member satisfaction (Hackman & Vidmar, 1970; Cummings, 1978; Cameron, Dunn, & Quinn, 2003; Lasado & Heaphy, 2004; Doolen et al., 2006; Edmondson, 2012) and team interdependence (Bennis & Sheppard, 1956; Bion, 1961; Wageman, 1995; Hackman, 2002; Edmondson, 2012; Katzenbach & Smith, 1993, 2006, 2015).

The social identity theory of leadership is a social psychological analysis of the behavior of people in groups, where the fundamental belief is that the groups with whom we associate will define critical aspects of our individual identity (Hogg, 2001, p. 186). Realizing that individuals socially construct their own identity from their associated groups provides a new perspective where groups influence the leader and other members, more than the more traditional hierarchical view of the leader influencing the group. Hogg (2001) says:

Theories of leadership have always tended to focus their attention on the leader and what makes him or her special and different from other people. Other analyses of leadership have focused on followers’ or subordinates’ schemas of leadership and their perceptions of leaders. One thing missing or underemphasized in these analyses of leadership is an explicit focus on the role of group membership and shared identity in leadership effectiveness. (p. 184)
Individual social identity is constructed from the interaction of our internal social cognitive beliefs and self-generated motivation, with the external group beliefs and social influences of the group. Research testing of this theory determined that the collective voice and influence of groups can significantly determine leadership effectiveness. More specifically, leadership effectiveness was highest in salient groups, where the constructions of the four noted areas are strong, and the leader was considered prototypical of its membership. Leaders are seen as prototypical when their beliefs and actions aligned with the group norms and are seen as interregnal to the group. Conversely, in low salient type safe environment groups, the leaders who were considered as nonprototypical to the group were more effective. An especially interesting paraxial finding is that members who were perceived as most conformant to the salient group norms, were given the most leniency; therefore the perception of past normative compliance socially constructs a projected belief of conformity. The overall findings of the study of social identity theory of leadership strongly support the team as the primary unit of performance, through the lens of viewing leadership as a shared group process, where members are able to influence others.

Group development is a collectively constructed social reality based on the integration of each team member’s individual social reality (Brower, 1989, p.38). Each team member starts with an understanding of the environment based on their own schema or cognitive representation and through substantial interaction and
negotiation, co-creates a common social reality. An individual’s schema is a proposed internal structure that influences how each person encodes, stores, and then retrieves information about their world (Cohen, 1981). When individual team members can create a common schema, the social cognitive understanding of group function can exceed the ability of any single member.

**Generative Group Norms**

There are three different ways that norms emerge within groups. Norms can be imported by an individual, norms will develop over time through a trial and feedback, and group norms can be deliberately established. Evidence suggests that the norms that develop naturally over time will maintain harmonious interpersonal interaction, while the norms associated with team effectiveness and long-term well-being are unnatural, create anxiety, and therefore must be deliberately created (Hackman, 2002, p. 112).

Whether norms are introduced or emerge in a group, the set of norms followed by the group will be collectively and socially constructed at both the individual and team levels, yet often be hidden to outsiders. Leaders have an opportunity during the initial formation of the group to specifically focus on the norms that will lead to longer term effectiveness as a balance to the naturally evolving norms associated with short-term interpersonal interactions. Introducing norms after teams have started to share experiences is typically much more difficult, especially if the leader is considered an
outsider to its membership. Edmondson (2012) suggests that immediately after enrolling members into a group, discussion regarding “how the team should work together, how to encourage speaking up with concerns and observations, and how power relations might affect the groups” be established in the preparation stage (pp. 105–107). Establishing these group norms early will enable the members to self-manage conflict constructively with far less anxiety and naturally lead to the systematic states associated with health and sustainability.

A final comment on the leader’s responsibility is that group norms need to establish purpose, generate inspiration, and be simple to remember. Hackman (2002) made this point well during one of his lectures when stating that in 4 Matt. 19 (Revised Standard Version), “Jesus did not have little team meetings to decide about the goals of ministry. Instead, he simply stated come follow me, and I will make you fishers of men.” (p. 90).

**Psychological safety**
Creating a culture of psychological safety and generative thinking are critical conditions for engagement of employees, interdependence, learning, and development of groups. A generative environment supports Hackman’s third condition of an enabling structure and specifically the team norms. Psychological safety was rooted in the work of Edgar Schein and Warren Bennis, focused at the individual level of analysis. They proposed that psychological safety enables individuals to speak up,
accept change, as well as remain motivated to improve their team or company (Schein & Bennis, 1965). Motivation to improve their team then becomes a driving force for member interdependence, which is a targeted variable in this paper. William Kahn’s research on the conditions of employee engagement and disengagement argued that psychological safety in individuals results in higher levels of trust and respect in the work environment which increases employee engagement (Kahn, 1990).

Edmondson (1999) presented psychological safety as a group-level construct, where the shared experiences of group members create a common perception as to the level of psychological safety. The term group-think refers to the conditions where individuals refrain from offering new ideas and basically go along with the status quo. Research has indicated that individuals who are motivated and want to share ideas for improving work performance, will typically not speak up because they fear being judged harshly (Detert & Edmondson, 2011), where group level psychological safety increases interpersonal risk taking (Edmondson, 1999), as well as helping people overcome the anxiety associated learning from information which is contradictory to their previous beliefs (Schein, 1985). The psychological health of team environments greatly influences its members both positively and negatively as captured in the following quote from a leadership author and guest professor of mine, Dr. Peter Northouse, during an informal breakfast discussion, “By groups we are sickened, and by groups we are healed” (personal communication, 2015).
As discussed in the previous section on systems, control and balance are achieved by applying dialectic forces. Extending this concept to psychological safety, an opposing group construct of mutual accountability must operate as in dialectic to achieve equilibrium. Paradoxically, when clear boundaries communicate accountability through acceptable and unacceptable norms, individuals will feel a higher sense of freedom and psychological safety (Edmondson, 2012, p. 144). The pairing of psychological safety and accountability in a work environment is referred to as a Just Culture. A Just Culture was developed to acknowledge that competent professionals make mistakes, especially in high-risk operations, therefore progress can only be realized through open discussion regarding the challenges and constraints (pp. 144–145). Psychological safety enables teams to explore successes and failure, such that considerable collective learning can occur (Hackman, p103, 2002). Collective learning is a team and organizational level construct and required for adaptability as previously discussed in system feedback. Extensive research on psychological safety reveals that when interpersonal fear is mitigated, then seven specific organizational benefits emerge:

1. Encourages employees to speaking up
2. Creates cognitive space enabling clarity of thought
3. Supports constructive conflict
4. Mitigates failures
5. Promotes innovation

6. Removes obstacles between goals and performance


Positive and negative affect
Positive organizational scholarship (POS) is an organizational construct where research is concentrated on generative norms referred to as positive organizational phenomena (Cameron, Dutton, & Quinn, 2003). Organizations naturally generate affect as an individual construct including the range of emotions, feelings, and attitudes of an individuals’ experience. Positive affect has been found to predict and create human flourishing (Fredrickson & Losada, 2005) and well-being (Diener, 2000; Kahneman, 1999; Rath & Harter, 2010). Fredrickson (1998) developed the broaden-and-build theory of positive emotions, suggesting that positive emotions will broaden thought-action inventories, stimulate creativity, and build durable physical, intellectual, and social resources, whereas negativity will have a narrowing or limiting effect on both thinking and action.

Losada and Heaphy’s (2004) research presented positive affect as an amplifying agent of feedback enabling response and adaptation, where negative affect was presented as a restrictive or dampening feedback (pp. 740–754). They additionally determined that excessive positive affect will cause a loss of regenerative and innovative powers, therefore excessive positive gain results in system convergence to
a low state of performance. Losada’s 1999 meta learning model of nonlinear
dynamics provides yet another example linking the nonlinear systems section of this
paper on generative norms. The ancient Greek philosophers knew about the
generative power associated with affect, as evident by a phenomenon called the
Pygmalion effect; named after the Greek myth of Pygmalion, a sculptor who fell in
love with a statue he had carved. This phenomenon suggests that higher expectations
lead to an increase in performance. Evidence with school children reveals two
interrelated discoveries: first is that the way leaders treat their staff and the
expectations for their achievement will greatly influence their performance. Second,
in rare and unique situations some leaders are able to create high-performance
expectations that cause employees to rise the occasion and execute remarkable

Similar to the dialectic framework of psychological safety and accountability, the
generative and creative attributes of positive affect require the opposing and
restrictive attributes of negative affect to achieve system control and balance.
Negative feedback is necessary to promote learning, growth, and development, and
without the disciplined of regular feedback, continuous learning, and adaptability,
“success can breed failure” (Gino & Pisano, 2011, p. 71). The ratio of positive to
negative (P/N) affect is a predictor of human flourishing, defined as living “within an
optimal range of human functioning, one that demotes goodness, generativity, growth, and resilience” (Fredrickson & Losada, 2005, p. 680).

P/N affect ratio similarly predicts the state of well-being (Diener, 2000; Kahneman, 1999). The authors of these generative mental models discuss a psychological emotional space for cognitive thinking, a space that expands with positive feedback and regresses with negative feedback. Losada and Heaphy (2004) developed a visual representation of this psychological concept as seen in Figure 8 and referred to as a space-phase diagram (p. 756). The diagram indicates with two sets of bipolar inputs and outputs of inquiry and advocacy, then self and others. The model suggests that emotional space is created through the ratio of P/N discourse and is graphically represented by the area within each circle. Losada and Heaphy suggested that P/N ratios below 1.0, where negative feedback exceeds positive feedback, will cognitively be restrictive and contribute to low performance, where P/N ratios around 5.0 will increase the emotional space while contributing to higher performance. A similar study by Fredrickson and Losada (2005) determined that a P/N ratio of 2.9 was a bifurcation point between flourishing and languishing.
The meta learning (ML) performance measurements indicated strong and sustained patterns of the members having interlocked behaviors, higher connectivity, and better performance. A qualitative observation within this study was that high-performing teams generated a dynamic and energetic atmosphere, where the atmosphere with low-performing teams lacked mutual support and enthusiasm. The exact ratio of P/N affect of 2.9013 has been rejected, while the basic concept of creating emotional space through a higher level of positive reinforcement remains credible. Wikipedia
summarizes the error found which lead to the rejection of the exact number and also the general conceptual acceptance of the model, yet the specific ratio rejection:

The concept of a critical positivity ratio was widely embraced by both academic psychologists and the lay public; Fredrickson and Losada's paper was cited nearly 1,000 times ... etc. Brown collaborated with physicist Alan Sokal and psychologist Harris Friedman on a re-analysis of the paper's data. They found that Fredrickson and Losada's paper contained "numerous fundamental conceptual and mathematical errors. (Critical Positivity Ratio, 2015)

In my research I see a reoccurring theme emerge within the paradox of individual and group, where in giving of our most inner self, we unexpectedly receive and often find a deeper level of ourselves. Smith and Berg’s 1987 theory of letting go of self, Stevens-Long and Trujillo’s 1995 concept of self-disclosure, Rath & Conchie (2008) in their discussion of commitment to a work-life balance, and Greenleaf’s 1991 definition of servant leadership all point to group interaction as a source of self-awareness. Losada & Heaphy (2004) summarized this concept effectively when they said that teams who can put themselves sympathetically in the place of other team members will generate the highest level of connectedness, as well as emotional space, leading to high performance (pp. 756–757).

**Development, Learning, and Reward to Drive Performance**

The previous sections in this literature review discussed the importance of continuous learning and adaptability for organization to survive and then thrive in the twenty-first century. This section will review organizational development and learning, then consider the unique environment created within engineering teams. Organizational
learning and adaptability are just as important for a large and successful company to sustain performance as they are for a small start-up firm on a fast-paced learning track. Developing, learning, and setting sights on future goals places a great focus on who we want to be as individuals and as an organization. Accepting this premise suggests that organizational learning is essential for success, and team learning becomes paramount. Edmondson (2012) says that “learning in small groups—is regarded as the primary vehicle for organizational learning” (p. 1). Research has discovered a common pattern that collectively oriented team members are more likely to improve their own performance and enhance the performance of their team mates, than individual members (LaFasto & Larson, 2001, p. 25; Driskell & Salas, 1992).

**Traditional linear group development models**

The traditional models of group development can be organized into two main streams of academic research and theory building. The first grouping of research and theory was focused on group dynamics, while the second grouping is focused on group problem solving at various stages of development. Group dynamics research on development began in the late 1940s, with a focus on the psychosocial and emotional aspects of group life (Gersick, 1988). Research primarily focused on working with therapy groups, T-groups, and self-study groups, where the researcher originally modeled a group's task in terms of the achievement of personal and interpersonal goals such as insight, learning, or honest communication (Mills, 1979). The second grouping of researchers typically made observations in a laboratory environment,
working with groups for limited durations as they performed prescribed tasks of solving specific problems. These laboratory studies focused on discovering the sequence of activities as groups empirically reach solutions, and then used various systems of categories along with communication coding to analyze the results. Both streams of research on team development shifted focus in the 1950s and 1960s toward a sequential progress having a time domain, which extended through a group's life span rather than a destination point. This sequential perspective gave light to groups getting stuck in an early developmental phase due to issues of dependency, control, and intimacy, so that groups never reached effective performance (Bennis & Shepard, 1956; Bion, 1961; Mann, Gibbard, & Hartman, 1967; Slater, 1966).

Tuckman (1965) integrated the literature from the authors referenced above to create a model of group development as a linear sequence. The general sequence consists of forming, storming, norming, and performing, and is theoretically the same for all groups. Tuckman’s analysis was cited in most of the articles on team development included in this paper and considered a foundation upon which other models take reference. Tuckman and Jensen (1977) added a fifth and final stage, adjourning, to the original model. Other team models proposing sequential development during this late 1970s time frame kept the same pattern. Three similar proposals found on sequences include define the situation, develop new skills, develop appropriate roles, carry out the work (Hare, 1976); orientation, dissatisfaction, resolution, production, termination
(LaCoursiere, 1980); and generate plans, ideas, and goals; choose and agree on alternatives, goals, and policies; resolve conflicts and develop norms; and perform action tasks and maintain cohesion (McGrath, 1984). Models by the 1980s were in general agreement of group developmental being primarily a linear progression, where a group cannot get to stage N without first going through earlier stages (N-1, N-2, etc.).

**Developmental obstructions to learning**

Group learning starts at the time of enrollment of members and is most critical during their development phases. Learning at both the individual and group level is what enables progression to the next development phase, and also what sets the stage for continuous learning. The discussion on obstructions to learning starts with Bennis and Shepard (1956) in *A Theory of Group Development*, which was referenced in modern-day literature on team development and performance (over 1081 citations). The theory states that “the principal obstacles toward authority and intimacy that members bring to the group . . . etc., prevent the setting, clarification of, and movement toward group-shared goals” (p. 417). The theory argues that the response to authority figures of rebelliousness, submissiveness, or withdrawal, as well as the behavior response to peers of destructive competitiveness, emotional exploitiveness, or withdrawal, will prevent the collective validation of group experiences. Uncertainty associated with dependency on authority and the interdependency with other team members emerges as feelings of anxiety. “Anxiety prevents an individual’s internal communication
system from functioning” (p. 415), while also resulting in external inputs from the social environment to become unintentionally filtered and manifested in the distortion of communication to others. Personal level relationships form as dependent with authority figures and counter-dependent with another group member, rather than as interdependent relationships.

Theory of group development
Phase 1 of this theory starts with individual member’s dependence, which moves to counter-dependence (a state of retraction often rooted in a failure to trust others) and then to resolution. The emotional response to dependence starts as the desire to disconnect (flight), followed by an assertive desire to fight, and then pairing. The structure associated with phase 1 starts as interpersonal, then moves to distrust and withdrawal, and finally to defining roles and group norms. The actions start as projection to the leader, then search for consensus, and finally to revolt and a new leader. Phase 2 of this theory centers around creating interdependence and building personal relationships starting with enhancement, then moves to disenchantment, and then to consensual validation of group. The emotional response in phase 2 turns from pairing to fight and flight, and then finally acceptance. The structure associated with phase 2 starts as over personal and group think, then moves to counter personal and defining group, and finally to group bonds. The actions start as social transfer and rejection, then codes of behavior and tardiness, and finally to acceptance of group
terms. In summary, this theory creates a framework where individual team members rationalize their own identity with how they identify within the group.

**Punctuated equilibrium model**

Gersick (1988) challenged the paradigm of a linear progression model by creating an empirical study that included the interpersonal issues and problem-solving activities like previous work, yet also integrated the influence outside the group. External influences are found to be pivotal for groups to make developmental progress in more recent studies that preceded her study (Hackman, 1985; Katz, 1982). The question that drove her study was “what does a group do, from the moment it convenes, to the end of its life-span, to create the specific product that exists at the conclusion of its meeting?” (Gersick, 1988, p. 11). This research was based on grounded theory methodology (Glaser & Strauss, 1967), where similarities and differences of team progress are compared and trended against a hypothesis. The study resulted in the creation of a punctuated equilibrium model of group development, where group progression is not linear, but rather contains discrete periods of time with high progress, then followed by longer periods of minimal progress. The findings suggested that high levels of progress were triggered more by external group factors, such as scheduled deliverables, than the actual amount of work. Another key difference from the traditional models is the critical nature of the first meeting. The four key points from Gersick’s 1988 model are listed in Table 4.
Table 4. Punctuated Equilibrium Model

<table>
<thead>
<tr>
<th>Gersick model key points</th>
<th>Hackman model</th>
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| 1. The first group meeting will set precedence for the first half of the project, where a clear definition of the assignment must be communicated and understood. | 2.1 Challenging, clear, and consequential.  
2.2 Defined start and end, while leaving the means and methods for team. |
| 2. Groups that start with disagreements perform best when they pursue the argument enough to resolve assignment and team member boundaries, which requires a shorter deadline to resolve differences before developing a detailed plan. | 1.1 Clear boundaries of members and non-members.  
1.2 Members tasks are interdependent for a common purpose. |
| 3. Groups that start with a clear mission will perform best when a detailed plan is developed focusing on both the strong and weak transition points. | 3.1 Well designed task; whole and meaningful work enabling team autonomy and judgment to effect knowledge results. |
| 4. The project midpoint was determined to be a particularly critical point in determining the final performance, where communication to confirm and realign assignments and the mission to both the team and external stakeholders. | 5.1 Motivational at start, strategic near middle, and feedback; including technical and operational. |

Sources: Gersick, 1988, p. 22; Hackman, 1985, p. 256

A common theme across team development models was the observation of emotions such as anxiety and anger, as determinants of what phase or stage of development a team is experiencing. (Bennis & Shepard, 1956; Slater, 1966; Tuckman, 1965).

Emotional management and conflict: unique to engineering teams
Psychologists have known for over 50 years that emotional feelings such as anger and anxiety restrict an individual’s ability to learn and a group’s ability for collective
learning as noted above where “teaming calls for developing both affective (feeling) and cognitive (thinking) skills” (Edmondson, 2012, p. 2). Then why are emotional management and conflict resolution skills seldom taught in practitioner environments? Edmondson proposes that “teaming, by its nature, is a learning process,” where “proficient teaming is a matter of developing interpersonal skills related to learning (inquiry, curiosity, listening) and teaching (communicating, connecting, clarifying),” (p. 52). These simple and natural skills of communication are inhibited primarily by employees simply not speaking up, as previously discussed in the section on psychological safety. Teams need to be taught basic conflict management skills. Metcalfe and Mischel (1999) have developed a hot and cold system using the delay-of-gratification paradigm through the processes that enable self-control and willpower. The cold topics are defined as “know” topics with high levels of certainty and usually with low to moderate impact, while the hot topics, labeled “go,” are emotionally based with controversy and often have high impact.

Constructive disagreement and conflict are essential for individuals to add context and depth to their knowledge as they relearn previous knowledge obtained under simplified conditions. The problem with disagreement is that people spontaneously engage in sense making (Edmondson, 2012, p. 63), while intuitively filtering the context. The importance of context has been discussed throughout this document and mentioned over fifty times. The process by which individuals explain the causes of behavior and events is referred to as *attribution*. Specifically, the term for filtering
situational influence is called a “fundamental attribution error,” which is the cognitive
tendency to blame people more than the contextual conditions and circumstances of
the situation (Ross, 1977). Ross additionally argued that people have what he referred
to as a “naïve realism,” where they construct their own reality based on personal
experiences, then project that construct on others. Argyris (1993) further argued that
that people tacitly assume that they know the motivation of others and act on these
erroneously assumptions.

The question as to why emotional management is seldom taught to practitioner
engineers or student engineers was discussed during an advisory discussion and
interview with Dr. Paul Yelsma, a Professor at Western Michigan University in the
Department of Communication, when he stated, “Emotional management is not
taught in most curriculums, only the military with mottos like: take care of your
buddy” (personal communication, November 18, 2015). I discovered further support
in Joyner et al. (2012) for the benefit gains from teaching emotional management in a
study by Joyner et al. at the Indiana University East as follows.

Globalization has created hyper-diverse organizations, magnifying the
possibility for both generative creativity and destructive conflict. A
growing body of research makes it clear that effectiveness in the
changing world of work requires thinking differently and working
differently. There is an emerging consensus that socio-cultural
competence is an essential addition to the technical competence that
has traditionally been identified as critical for engineers. Related to
this, the value added to the work of engineering by the development of
emotional intelligence (EI) competencies is gaining attention in the
professional and the educational engineering literature. (pp. 67–68)
Yelsma (personal communication, November 18, 2015) further explained his more recent research on emotional intelligence and more specifically alexithymia, which increases the learning barrier. I further researched alexithymia to discover there are four main characteristics: difficulty in identifying feelings and distinguishing between feelings and the bodily sensations of emotional arousal; difficulty in describing feelings to other people; constricted image processes, as evidenced by a shortage of fantasies; and a stimulus-bound, externally oriented cognitive style (Taylor, Bagby, & Parker, 1997). Yelsma (personal communication, November 18, 2015) further explained that teams that have similar emotional recognition and expression capabilities will be fine. Therefore engineering teams where interdependence is governed more by logic and less by emotional cues will be fine. The problem occurs when some members have high emotional capabilities and other members have alexithymia and experience difficulties identifying emotions in others and inability to express emotions. He further explained that “one in a group is ok, but two in a group, they can’t get by,” because the team can often adapt to one team mate with low emotional capability, yet teams of four or more with two members with alexithymia, can’t function.

Engineering remains a male-dominated field, with only 20% of engineers being female (Wright, 2014). Alexithymia was found to be higher among men, and
especially in men who had “more technical careers such as Engineering, present higher alexithymia” (González-Pinto, Yllá, Ortiz, & Zupiria, 2003, p. 142). This study also discovered that “engineering students obtain the lowest (scores in) neuroticism” (p. 143), which is a personality trait associated with the negative emotions of fear, anxiety, and anger. Other personality trait and behavior studies indicate that “engineers were shown to score lower on the factor agreeableness, and higher on the factors extraversion, conscientiousness, emotional stability, and autonomy than a national comparison group” (Van Der Molen, Schmidta, & Kruismanb, 2007).

Recognizing that not all individuals follow personality profile trends, these listed studies provide probable traits and therefore should be considered when building engineering teams. Several of these traits, such as emotional stability and neuroticism, will help to enable continuous learning and a psychologically safe environment, while other traits, such as autonomy and less agreeableness, may become challenges to team development and increase the potential for getting stuck in early development stages. Table 5 provides a list of these traits to consider when leading engineering teams. Engineers often demonstrate behaviors of autonomy and tend to work more independently; therefore, consider more formal team gatherings. Engineers have a higher level of conscientiousness and will recognize visual details within their surroundings. Engineers will often be more emotional stability and be less neurotic,
while have a difficulty expressing their feelings and recognizing the feelings of others. This combination allows engineers to remain logical in stressful situations and be more open to feedback, but they need others to help recognize the anger or anxiety in teammates or clients, because they often miss important cues. The last trait is that engineers can be less agreeable and require more discussion and debate to reach team concession. (I don’t agree—just kidding!) Investing the time and effort to reach agreement and concession is an important point, because otherwise team members may withdraw from the team into an autonomous working state.

**Table 5. Engineer Trait Trends**

<table>
<thead>
<tr>
<th>General trait</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher on autonomy</td>
<td>Need regular team gatherings</td>
</tr>
<tr>
<td>Higher conscientiousness</td>
<td>Will recognize visual details</td>
</tr>
<tr>
<td>Higher on emotional stability</td>
<td>Manage anger and anxiety effectively</td>
</tr>
<tr>
<td>Low neuroticism (anger &amp; anxiety)</td>
<td>More accepting of feedback</td>
</tr>
<tr>
<td>Lower emotional expression and recognition</td>
<td>Need help with emotional cues.</td>
</tr>
<tr>
<td>Lower agreeableness</td>
<td>Plan for effort reaching concession</td>
</tr>
</tbody>
</table>

The study on managing organizational context for engineering team effectiveness (discussed in the section on defining real teams) was conducted with 16 engineering teams by Doolen et al. (2006), supporting the considerations in Table 5. This study suggested that “eight independent variables were found to have significant relationship with team member satisfaction” (p. 148). The eight independent variables
are: clear goals, resource allocation, inter-team interaction, management support of
teaming, team-level feedback, recognition, training, and access to both technical and
business necessary information.

**Goals and rewards**
In his research at Xerox Corporation (discussed in an earlier section), Wageman
(2001a) found that higher team performance was, “principally due to: clear direction,
task interdependence, and group rewards, respectively” (p. 568). Reward systems
have been traditionally focused on to incent individual contribution, as reported in a
recent *Harvard Business Review* article: “leaders are hoping for collaboration, while
rewarding individual achievement” (Cross, Rebele, & Grant, 2016, p. 79). The article
also reported, “We find that roughly 20% of the organizational ‘stars’ don’t help…
the success of their colleagues.” Team members need to have significant influence
over their individual goals and strive toward self-regulation, while being bound by the
clear rules, guidelines, and mission of the group. Socio-technical systems theory
(Cummings, 1978) and cognitive theory (Deci, 1975) reinforce this need to create a
balance between structure, authority, and self-regulation. Achieving balance of social
forces is a unique paradox within each team, and it will often require periods of
regression for group learning to occur (Smith & Berg, 1987, p. 126). Regression gives
space and time to the paradox, such that it should be considered a departure point for
new group norms of communication. Performance-based team norms will evolve
through this development process, which extends beyond the more formalized rules
and guidelines developed as working groups. Teams must lean into conflict and resolve differences for learning to occur, which enables high performance.

Improvements in group effectiveness can best be obtained by changing the circumstances in which groups work. Thus, organizational reward systems can be changed to recognize team accomplishments, group and organizational goals must be actively managed to ensure that group and organizational goals are aligned, technical and human resource support systems can be adapted to promote the welfare of work groups, and so on. A diagnosis of the contextual factors facilitating or inhibiting group effectiveness should precede implementing changes in order to identify the specific changes to be made to enhance effectiveness (Guzzo & Shea, 1992, p. 306). Edmondson (2012) comments to the misunderstanding of individual reward: “Many consider the ability to measure and reward the specific, differentiated performance of individuals crucial to good management – a belief that is inaccurate and unhelpful in certain settings” (p. 16).
Chapter 3: Research Methodology and Design

Research Methods Overview

This methodology section will include how my research was conducted, a rationale for specific design decisions, and a detailed explanation of the process, along with the instruments used, as outlined in Waldman (2013) Publish without Perishing How-to-Guide (p. 5). I will first provide an overview of my research and analysis plan to provide a holistic perspective, then discuss my research methodology in greater detail in the following sequence: topic and theory, application of Wageman (1995) and Eisenhardt (1989) methods, history and selection of research participants, integration with the return-on-vales project, and a process flow chart with detailed descriptions of each step.

Scholarly research design follows one of three basic types: quantitative, qualitative, or mixed methods. My research data collection will follow a qualitative method of analysis, followed by the comparison of my qualitative findings to quantitative data that has been collected prior to this study. The framework of a good research plan consciously recognizes and integrates three components: philosophy, strategy, and specific method (Creswell, 2009, p. 5). The primary philosophy behind my research aligns closest with a constructivism viewpoint, where I be looking for multiple tacit assumptions and implicit meanings. These assumptions and meanings are socially constructed by the culture within each firm. The strategy of my data collection is case
studies using open-ended questions, which are based on a qualitative hypothesis and grounded and generative theories, and appreciative inquiry. My specific method of analysis will first be focused on qualitative investigation of interview data using an iterative coding and memo writing process, as defined by grounded theory (Charmaz, 2014). The second phase of analysis will compare my first-order qualitative data, collected at the individual and team levels of analysis, with quantitative data previously collected at the firm level, where my research participants are employed. Therefore my data collection will be qualitative, with a compilational mixed-methods analysis.

Research method overview:

1. My plan is to conduct research within sustainable engineering firms.
   a. Looking for correlation between a team’s performance, individual member performance, and associated firm’s performance
   b. Strategic method is a case study comparing themes from teams across multiple firms.

2. Source of participants selected from database of over 1,000 firms.
   a. PSMJ conducts annual survey of A/E firms, past 40+ years.
   b. Annual survey has 13 qualitative metrics, primarily financial.
   c. A/E firms are ranked, with top 20% being recognized as COE firms.

3. Blind selection of four to six firms to reduce research bias.
a. Criteria for firm selection: professional engineering services as a primary business and sustainably stable per PSMJ metrics.

b. PSMJ selected three to four middle and three to four top performing teams.

c. Firms will remain blind to me until after qualitative analysis.

4. Quantitative interview research.
   a. Six to eight team members per firm (36 to 64 total interviews).
   b. Multilevel team member interviews. Target of one principal, two senior project managers (PMs), two mid-level engineers, and one to two junior engineers.
   c. Open-ended and appreciate inquiry questions, aligned with hypothesis.
   d. Audio and video recording of interviews for accuracy.

5. Analysis per grounded and generative theories, using three levels of coding.
   a. Compare in-group interviews for common themes.
   b. Compare cross-groups for common in-group themes.
   c. Create firm groupings per qualitative themes.
   d. Collect generative ideas and concepts.

6. Quantitative comparison to first order qualitative data.
   a. Obtain the blind qualitative data for comparison of firm groupings.
   b. Determine if qualitative theme groupings correlate to qualitative data.
   c. Develop theories for sustainability of mid and high performance firms.
7. Anticipated outcome of research analysis.
   a. Theory of implicit actions that were constant with all stable firms.
   b. Theory of actions that the top firms do differently from middle firms.
   c. New generative theories emerging.
   d. Document study limitations and suggest potential future research.
   e. Update my current engineering team model based on new theories.

**Research Topic and Theory**

**Research topic selection and refinement**
My dissertation topic of high-performance teams was conducted by the method of interviewing active engineering teams, where their firms demonstrated sustainable performance, either at the top 20% of their peer grouping or sustainable performance near the median performance level compared to their peers. I conducted a comparative case study using quantitative data at the firm level of analysis for selection, then compared qualitative data at the team and individual level of analysis. This case study will more specifically search for the actions, tacit assumptions, and implicit meanings within each firm’s teams, discovered through the grounded theory method (Charmaz, 2014, p. 25), then compare these actions, assumptions, and meanings of teams within high-performance firms to teams within median, or baseline, performing firms. Generative, emotionally energizing, and unique ideas will also be collected. A common variable for all firms in this study will be their sustainable performance, where the differentiating variable will be the firm’s level of financial
performance, either at a median or high level. The rationale behind selecting only firms with sustainable performance is the assumption that these firms have control of their performance, where firms with erratic performance have much less control of their performance. This study assumes that external influences, such as economic and marketplace cycles, are not within the firm’s control and appear to be a significant factor for firms with erratic performance. Selection for firms with consistent and sustainable performance, compared to their peers in a large database, should filter out the firms where only short-term high performance is achieved.

Traditional case studies, which compare the extremes of high performance to low performance, typically document a high number of differences between the conditions associated with high performance verses low performance. When the number of differences is significant, then the associated long list of variables and factors can make it difficult within a single case study to isolate specific variable correlations. My practitioner experience has shown that firms who have achieved high performance for only a single year or two most likely performed well as a result of a specific event or events, which are not sustainable. These events are also shown to be beyond the immediate control of firm leadership—such as winning a major project or merging with another firm. After the event has passed, the firm returns to a lower level of performance and repeats the cycle. In my experience, firms that experience cyclical performance can suffer from external forces not accommodated
by internal controls; these firms will be considered unstable and not appropriate for this study. A basic assumption of this study is that firms who maintain stability through the changing external market conditions have created internal conditions that mediate these external factors. The purpose of my research journey is to discover these internal team conditions that create and sustain success. I will concentrate on the narrower view of positive conditions that enable stability, and then differentiate the conditions that promote high, verses median performance.

The design direction of going deeper into a limited number of firms to gain an insider’s perspective is a common multiple case study practice in research. I have chosen two multiple case study exemplar articles to provide guidance and a framework for the design of this case study. In the first article, “Building Theories from Case Study Research,” Eisenhardt (1989) provides an overall framework for developing theory from case studies. This article was written as a guideline to help standardize qualitative research through an eight step process, which is further discussed in a subsequent section. The article also used Gersick’s 1988 article on time and transition within teams, as an exemplar of inductive research. Eisenhardt’s article is one of the key articles in my literature review, and it contributed to my early design concepts related to both methodology and hypothesis content on nonlinear performance. The second exemplar article used as a guideline was written by my committee member, Dr. Ruth Wageman. Wageman (2001a) published “How Leaders
Foster Self-Managing Team Effectiveness: Design Choices Versus Hands-on Experience” in Organizational Science; in it she investigates team performance conditions. This article describes a multimethod case-study using individual interviews as a primary source of data. Wageman performed “the first field direct test of Hackman’s (1986) model of work team effectiveness,” and sought to “provide confirmation for the model” (p. 560). These two exemplar articles will be further unpacked in the next section of this paper.

Theories of inquiry
The design of my interview questions outlined in Appendix B incorporate several theories of inquiry. Grounded Theory provides the fundamental approach for my research, where interview questions emerge from an initial hypothesis, then iteratively evolve throughout the process, based on learning from the previous interviews (Glaser & Strauss, 1967). The data structure will include first order concepts and second order themes, derived from my initial coding of words and phrases. My initial coding will collect both vivo coding (which is exact-word coding) and common concept coding associated with similar wording associated with a common meaning. The specific intent of this initial coding was to search for actions, tacit assumptions, and meaning within the field notes. During the interview process and at the end of each set of interview, I will create memos of emergent themes, based on Chapter 7 of Constructing Grounded Theory (Charmaz, 2014). These memos will answer such questions as what is going on in these engineering teams as
they perform and what are the members doing, saying, or not saying that might influence performance? The grounded theory approach looks for process; therefore questions related to routines will be explored: what usually happens here, how does members learn these routines, how does the participants act or feel while involved, and what are the consequences of these processes?

Appreciative Inquiry (AI) is a positive framework for searching for underlying assumptions and beliefs discovered through story telling (Cooperrider, 2002). The theory of AI is in direct contrast to the more traditional method of problem solving, where solutions usually concentrate on eliminating the negative while restricted by the boundaries of anticipated limitations. These boundaries and limitations are usually socially constructed norms or an organizational bias, originally created to provide structure. Cooperrider and Srivastva (1987) articulate the need for a new framework of inquiry, which drives action as follows:

We need a bold shift in attention whereby theoretical accounts are no longer judged in terms of their predictive capacity, but instead are judged in terms of their generative capacity—their ability to foster dialogue about that which is taken for granted and their capacity for generating fresh alternatives for social action. Instead of asking, "Does this theory correspond with the observable facts?" the emphasis for evaluating good theory becomes, "To what extent does this theory present provocative new possibilities for social action, and to what extent does it stimulate normative dialogue about how we can and should organize ourselves?" (p. 135)
AI provides a new vocabulary using positive affirmation to leverage the strength of the organization and promote future growth. The inquiry process starts by asking for stories associated with success, to bring forth the organization’s strengths. The inquiry then asked for the ideal conditions, to stimulate creativity, and then combines the organizational strengths as a foundation, with these new creative ideas, to project images for future possibilities. This process is defined step-by-step in *The Appreciative Inquiry Summit: A Practitioner’s Guide for Leading Large-Group Change* (Ludema, Whitney, Mohr, & Griffin, 2003). In summary, problem solving focuses on the negative attributes of the organization, where redirecting focus toward positive images will directly affect the future results, much like in the placebo effect (Cooperrider, 1990, p. 5). My analogy for focusing on the expansive nature of positive imagery is the filling of an empty balloon with air, therefore creating growth and eliminating the void.

The goal of generative theory is to create new and innovative possibilities and focus on generative capacities, rather than to be predictive and traditional (Gergen, 1978). Generative theory naturally aligns with the use of appreciative inquiry exploring what is possible, where grounded theory seeks to explain why. An important perspective of generative theory is to contradict the organizational assumptions that may have emerged during an earlier stage of development and currently limit future possibilities. Organizational assumptions are usually hidden from outsiders and often
known only subconsciously by insiders. Assumptions are discoverable through inquiry and captured by the exact words and unique metaphors used in the dialogue of the members on a daily basis. These words and expressions become the window through which an outside is able to discover the tacit meanings that can be held with deep conviction by the organization. Generative theory looks to uncover new constructs and generate new insights as catalysts for transformational action and change. This is the cognitive space where new possibilities are created and former norms and deeply rooted convictions can be broken. While grounded theory looks for common themes emerging during the coding process, generative theory gives voice to unique ideas filled with passion and emotion to enable innovation and transformation. Generative themes are like finding that oldest penny in a jar full of coins, where there may be only one, yet it has the highest value.

**Wageman and Eisenhardt Methods Application**

My research methodology is uniquely designed to address the hypothesis, while leveraging two exemplar articles as methodological resources. I consider these articles to be rigorous and highly credible, based on the high rate of reference and citation by other scholars, as well as on my own research. The first is Dr. Ruth Wageman’s case study “How Leaders Foster Self-Managing Team Effectiveness: Design Choices Verses Hands-on Experience” in *Organizational Science* (Wageman, 2001a) and second is Dr. Kathleen Eisenhardt’s paper “Building Theories from Case Study Research,” in *Academy of Management Review* (Eisenhardt, 1989).
My original interview design was developed as a qualitative case study, comparing sets of interviews, prior to reading Wageman’s 2001 article and her face-to-face consultation. This article researched the conditions of team effectiveness within Xerox Corporation using qualitative interviews, grouped by team. Wageman discussed her design approach and provided me with a copy of her interview questions. Her interview questions were in strong alignment with my theories of inquiry and they included the critical elements of being open-ended and appreciative, searching for action, looking for tacit assumptions, and underlying the meaning discovered through storytelling responses. This research was clearly similar to my research intent regarding both the methodological approach and the subject matter and content, and this article and interview questions were influential in my final design, while setting a high bar for empirically findings and accuracy. The most significant content-based finding from Wageman’s 2001 research was that higher team performance is “principally due to: clear direction, task interdependence, and group rewards, respectively” (p. 568). This 2001 article research was the first published testing of the five conditions of team effectiveness (Hackman, 1987, 1990, 2002). The instrument used in this 2001 article is also the earliest version of the Team Diagnostic Survey (TDS), published as final four years later by Wageman, Hackman, and Lehman (2005). Review of the TDS and the original publications by Hackman, establishing these five conditions, was important to ensure that the original definition
and my full understanding of these conditions were integrated into my research. The design of my interview took into account the dimensions known to affect engineering team performance and to be applicable across various team types and settings.

Wageman et al. (2005) noted:

Instruments intended for use in helping teams perform better must focus on variables that are known to effect performance, can be manipulated, and are applicable across a variety of team types and settings so that norms can be developed for use in interpreting a team’s score. Numerous instruments exist that meet either one or the other of these aspirations. Typically, these instruments ask members to assess their teams on those dimensions that their developers assume to be most consequential for performance and most amenable to improve through consequential interventions outside the context in which they are developed. (p. 374)

My research design will triangulate three independent sources to help ensure that my hypothesis is directed at factors which affect engineering performance, yet are applicable in various contextual situations. The first source to validate effectiveness comes from the finding that team performance was principally due to a clear direction, task interdependence, and group rewards (Wageman, 2001, p. 568). The second source of effectiveness came from a former engineering executive with practitioner experience as noted in the Appendix B table. The third source to ensure application in various settings came by comparing my interview questions to the TDS instrument questions, which were tested with a wide range of organizational settings for use in “any type of team that operates in an organizational context” (Wageman et al., 2005).
Table 6 contains the five conditions selected for this study and creation of the hypothesis statements. The first column includes the findings from Wageman’s 2001 study. The second and third columns include my ranking and a second expert practitioner’s ranking. All rankings use a scale with 1 equal to the lowest impact and 12 equal to the highest impact. The third column notes if the condition will be a test condition in this study. Note that each of the selected items was ranked highly by two of the three inputs and that my original ranking of 1.2 received a lower priority when defined as member interdependence. During a discussion with by practitioner friend regarding our rankings and specifically condition 1.2, it became clear that his definition was based on work interdependence, which aligned with the number two ranking of task interdependence from the Xerox study. The work task was added to condition 1.2 and included as a test condition. Therefore this validation exercise added an important test factor and helped ensure accurate definitions of each condition. Appendix B includes a more detailed explanation of the narrowing of conditions and a full list of all five of Hackman’s (1987, 1990, 2002) conditions separated into 12 subconditions and their rankings.
Table 6. Test Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Wageman (2001a)</th>
<th>My Rank</th>
<th>Other Rank</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Clear boundaries of members and non-members.</td>
<td>Required</td>
<td>3</td>
<td>9</td>
<td>Yes</td>
</tr>
<tr>
<td>1.2 Member “tasks” are interdependent for a common purpose.</td>
<td></td>
<td>2</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Stability of membership sufficient for learning to work together.</td>
<td>NA</td>
<td>2</td>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td>3.2 Team composition; small group with sufficient collective skills to achieve their purpose.</td>
<td>7/9</td>
<td>4</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>4.1 Team based rewards for collective achievement, while not in conflict or competition with individual development and recognition.</td>
<td>3</td>
<td>1</td>
<td>11</td>
<td>Yes</td>
</tr>
<tr>
<td>Group norms associated with psychological safety and accountability. Enabling constructive conflict, learning, and innovation.</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Sources: Hackman, 1987; Wageman, 2001a

The last condition to be the tested for, shown in Table 6, is group norms, which establish Just Culture. I believe that this higher order and complex condition incorporates and expands on many of Hackman’s conditions as a more complex condition associated with high levels of effectiveness. A Just Culture, built on psychological safety and accountability, is the foundation firms need to enable continuous learning, adaptability, and sustainable high performance, through two interdependent elements of psychological safety and accountability (Edmondson,
Accountability of team members has been determined to be a good test for a unified team purpose and approach (Katzenbach & Smith, 2015, p.57), such that a lack of accountability suggests realignment of team purpose and approach. Psychological safety enables teams to explore successes and failure, such that considerable collective learning can occur (Hackman, 2002, p.103) and learning allows adaptability to external conditions. Research on psychological safety reveals seven specific benefits: it encourages employees to speaking up, supports constructive conflict, creates cognitive space enabling clarity of thought, promotes innovation while mitigating failures, moderates the relationship between goals and performance, and increases employee accountability (Edmondson, 2012, pp. 144–145).

The Eisenhardt process defines eight key steps for building theories from case studies (Eisenhardt, 1989, p. 533), which will be unpacked in this section and integrated into my research methodology. The first step in Eisenhardt’s qualitative research process is to develop a focused question with a broad topic, therefore allowing the initial data collection to influence final question, as evident in grounded theory studies (Glaser & Strauss, 1967). My research statement and questions per step one are listed in the introduction section of this paper.
The second step in the process is to select cases based on research interest, rather than random selection. The goal is to obtain accurate statistical evidence on the distributions of variables within a limited population. The cases to be selected for my research will be project teams from high-performance engineering firms as determined by an industry recognized organization. The high-performance firms will be matched with median performing firms of similar demographics and the final selection of four to eight firms will be codetermined by the organization and me. (Refer to the previous section regarding the specific sampling process and means of data collection.)

The third step will be to craft instruments and protocols for data collection. This will be accomplished through a triangulation of rigorously proven methodology, following the examples of past research, and comparison to expert practitioner cross-checking as previously discussed and summarized in Table 6.

The fourth step in the Eisenhardt process is performing a qualitative analysis of the data collected in an iterative manner, allowing further refinement of the research question and narrowing of the research focus. The fifth step is to analyze the data within each case study while looking for in-group similarities and intergroup differences. This iterative process in steps four and five will be achieved within my research through detailed write-ups of each interview and continuous qualitative
coding analysis as discussed in a previous section, “Theories of inquiry.” Parallel analysis will be conducting searching for internal firm and cross-case patterns, as defined by the grounded theory. Unique ideas associated with generative theory will also be collected as data.

My data collection, data analysis, and coding will overlap as recommended by multiple sources (Glaser & Strauss, 1967; Charmaz, 2014). In the sixth step, relationships between variables will emerge from the data and be continually compared with theory to start to reshape the hypothesis statements. The seventh step in the process is to enfold literature into the conversation for both agreement and contradiction. Special attention will be paid to literature in conflict with my findings, because it is not through agreement, but disagreement that the opportunity to learn is present.

The eighth and final step in the process is reach closure, which will be obtained through the presentation and testing of my findings to my advisors and industry experts as indicated in my process flow chart in a later section. Appendix B also includes a check list to assist in maintaining compliance with the Eisenhardt (1989) method.
The reliability and validity of the data and research design will be achieved by rigorously following the theory guidelines of grounded, generative, and appreciative theories, along with, applying the methods used in the Wageman (2001a) and Eisenhardt (1989) processes and triangulation discussed through this section. The intended outcome of this study is to discover emerging theories in an engineering context and to strengthen my existing practitioner-based model for building, achieving, and maintaining high performance teams.

**Research Participants: COE History and Selection Process**

A significant determinant in the selection of my research topic was to find a current industry issue where my research could provide practical application. The industry where I have the most knowledge is in consulting services, with an emphasis in engineering design and construction, so I searched for organizations who have access to engineering firm performance.

There are three nationally recognized industry organizations that annually evaluate the performance of engineering firms: PSMJ, ACEC, and Zweig White Group. I have personal experience with each of these organizations over the past decade as an engineering leader, so I contacted each organization to discussed current industry issues and practical needs, as noted in step 4B and 5B of my flow chart (Figure 9). I then investigated each organization’s process in detail as to how they evaluate and select high-performance firms for the purpose of this study.
This evaluation of each organization's processes, along with discussions regarding practical need, led to the selection of PSMJ as the targeted source for the selection of engineering firms. David Burstein, PE, PSMJ’s Director of Client Services, indicated a high interest in conducting qualitative and intrafirm research, after their 40 years of conducting mostly qualitative research. At the December 2014 PSMJ Summit, David gave me preliminary agreement that PSMJ would participate in my research and requested Kate Allen, PE, PSMJ’s Director of Research, to assist me in the process.

The following description is PSMJ’s brief summary of the key metrics that they associate with performance and the COE, select process:

PSMJ’s Circle of Excellence (COE) honor is annually awarded to engineering firms that demonstrate outstanding achievements in profitability, cash flow management, productivity, business development, staff growth and turnover. In other words, the firms that set the bar as a result of top-notch business practices! (http://www.psmj.com/surveys-research/circle-of-excellence.cfm).

PSMJ has been publishing and consulting to the Architecture, Engineering, and Construction (AEC) Industry for over 40 years. Each year PSMJ surveys hundreds of AEC firms collecting mostly qualitative data through extensive online surveys and then awarding a COE designation to the top firms. The surveys are evaluated using 13 quantitative performance metrics to define high performance. These metrics are then grouped into the following seven areas: profit, overhead, cash flow, productivity, business development, staff growth, and turnover. All data collected is quantitative and primarily financially based. The two metrics of staff growth and staff turnover,
possibly a third measure of productivity, are the metrics that may provide insight into the conditions of team effectiveness researched in this study.

The proposed demographics I plan to use as dependent variables will be firm size, geographic region, similar client and industry services, and other empirical factors determined during the review of previously collected quantitative data. Table 7 includes the independent and dependent variables used for selection of firms. The five firm conditions in the first line are my criteria for selecting firms. The second line includes PSMJ’s seven metric groupings and the third line has the four dependent variables used to creating firm pairings.

Table 7. Firm Selection Variables

<table>
<thead>
<tr>
<th>Firm Conditions</th>
<th>Independent Variables</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSMJ Participant</td>
<td>Overhead</td>
<td>Firm size</td>
</tr>
<tr>
<td>Stable</td>
<td>Cash flow</td>
<td>Client type</td>
</tr>
<tr>
<td>Repeat COE or median</td>
<td>Productivity</td>
<td>Industry served</td>
</tr>
<tr>
<td>No change in structure</td>
<td>Business development</td>
<td>Geographic region</td>
</tr>
<tr>
<td>Firm pairs</td>
<td>Staff growth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staff turn-over</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profit</td>
<td></td>
</tr>
</tbody>
</table>
My dissertation research data will be collected through individual interviews of typically six members, across six to eight firms. The specific design of the research will be to select six to eight firms, with a criterion that a minimum of two and maximum of four firms were recent COE winners and preferably for many of the past three to five years. The same number of baseline firms will be selected for comparison. Baseline firms will have the same criteria of achieving stable and consistent performance while obtaining at least a median level of performance during resent past surveys.

The firm selection process started through multiple discussions between Kate Allen, PSMJ’s Director of research, and me, where Kate explained to me the detailed financial survey and COE selection process. I then explained the intended research goals and over several months co-created the criteria. The actual selection of COE and median firms was conducted by Kate and my dissertation chair, Dr. Gus Gustafson, as to keep which firms were median verses high-performance blind to me until after the interview and initial analysis was complete.

The firms were selected and I conducted interviews without researching their websites, and I requested the interviewees to not inform me about firm-level awards related to PSMJ. I did inform the leadership of each firm that I would learn about their COE level performance metrics after my qualitative coding and analysis was
complete, at which time I would provide confidential feedback to each firm. This feedback would include a summary of the collective findings within their firm, then a collective summary of all firms. This allowed me to provide value back to each firm for allowing me to interview their teams, while maintaining confidentiality at both the individual level, as well as the firm level.

Several documents were created to define and narrow my topic for question content, provide a framework for the inquiry, and prepare for the interviews. These documents are included in the following appendixes: Appendix C includes the draft introductory letter sent to potential firms and used after the initial phone request. Appendix D includes a draft letter provided to PSMJ, which assisted in the overview and explanation of the interview questions to obtain the firm’s leadership approval. Appendix E includes the Institutional Review Board (IRB) approved form “Informed Consent to Participate.” The IRB is a University required process to ensure that research does not harm interviewees nor disclose information which might negatively impact interviewees. The IRB form was signed by each participant prior to interviews. Appendix F contains the actual interview outline with setup notes, questions, and researcher notes.

**ROV Project**

The Return on Values (ROV) project was created and executed by the Center for Values-Driven Leadership (CVDL) at Benedictine University. I am a student in
Cohort 2 of the CVDL, a gathering place where top executives, entrepreneurs, and thought leaders come together to learn and innovate. Our mission is to develop bold, enlightened leaders who have a transformational impact on business society. The Small Giants Community provided the initial funding and ongoing support of the CVDL and ROV project. The Small Giants Community is made up of small business leaders all over the world who define success by more than just their financial bottom lines, but also by their contributions to their communities, a dedication to great customer service, and the creation and preservation of workplace cultures of excellence.

The ROV research question is: What is the relationship between culture, values and profit in small to mid-size businesses? Initial studies included interviews of member firms and individual case studies. A survey is currently being developed by several of the CVDL professors and two of my Cohort 2 colleges and will be sent to 50,000 privately held small and mid-sized businesses. My study has been created with a values-driven lens, in hopes that the outcome of this study will contribute to the ROV project and add to the CVDL’s longitudinal mission.
Methodological Flow Chart

Figure 9 provides a visualization of my journey in a flow chart diagram documenting the process starting from initial topic selection, which leads to my research approach, the selection of firms, interview instrument design, and plan for iterative analysis. This section is a chronological sequence taken from my research journals, where the detail content associated with each step, is explored elsewhere in this document.

Throughout this dissertation journey I have paid close attention to the source of information and ideas, then tried to reference and cite these sources beyond the standards of good scholarly practice as a token of appreciation for the many people who assisted along the way. My dissertation chair has been a great motivator through this process and has showed me ways to integrate academic rigor with practitioner application. Probably the best representation of this was the suggestion to present my methodological journey in a flow chart format, similar to his dissertation methods chapter titled “Like all method chapters, the intent is to create a ‘how-to’ manual for future researchers to follow like a recipe” (Gustafson, 2004). At the time of publication for final research proposal approval, the first eight steps have been completed and shown with a solid line, where the next seven steps are indicated as my future action plan by indication of dash lines.
Figure 9. Methodological Process
Identify topic of personal interest
The first step in defining my research methodology started with finding a topic that I am most passionate about. Realizing that I am more of a deductive thinker, I felt that the only way in which I would be comfortable selecting a topic was to review all topics studied and discussed over the previous 24 months of class work, as well as the topics of interest I came to the CVDL program with. I first reviewed the seven topics of original interest, and then created a list of “passion-driven,” intuitive goals. These topics and goals were summarized into four themes as follows: spirituality and human happiness, the harmonious success of the business and people, team and all the topics from dyadic relationships to nonlinear performance, and change, which included building, growing, and entrepreneurial expansion. (See Appendix A for a list of these topics, goals, and themes.) I then looked to the architectural and engineering industry for current topics and reviewed all three notebooks, where I had outlined hundreds of books and articles, as well as all class discussions. After review of the industry and class room materials and discussions, I reviewed my Qual#1 paper, which was an overview of leadership discourse in recent years. This paper was a synopsis of 25 journals from 2010 through 2013 and totaling over 5,000 articles and created a list of the eleven journals which most align with my interest. (See Appendix A for Qual#1’s mission statement.)

Conduct Qual#2 literature review
I then compared this broad-brush view of topics across the industry of personal interest to my more focused research of Qual#2. (See Appendix A for a list of
Literature Streams of Review from Qual#2). The initial research for this literature review seemed to hit several dead ends until I returned to the assigned readings on leading teams and team development. The specific articles would often provide content for this literature review, yet more important were the citations and referenced articles.

Approximately 200 sources of information were collected with 58 formal citations used and 64 citations and sources of literature review noted for future research. An interest point to make is that of the 58 citations, there was nearly an equal distribution of nine to ten references across each decade starting with the 1950s where the majority of the 64 references for future research are within the more recent years. Cornerstone type authors and key articles started to appear as citations in multiple articles, providing the confidence that I had discovered most of the key articles for sections this paper. The authors for the sections relating to defining, identity, and relationships in groups were Bion, Goffman (1959), and Smith & Berg (1987); the sections on development and modeling teams were: Bennis & Shepard (1956), Hackman (1987), and Tuckman (1965). My research in the areas of affect, POS, spirituality, and other inspirational have discovered: Cameron (2003) and McCraty (2010), while others appear as this research was completed.
Consult CVDL professors
I consulted my CVDL multiple times during this discernment process and will highlight a few key moments. I met with the founder and lead professor of the CVDL, Dr. James Ludema to discuss my topic selection several months prior to final dissertation chair section. Dr. Ludema discussed two approaches and the roadmap associated with each direction (personal communication, August, 2014). These early roadmaps were to either develop and instrument or create a theoretical model using existing instruments. The roadmap associated with the second option was hand sketched, yet looks quite similar to my final approach.

Another highlight of professor feedback came from Dr. Michael Manning, who is considered an industry expert in methodology and has worked at many universities. Dr. Manning informed me of a team assessment tool, which he had done a peer review. This tool was the TDS developed by Dr. Ruth Wageman (2005). Dr. Manning also informed me of Dr. Amy Edmondson’s research at Harvard University. The TDS instrument and connection to both Dr. Wageman and Dr. Edmondson, have been clearly foundational as a source for my research and appropriately noted throughout this paper. The third CVDL professor, Dr. James (Gus) Gustafson, has been most influential during my journey and spend many hours helping me find the true passion and paradox, which refined and defined my final topic selection. One of the helpful resources was the book: Surviving your dissertation: A comprehensive guide to content and process (Rudestrom & Newton, 1992).
Conduct refined literature review
Based on the advice of the CVDL professors, I expanded my literature research of additional books and articles on teaming. These books and articles included a biography of the late Dr. Hackman: *J. Richard Hackman (1940–2013)* (Wageman & Amabile, 2013); Team Diagnostic Survey: Development of an Instrument (Wageman, Hackman, & Lehman, 2005); Interdependence and Group Effectiveness (Wageman, 1995); How Leaders Foster Self-managing Team effectiveness: Design Choices verses Hands-on Coaching (Wageman, 2001a); and *Teaming: How Organizations Learn, Innovate, and Compete in the Knowledge Economy* (Edmondson, 2012).

During this time of additional research I meet with Dr. Peter Northouse, who was a guest professor in the CVDL program. He reminded me of the research on groups completed by Frank LaFasto and Carl Larson in their book: *When Teams Work Best* (LaFasto & Larson, 2001). I also discovered several HBR articles and the reprinting of *The Wisdom of Teams: Creating the High-Performance Organization* (Katzenbach & Smith, 1993, 2006, 2015).

Select expert advisors
My refined literature review was heavily influenced by Hackman’s original work and Harvard University where he was a professor the last 17 years of his career. While there were literally dozens of authors across hundreds of articles on team dynamics, there were two authors who stood out from the others, such that Gus and I know would be a world-class committee: Dr. Amy C. Edmondson and Dr. Ruth Wageman, whose work is mentioned often throughout this dissertation. Edmondson is
considered one of today’s highest ranking thought leaders on teams and in the field of business and management, would be advising as an industry subject matter expert. Wageman created the TDS assessment instrument, while conducting both academic case studies and private consulting studies, through the Hay group, therefore would be an expert methods advisor also with subject matter expertise.

**Make Harvard trip with Gus**
The trip to Boston and meeting with Dr. Wageman and Dr. Edmondson was an energizing and yet focusing event in this process—probably the most significant event of my dissertation journey, at least at the time of publication of Chapters 1, 2, and 3 as a formal dissertation proposal. A few of the important achievements are as follows: I must start with the intellectual atmosphere on the Harvard campus, which created an environment for Gus and me to have some of our most productive discussions. Meeting Ruth and Amy and listening to their past experiences was amazing, yet the highlight and most humbling moments occurred when both professors agreed to be members of my committee.

**Search industry practical issues and determine practical need**
I conducted many discussions with PSMJ, ACEC, Zweig White and other industry journals in search of the key practical issues and practical need. The issues discovered were related to the shifting economic trends within each industry, such as the decline of the oil and gas industry or the recovery of the residential market. The most pressing and urgent concern in the engineering community was the transition of their
firms to the next generation. Many of the engineering firm leaders were of the baby boomer era and looking to retire over the next decade or sooner. I attended several seminar discussions and spoke informally with many owners to better understand the situation, realizing that the firm where I was the general manager was experiencing a very similar situation. The big-picture issue contained two primary interdependent components: First, most of these firm leaders wanted to transfer the firm’s legacy to the next generation with hopes that their tradition would continue. Second, the number of engineers from the X and Y generations were significantly lower than the number of baby boomers working in the firm. Generations X and Y were born approximately the years of 1965 through 1985, and they are 30–50 years of age, leaving a gap behind the 50–70 year old baby boomers and making the number of candidates hard to find and in high demand. The hope for my research is that I help engineering firm leaders create stronger teams within their firms, providing higher efficiency and opening the opportunity for shared leadership.

**Rank conditions per practitioners**
The 12 subconditions of effective teams, listed in Appendix B, were ranked from highest to lowest concern on a scale of 10 to 1, as related to the specific engineering design services industry. I created the first ranking based on my 30 years of experience, and then asked a peer engineering executive with over 30 years of experience at firms other than mine to provide me his ranking. I compared both rankings to Wageman’s (2001a) findings for conditions of highest influence.
Triangulating these independent sources helped to ensure the integrity of the condition selection, as explained in the methods section. Refer to appendix B for a detailed ranking discussion, along with additional discourse on my hypothesis refinement process.

**Refine hypothesis and interview questions**
One of the most significant recommendations that came from my committee during the trip to Harvard was to narrow my research focus. Therefore I started to redefine my research methodology by stating the fundamental theories framing my qualitative study. The three theories are grounded theory (Glaser & Strauss, 1967), appreciative inquiry (Cooperrider, 2002), and generative theory (Gergen, 1978). The methodology would follow the Eisenhardt method as explained in the following section. The interview questions were based on the five conditions of effective teams (Hackman, 2002) as well as the TDS (Wageman et al., 2005). These five conditions are listed in Appendix B as 12 subconditions, which were ranked from highest to lowest regarding their influence and impact. Refer to Appendix B for additional hypothesis refinement details.

**Blind selection of interview firms**
The data collection process will be a case study comparison of three COE (great) firms with three median (good) firms. The types of firms will have similar demographics to reduce contextual impact, such as type of engineering firm, primary customer type and industries, type of services, and multiple or single office locations.
The ideal intent is to select firm pairings of very high similarity, allowing less similarity across pairs. The good verses great firms will be selected by PSMJ’s lead research director Kate Allen with advisory assistance from my dissertation chair, Dr. Gustafson. I have provided criteria for the firm selection process, yet will not directly participate to keep the selection blind. I will not be informed if a firm has a COE or median status until after initial coding is complete. Table 6 in a previous section summarizes the firm selection criteria.

**Expanded literature review**
The process of selecting firms and scheduling interviews was originally planned to take four months. The actual process took eight months for several reasons. Several firms were not able to participate for various reasons, not always disclosed. The first firm interviews took over a month to schedule. The first and second interviews were completed before the Thanksgiving, Christmas, and New Year holidays, but it was difficult to schedule interviews during the holiday season, so I shifted my efforts to conducting research on current articles. Articles from the 2010–2014 had predicted an increased focus on teams, teaming, collectivism, and viewing teams as subsystems within organizations, which I discovered to be accurate. This dissertation is filled with many articles from the 2015 and even 2016 time frame. These current findings provided confidence to my proposition suggesting a shift toward teaming, as it has started to materialize.
Conduct interviews
The interviews were conducted over a five-month timeframe from October 2015 through February 2016. The original plan was to meet with six individuals from six to eight firms, with a total of 36 to 48 interviews with engineers. This plan was achieved by interviewing over 40 engineers at five firms. The interview design includes a wide level range: one principal, two project managers/team leaders with a minimum of four years with the firm, one to two midlevel engineers with four to eight years at firm, and one to two younger engineers with one to three years with the firm. The interviews were recorded by an audio device and an audio-visual device, to ensure that audio data did not get lost with the failure of a single device and to provide video to review animated expressions and body language. The design decision to record video turned out to be important, mostly to revisit the body language, but also because in one interview the audio failed. Additional details of the interview process and findings are presented in Chapter 4. This information will remain confidential to only the research team as required by IRB.

Perform level 1 coding and analysis
My level 1 coding searched for actions, tacit assumptions, and meanings within the field notes. These vivo codes of common dialogue, assumptions, and meanings will create emergent themes captured in memos. These memos will answer such questions as: what is going on in these engineering teams as they perform, what are the members doing, saying, or not saying that might influence performance (Charmaz, 2014)? Level 1 coding will look for routines and process common within a team,
while looking for unique contradictions associated with new possibilities and generative ideas. Each interview was scheduled for 45–60 minutes with a 30 minute break between. During this break I would take additional notes based on the interview or other information gathered during my visit. The vast majority of the information collected came directly from interviews, while additional information was collected during office tours and informal interviews with office managers, HR directors, and similar firm employees. Specific information on each of these additional resources has been included in the Chapter 4, except for the names of these individuals along with the firm names. All names are coded to ensure confidentiality. The audio was converted into text and level 1 coding was completed shortly after each interview, by reading through the interviews twice. The first read was to underline key statements write comments; the second read was to develop hand writing comments for each of the interview statements

**Perform level 2/3 coding and analysis**
The level 2 coding was conducted by going back through each interview text for a third time and recording themes and quotable statements into a large spreadsheet. Coding was compared within a single firm first by separating the information into four categories by level and then my men and women. Common themes and differentiating themes were discovered within each firm. The same process was repeated across firms to find collective themes and also unique themes. The internal firm themes and cross-firm themes were then issued to Kate from PSMJ and Gus my
chair in preparation for comparison to the quantitative data. Sixty-five themes emerged through the iterative process and were grouped by similarity, as shown in Appendix G. For example, there were many statements that were related to team member interdependence such as “worked for each other,” which indicated interdependence.

**Discuss initial findings with advisors**
Upon completion of level 3 coding and development of 65 themes, I flew to Denver and met with Kate Allen, PE, and Dr. Gustafson to present these themes and to hear which firms were in the circle of excellence. As we discussed the data and specific interview quotes, there were a few key perspectives that became apparent. The first perspective is that several of the initial groupings related to character behaviors and other groupings related to contextual conditions. This perspective assisted in realigning the initial 65 themes groupings into nine major themes, as presented in Chapter 4. The second perspective is that many of the quotations from interviews linked major themes together into a model with findings similar to existing individual constructs, leading to the model comparisons in Chapter 5.

A team-centric model emerges upon comparison to quantitative data
Knowing which firms were COE firms and which firms were “good” firms allowed further analysis of the 65 themes, even if they were not fully present in all five groups. Several of the themes were found only at one or two of the groups and other
themes were present within a team-level context, while not across the firm. The themes found with the most consistencies across all groups suggested that the theme was an antecedent to other themes and near the foundation of a model. The themes found only within COE firms suggested correlation with a higher level of performance. Therefore the nine major themes could be ranked by comparing the themes and where they were most evident. Independent from this ranking of themes, the data provided critical linkages. For example, caring and trust were found across the five groups, yet caring was present at both a team and firm level context. Trust was consistently found within all groups at the team level, while having a stronger presence in the COE firms at the firm-wide level of analysis. This finding suggested that caring was more foundational and lower on the model than trust. Ranking trust after caring was independently confirmed upon finding many quotes in the data where interviewees stated that caring and communication lead to trust.

**Operational differences in COE firms**

The initial investigation and data research concentrated on the culture of the firms by considering behavior norms and environmental context. The behavioral and contextual findings became themes as previously discussed above. A second analysis was then conducted on the data to determine if there were operational differences between the Good firms and COE firms. Six themes, presented in Chapter 4, emerged from the data as possible factors that differentiate these top firms. While a strong correlation of these six findings to the three COE-firm groups provides a high level of
confidence, the small sample size of only five groups among an estimated 1,500 firms, produces the obvious question of what other operational differences might be found in a larger sample size.

**Present, test, and refine**
The team-centric model and the operational findings were discussed with my committee members, including a second trip to Boston to meet face to face with Dr. Edmondson and Dr. Wageman. Additionally I created a brief write-up for both the team-centric model and the operational findings, which made it easier to obtain feedback from industry experts and practitioner consultants, including Patrick Lencioni (2002) for comment based on his five dysfunctions model; David Burstein, PE, from PSMJ; Jay Rudberg, PE, who provided conditions ranking as previously noted; a full-time leadership consultant within the STEM industry; and our CVDL professor leading the ROV project. As a small token of my appreciation, the team-centric model and operational findings were sent to the five participating firms along with a unique cover letter. The cover letter included specific findings for each firm, some of which are noted in Chapter 4 as part of the internal discoveries, and other findings that must remain confidential to these firms.

**Finalize team-centric model and publish**
The nine major themes and six operation finding titles remained constant through the present, test, and refine process, except for minor editing. The comments from each of these advisors provided rich discussion that resulted in expansion and clarification
of both the model and also operational findings. The final model and findings were then presented at my oral defense.
Chapter 4: Team Research Results

Overview Results: Major Themes and Operational Differences

This chapter will present my qualitative research findings of the five groups along with PSMJ’s quantitative data which defines Circle of Excellence (COE) performance. This chapter will be presented in five sections and in the reverse order of discovery to enhance readability. This first section starts with a summary of the results presented as two distinct sets of findings. The first set of findings presented emerged as a collective finding among these five groups as major themes for achievement above the median. The second set of findings presented is the operational factors which differentiate COE firms from Median and Good firms. The second Chapter 4 section will include PSMJ’s quantitative data showing a significant performance difference between the COE firms and Median-firms. This section will further unpack the operational findings list at the beginning of the chapter. The third section will unpack the nine major themes which emerged from the data as 65 separate themes. The nine themes appear to be sequentially related and are list in the order where linkages were evident. These nine themes suggest a team-centric model which is beyond the scope of this dissertation, yet intended for future publications.

The fourth sections will present a description of the firms and interviewees in comparison to my methodology design, and then present the findings for each firm as individual case studies. The firm descriptions include their designation as a COE-firm or Good firm along with demographics such as: geographic state the firm was located,
confirm of their core business as engineering services, and approximate firm size. The interviewee descriptions provide a breakout by rank and position within the firm, as well as their gender to ensure diversity. The names of the firms, the names of the interviewees, and the specific location of business have not been included to maintain confidentiality commitments. A list of the industry experts interviewed has also been provided. The fifth and also the longest section of this chapter presents the in-case analysis of each firm using grounded theory and generative theory as suggested by step four and five of the Eisenhardt process as discussed in Chapter 3. An important preamble to presenting my results is to recall that the framework of grounded theory and generative theory is to search for actions. Actions disclosed through interviewee stories, become a window for an outsider to understand tacit knowledge, underlying assumptions, and hidden meaning within a firm’s culture which are not directly accessible. This section includes what I believe are the most important quotes and discoveries. Many of these quotes are inspiring and make the hundreds of hours of research worth the effort.

**Major themes discovered**
The results of the coding process created 65 themes and listed in Appendix G. These themes formed into the following nine major themes where linkages between the themes were discovered. This list of major themes will be further discussed in the third section of this chapter.
2. Structure of small stable teams and external support

3. Team-centric performance goals

4. Care for mission and others leading to mental value formation

5. Trust and values alignment

6. Team member interdependence

7. Shared accountability

8. Conflict resolutions were constructively achieved through discourse.

9. Commit to continuous learning

10. Team-actualization and peak performance

**Operationalized factors that differentiate COE firms**

The second set of findings from this research is the themes which differentiate COE firms from other firms in the industry. While these themes have some overlap with the major themes list above, these themes are intended to focus on more operational aspects and possibly explain why COE firms perform significantly better than other firms in the market.

1. COE firms entrust their employees with financial performance information.

2. Technical leadership is symbiotic and equal in stature to business leadership.

3. Team-level accountability drives the process of joining and exiting members.

4. Conflict unites and energizes teams rather than bifurcating them.

5. Recognition emerged through team-actualization and peak performance.

6. They target the more complex end of their markets.
**COE Performance Difference**

**COE firms achieve higher performance**
COE firms achieve significantly better financial results than the statistically
determined median firm in the industry year after year. PSMJ’s 2015 Financial
Performance Survey (PSMJ, 2015) benchmarked 328 firms across 13 factors, where
the top 20% of firms were awarded a COE designation. These 13 factors are
quantitative metrics derived from PSMJ’s financial questionnaire. This list of
performance factors is also the second order quantitative data listed as independent
variables in Chapter 3, Table 7, which was compared with my first order qualitative
interview data. The complete list of COE-firm factors comparing COE firms and
Median-firms is provided in Appendix H with breakouts at the 10%, 50%, 75%, and
90% ranges.

A summary of the 2015 average COE-firm performance comparison to the industry
median firm is shown in Table 8. Note that COE firms achieve nearly double the
profit and three times the staff size growth as median firms. While the performance
metrics of profitability, staff growth, and equity per employee, (the top three
benchmarks in Table 8 are significant; the following operational metrics of
chargeability, direct labor multiplier, overhead rate, and A/R collections (the next
four benchmarks in Table 8, demonstrate relatively small differences between 8% and
13%. Net revenue per employee and net payroll multiplier are factors of both the
performance and operational factors and therefore indicate a slightly higher difference, as does the staff turn-over rate.

Table 8. PSMJ’s 2015 COE and Median Firm Results

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Median Firm</th>
<th>C.O.E. Firms</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profitability (EBBT) as a % of Net Rev</td>
<td>14.3%</td>
<td>28.4%</td>
<td>+ 98%</td>
</tr>
<tr>
<td>Staff Change</td>
<td>3.7%</td>
<td>11.8%</td>
<td>319%</td>
</tr>
<tr>
<td>Equity per Employee</td>
<td>$33,363</td>
<td>$46,219</td>
<td>+ 39%</td>
</tr>
<tr>
<td>Chargeability</td>
<td>58.8%</td>
<td>63.6%</td>
<td>+8.2%</td>
</tr>
<tr>
<td>Direct Labor Multiplier</td>
<td>3.09</td>
<td>3.38</td>
<td>+ 9.4%</td>
</tr>
<tr>
<td>Overhead Rate</td>
<td>160.7%</td>
<td>144.6%</td>
<td>- 10.0%</td>
</tr>
<tr>
<td>A/R collections</td>
<td>67</td>
<td>58</td>
<td>-13.4%</td>
</tr>
<tr>
<td>Net Revenues per Employee</td>
<td>$134,839</td>
<td>$156,003</td>
<td>+ 16%</td>
</tr>
<tr>
<td>Net payroll multiplier</td>
<td>1.80</td>
<td>2.14</td>
<td>+ 19%</td>
</tr>
<tr>
<td>Staff turnover rate</td>
<td>13.4%</td>
<td>10.2%</td>
<td>- 24%</td>
</tr>
</tbody>
</table>

Source: PSMJ (2015)

Firms are awarded the Circle of Excellence designation for a cumulative high achievement across all 13 factors; therefore it is mathematically possible for a firm to obtain low ratings in one or two areas and still reach COE status. The situation of most concern for this research would be where one of the participating firms achieved a low ranking in a critical factor which has an effect on my findings. I was not provided full detailed financial survey information on any of these firms due to confidentiality commitments made to each participant firm; therefore we needed a method to address my concern. The factors of most interested for my research are
related to staff growth and turnover, as well as productivity. Productivity is a measure of staff effectiveness and indicated in factors such as direct labor multiplier and net revenue per staff. PSMJ confirmed the following statements which nullified the previously stated issue.

1. The COE-firm participant’s total score was well within the top 20%.
2. The COE-firm participants were outstanding in all areas critical to this research: staff turnover, staff growth, and the productivity factors.
3. The Good-firm participants were actually in the top 1/3rd of all 328 firms.
4. The Good-firm participants exceeded Median-firm benchmarks in critical research areas: firm profitability, gross revenue growth, and productivity.

PSMJ has been conducting surveys for 35 years and using the thirteen metrics since 2006. They have found that while there are significant operational differences between poor performing firms and COE firms, which is also evident by the lower performances shown in Appendix G, the operational metric differences between Median or Good firms and COE firms are generally small. PSMJ analyzed non-performance information about these firms to determine that: size, geographic location, practice area, client type, nor market sector were significant, as shown in Table 9. The COE firms are slightly more operationally effective with marketing, accounting, and project management resources. As Burstein (2014) states each year in
his key-note speech, “COE firms do the same things as Median-firms do . . . they do it just a little better.”

Table 9. PSMJ COE Factors

<table>
<thead>
<tr>
<th>PSMJ Nonfactors</th>
<th>PSMJ Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm size is not a major factor</td>
<td>Marketing &amp; accounting were more effective</td>
</tr>
<tr>
<td>Geography was not a factor</td>
<td>Project Management was more effective</td>
</tr>
<tr>
<td>Practice area was not a factor</td>
<td>Spent less on overhead, except IT &amp; training</td>
</tr>
<tr>
<td>Client type was not a factor</td>
<td>Achieved nearly twice the profit!!!</td>
</tr>
<tr>
<td>Market sector was not a factor</td>
<td>Achieved over three times the staff growth!!!</td>
</tr>
</tbody>
</table>

*Source: PSMJ, 2015*

These nonfactors and small indicators from PSMJ’s 2015 Industry Summit Conference leave the question unanswered as to why COE firms significantly perform better. My research was therefore designed to use qualitative research methods to help discover the unique things that COE firms do different from median and even Good firms.

**COE-firm selection and research design**

Kate Allen PE, PSMJ’s Director of A/E/C Benchmark Surveys, selected both COE firms and firms designated as Good firms, based on my research design criteria variable from Chapter 3, Table 7. The interview research was conducted blind to reduce potential bias, such that the COE-firm designation was not disclosed to me until after the interview process and data analysis was completed. My research was designed to include both COE firms and Good firms as shown in Figure 10.
Selecting COE firms and Good firms enabled two sets of findings. The first set of findings would include the themes which are common to all five groups, yet were not typically common to the majority of firms in the market as based my thirty years of experience in the industry and the experience of my A/E Executive advisors listed in the next section.

![Diagram showing COE, Good, and Median Firms](image)

**Figure 10. COE, Good, and Median Firms**

Interview discovers common to all five groups and believed to also be present at median firms is condition #1 in Table 10. Discoveries found generally common to Good firms and COE firms and not common to Median-firms, are noted as condition #2 and listed as *Major Theme Finding #1*. The second search criterion was for potential differentiators between Good firms and COE firms as noted as conditions #3 and #4 and listed as COE Theme Finding #2 in Table 10.
Table 10. Simplified Theme Criteria

<table>
<thead>
<tr>
<th>Condition</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
</tr>
</thead>
<tbody>
<tr>
<td>COE-firm finding</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Partial</td>
</tr>
<tr>
<td>Good-firm finding</td>
<td>Yes</td>
<td>Yes</td>
<td>Part/No</td>
<td>No</td>
</tr>
<tr>
<td>Median firm finding</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Potential findings</td>
<td>None</td>
<td>Major themes</td>
<td>COE theme</td>
<td>COE theme</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finding #1</td>
<td>Finding #2</td>
<td>Finding #2</td>
</tr>
</tbody>
</table>

There were some discoveries which were observed at some interviews, yet not consistent at all interviews within the firm, or observed as a team-construct, yet not present at the firm-level of analysis. These discovered were coded as partially observed as shown in Table 10. Appendix G contains the full coding of all 65 themes where 31 of the 65 themes were discovered in all firms. The designation of a partial discovery has been coded as three possibilities: discovery at a team-level construct, a department level construct, or observed with some team members while not all members. Groups 1, 2, and 4 were COE firms, where 59, 62, and 61 themes were fully observed, as compared to groups 3 and 5, where 43 and 31 themes were fully observed. Additional coding analysis of the partial observances was conducted and evident in Appendix G, yet not elaborated on further in this dissertation.

This coding process resulted in nine major themes and six operational themes which differentiate these top firms. The number of interviews within each firm provides sufficient data to draw high scholarly confidence at the firm level of analysis, yet the
small sample of firms only supports the creating of a theory. Therefore, while data indicated strong correlations to support these six operational differences for this case study, a much larger sample of firms would be required to ensure a high level of scholarly rigger and confidence.

**COE-firm operationalized factors unpacked**

The following six operational findings are listed independently with a probable order of execution as listed. The intent of these six operational findings is to better understand why COE firms perform significantly better than median firm, yet not intended to be a simple list of action items. Successful execution of these operational differences will often require consideration of the sequential themes presented in the nine major themes which were found to be linked.

1. **COE firms entrust their employees with financial performance information**
   Employees are taught the key metrics of financial performance, such as productive hours, which includes a measurable value for each hour, rather than utilization, which is only a measure of hours. COE-firm employees know how their responsibilities contribute to the team’s project success and also the firm’s financial success. I found this even be true with newer employees and yet quite different from how most firms operate. These firms communicate the status of key performance metrics weekly. This enables every employee of the firm to contribute toward financial success. The employees with a more technical role told me that while they don’t spend much time reviewing the reports more than necessary, the fact that they are provided the
information on a regular basis greatly added to their level of trust from two perspectives. First perspective shared with me was the sense of open communication with nothing to hide. The second perspective of trust came through the confidence of knowing that others were actively focused on business matters, so they could focus on the technical matters.

2. Technical leadership is symbiotic and equal in stature to business leadership COE firms have senior technical leaders dedicated to technical excellence, training, and innovation with a similar level of authority as their business focused peers. A few stories were told where senior business leaders transitioned into a technical role to mentor younger staff and fulfill their own passion for design. These technical leaders are well known and respected within the firm, and usually to the external market place as well. They drive process improvements with tight controls for routine work efforts and more open guidelines for the more complex design efforts. They are critical to the firm’s commitment to continuous learning through their humility of openly sharing their own past mistakes and encourage open dialogue. COE-firm technical and business leaders share an acceptance of individual mistakes, yet they paradoxically hold their teams to high performance metrics. These technical leaders establish strong technical networks which connect employees across departments and offices. These technical cross-firm networks are orthogonal to the business lines of communication and connect project teams as loosely coupled subsystems of the larger organization. These networks provide project team support by means of project
management tools and other business systems, as well as by means of technical advisory and production support. COE firms realize the simplicity of small teams enables better client focus and more dynamic responsiveness, while knowing that support is readily available through these support networks.

3. Team-level accountability drives the process of joining and exiting of members COE firms value individual skill sets through the lens of team contribution. They come to realize that a person’s ability to collaborate and work well with others, contributes to a collective knowledge and skill base, which is more essential than any one individual. This collective mind set is why COE firms truly hire for cultural fit and values, as was evident through stories where candidates with higher collaborative skills were hired rather than another candidates with higher individual skills and experience. The most interesting discover on hiring was that these stores were told to me as a simple matter of practice by more senior employees, while the younger employees would get excited as they told their stories as if maybe it was hard to believe.

Valuing the collective knowledge and unique member skills enables interdependence among the team members. Stories emerged where interdependence of work tasks was evident due to unique member skill sets, as well as social and behavioral norm interdependence, which resulted in shared accountability. Shared accountability was most often revealed as peer pressure and evident in how members would help each
other and also how they would exit the team. Stories from all five groups were told where struggling employees received training, were moved to new teams to better align their skills, yet the employees who could not adapt to the collaborative culture or who demonstrated self-serving acts, felt sufficient peer pressure to resign. Three of the groups specifically made the point that more people leave the firm due to lack of cultural fit than for technical ability; following with a statement that we can train for technical ability, not values and cultural fit. Two of these groups further reported that the majority of employees who left the firm had self-terminated their position early in their employment. Management and HR resources were able to focus more on development and growth when team mates held each other accountable. Therefore, while COE firms have a low employee turn-over, the critical difference is that culture fit is a primary reason employees leave and early self-termination is often how they leave.

4. Conflict unites and energizes teams rather than bifurcating them
Employees have reached a high level of trust and interdependence, such that conflict is no longer personal, but rather a means to continuous learning and higher performance. My inquiry into the area of conflict, mistakes, and failure were often met with silence and interviewees struggled to respond. These firms had created a psychological safe environment where each employee was given voice, such that conflict to these individuals was like water to fish. Conflict was part of everyday life as an engineer and dealt with constructively. They told me about work processes
which anticipated critical activities and potential mistakes, while speeding up both
execution and learning. The best example is where younger engineers reported
continuously working beyond their design comfort limits and looking forward to
regular design check-ins and coaching by more senior staff. These firms pride
themselves on solving complex client problems, while having an unquenchable
hunger for knowledge. At times they used the term collegial, which has two
meanings: one associated with a college or university, while also having the meaning
of power shared equally between colleagues. Knowledge gain, learning, and teaching
were uniquely part of the reward system at COE firms.

5. Recognition emerged through team-actualization and peak performance
The most inspiring discovery of the operational factors was that teams were highly
motivated by the achievement of their collective team, more than by status or
compensation. Somewhat unique to technical design teams is that many of the tasks
can only be completed by the expertise of certain team members, and no member on
the team is able to perform all tasks. An overlap of skills must be present to ensure all
tasks are covered for any group to be effective, yet these high-performing teams seem
to create higher levels of overlap and support. Employees reported that helping others
to achieve their peak potential is where they found self-actualization and personal
peak experiences. There were many stories where teams reached peak levels of
performance resulting in stronger team bonds associated with interdependence and
accountability. My research found that team peak performance was rare and usually
accompanied with hard work and self-sacrifice. Interviewees often noted that the level of hard work and sacrifice for peak performance was not sustainable, yet afterwards were able to maintain team-actualization along with a new higher level of normal team performance. Employees who told stories where self-actualization was evident, also reported being energized through a rich culture of positive reinforcement, which extended into their personal lives. Therefore another paradoxical finding emerged among these teams; even though they often worked long hours and reported times of self-sacrifice, they found better work-life balance. I found the team-actualization construct apparent within teams at all five groups, yet finding cross-team-actualization in a firm-wide construct was less common.

6. They target the more complex end of their markets
The PSMJ qualitative data from Table 9 indicates that neither the type of client, nor the market sector was a significant factor, because COE firms were found basically evenly distributed across all client types and sectors. What I did find at COE firms is that they evolved toward the higher end of their industry. As a result of their collegial culture of continuous learning, they attracted employees with the same passions. These firms also had specific programs to develop and look for new innovation, while including guidelines to ensure that these innovation programs had positive returns on the investment. All of these factors were included in stories pursuing the most complex projects in the market. The interview data provided clear indication that COE firms evolved toward more complex projects and away from commodity type
engagements with no specific comment regarding higher margins. A natural assumption can be made that these more complex projects are less competitive, have higher margins, and therefore may significantly contribute to COE-firm’s higher profit margins. Operating at the higher end of the market also caused these firms to more critically do self-benchmarking and be less focused on market-benchmarking, which is clearly understandable having performance above most competitors. An inspiring and yet somewhat surprising discovery was that these firms cheered for their competitors and viewed advancements by other firms as raising the market. They view the world not as a zero-sum game, but rather as opportunities where advancement is positive for their industry and society.

**Generative Themes of Good and COE Firms**
The next sections will present a more detailed description of the 65 themes discovered in the Good and COE firms, which I believe are unique and not common to most engineering firms across the market.

**Discoveries within Good and COE firms**
The five participating groups were all in the top third of all firms in the PSMJ survey and exceeded typical or median firms as previously discussed. Firms who benchmark performance against the market have been shown to improve performance, therefore an argument can be made that the PSMJ survey respondents represent a higher median than the actual median of the entire market of approximately 1,500 firms. My research approach was designed to focus on positive activities, which I believe are not
common to the majority of firms across the STEM industry. This approach found 65 themes which were aligned into nine major themes which are believed to not be common across the industry. The data suggests that the nine major themes are sequentially linked and therefore listed in an order supported by these interviews. The hope is that these major themes will evolve into a performance model. The structurally based verses behavioral based elements of these themes will need to be separated and further developed before a model can be proposed.

1. Small stable teams with external support
These firms understand the importance of small teams and limit most teams at between four to six members. Small teams can naturally build dyadic relationships, maintain good communication, and provide project focus for their clients. Technical and production support are available to these small core teams, yet team boundaries are maintained, therefore individuals who support the team do not become full members. When members continue to work together over time, this stability creates dependability and trust among the members, which then leads to collective knowledge gain and effectiveness.

- "If you get like ten people, you start getting side conversations . . . people stray off topic."
- “We went from really big teams to smaller teams to be a more manageable size and be able to handle the workload and get the interaction that you need to have with everybody.”
2. Team-centric performance goals
Individuals have written position descriptions and developmental goals which align
with team goals. The team members understand their role on the team, as well as how
their efforts contribute to the team performance. There are formal weekly
communications and gatherings which provide feedback on team metric status and
progress toward team goals. Team goals synergistically align into firm-wide goals
and a mission, which are similarly communicated to all team members at monthly or
quarterly rates. When the firm-wide mission is delineated into team goals and
individual roles, then the mission can become personally embraced.

• “Everyone working toward the same goal.”
• “Everybody is made to understand how we make money and our clients make
  money.”
• “Productivity report that goes out company-wide . . . to every individual every
  week.”

3. Care for mission and others leading to mental value formation
Members of these small stable teams were passionate about the firm’s mission and
clearly stated their role and purpose during the interviews. Passion and care for the
type of work extended to their team mates. Altruistic levels of care were most evident
between leadership and employees at the team, department, or regional level and in a
few cases at the firm level. This genuine care for mission and team mates lead to
interviewees thinking about what they valued and were reported to create mental
images associated with collectivism and value creation. Mutual care for others creates
an inclusive culture with a strong set of social norms and practices. Hiring norm examples include stories where individuals with a better cultural fit were selected over individuals with stronger technical skills. A culture seemed to form in the balance between two dialectic and paradoxical influences of caring for team mates and caring for the mission. Interviewees explained their care for the mission as a passion for the work and commitment to its importance. Stories were told where people’s safety and well-being were at stake and other stories of how their work enabled their client’s performance. Stories were also told of former employees who did not fit the collaborative culture of high achievement and felt enough peer pressure to resign. The opposing dialectic forces of interpersonal care, as shown in Figure 11. Dialectic caring forces, was operationalized through formal processes to align employee skill sets with team roles, move employees to other teams, and also to help struggling employees become effective within the firm. Interviewees stated that their culture either molds people or makes it obvious that there is not a fit and that sometimes coaching lead to helping people find their best fit outside the firm. Two important points here is that while effort was invested in training and coaching, very little time was spent on the traditional long and negative termination processes and more importantly, employees gained a strong sense of job-security and fairness, which further lead to their trust in management.
Comments included the following:

- “They more care about what their team thinks, so they don’t want to let one of their teammates down. . . . That’s the motivating factor.”
- “Principals ready do care for them as people.”
- “I’ve seen people adapt to the culture. . . . They did actually adapt the way they thought about . . . how you treat people . . . ’cause values driven culture.”
- “If you don’t honor our values and if you don’t believe in our mission, you don’t fit and that’s okay ’cause you fit somewhere.”

**Figure 11. Dialectic caring forces**
4. Trust and values alignment
Altruistic cares lead to a deep level of trust among team mates and also between employees and management in these firms, which was apparent through the common reference of employees in a family type metaphor. Trust among employees at all levels enabled employees to regularly give voice to ideas and concerns and higher levels of engagement. There were many stories where ideas from junior employees voiced ideas that resulted in new business services or improved process. In the few cases reported where concerns were voiced, a fair resolution seemed to be reached. When constructive action was taken for ideas and complaints, then this further encouraged employees to speak up and move toward higher levels of collective performance. Interviewees aligned caring with an internal or mental formation of values, where trust was aligned with open communications. These open communications enabled employees to discuss and align their values, which lead to a collective set of socially constructed values and norms of high-performance. The idea that caring generated internal value creation and trust generated collective value alignment, led to the consideration that care precedes and is linked to trust. Several stories directly attributed trust among teammates as the motivation for encouraging others to give their best performance and create higher performance expectations than forces external to the team could generate:

- “Communication leads to trust”
- “I would almost feel obligated. . . . It’s kind of important to speak your mind.”
• “Everybody was pulling together and there was a lot of trust amongst the team members.”

• "There's a high level of trust in who you’re working with. . . . They're not going to let you down, and you feel you can't let them down . . . family.”

• “Our mentors and our supervisors are still here working side by side with us and so you trust that . . . and you want that next person to trust you along that same way too.”

5. Team member interdependence
When small teams repeatedly work together, they care about the mission and each other’s well-being, and also build trusting relationships; then increased interdependence appeared among these teams. Technical design groups require a minimal level of task-interdependence because the wide range of knowledge across multiple disciplines makes it basically impossible for anyone person to be able to perform all project tasks. This minimal level of task-interdependence is typically determined before design teams are formed. Teams within each of these firms reached a high level of task-interdependence where individual members discussed more specific tasks which focused more on their own skill sets strengths, and then relied on others for tasks they were less skilled. Especially common within the COE firms was employees spoke about finding their niche or special skill sets which enhance the team’s performance.
Interviewees also reported behavioral interdependence evident by similar quotes across several firms where; “we had each other’s back.” Several interviews with firm leaders communicated to me their responsibility to help teams create synergies of interdependence beyond the initial project assignments. Task-interdependent examples included unique seating arrangements with lower furniture partitions between core team mates and shares resources ranging from admin help to technical tools. Behavioral-interdependent examples from leaders ranged from organizing team social activities to presenting mistakes the leader had made. Leader organized social events and helped to create environments that encouraged communication, knowing that their brightest technical staff often had introverted tendencies and had difficulty expressing and perceiving emotions, as discussed in Chapter 2 regarding alexithymia. Leaders also presented their past mistakes as learning opportunities to encourage similar behavior among the teams so they would learn from each other’s mistakes. The magical quality of interdependence is that teams can achieve non-linear performance beyond the traditional expectations. These team members displayed the same type of interdependence as the second-baseman and the short-stop playing baseball, where one player has the primary role and their team mate has a secondary backup role. A ball hit up the middle of the field becomes a shared responsibility, just as interdependent teams created a shared responsibility.

- “All of us only have a piece of the puzzle, and so . . . we need to pull in a lot of help.”
• “I think that’s a big part of my job is to make sure people feel close and connected.”

• “We need to make sure people are collaborative and respect each individual’s contribution.”

6. Shared accountability
These interdependent teams realized that a single member cannot know all the critical information (“all of us only have a piece of the puzzle”), which resulted in collective decision making and higher performance: “We've become more financially successful if we get buy-in.” These collective decisions led to shared accountability. Team leaders set examples of shared accountability when mistakes were discovered: “If it was a mistake that was maybe I didn’t tell them clearly enough.”

Interdependence enabled team members to dynamically anticipate the need for support and backup on critical tasks. Interviews with team members across all firms, spoke of team-level accountability being enforced, which took significant burden off management to force accountability from a less informed position. Shared accountability based on trust and interdependence, significantly reduces the need for inter and intra-team controls associated with traditional hierarchy, therefore further increasing: effectiveness of team members, efficiency of the team, and performance.

• “Integrity, accountability. . . . If you’re not accountable, those mistakes you found, if you don’t take accountability for those you’re not fitting the culture of
our whole team and those people stood out right away . . . very obvious that they did not fit our culture.”

• “That meant a lot to me. . . . I really needed to hear that they stuck to their guns on hiring and encouraged me to do the same as I moved into that role.”

• “It was our values . . . so I’d say those are just words on the wall but they’re not. I’ve noticed we follow those very well. I’ve been here (many years) and I would say those drive most of the decisions we make.”

• “We're a family, we've got each other's back. . . . We're accountable to each other. . . . It's very hard to explain, we're a team.”

7. Conflict resolutions were constructively achieved through discourse
Conflict among these teams became such a constructive and low anxiety event that employees it became part of the aura as this employee states; “Don't know how conflict is dealt with. . . . Weird now that you ask.” Asking making employees how they resolve conflict was like asking fish about water. When firms have a foundation of caring, trust, interdependence, and accountability, then they view conflict through a different lens. Caring and trust enables conflict to remain constructive, rather than becoming personal. Interdependence and shared accountability then become a uniting force as members realize collective benefit gain of knowledge and learning, rather the short term anxiety that naturally comes with conflict. My interview questions were open by design, which lead to responses regarding conflict, mistakes, and failure to follow three streams of thought. The first stream was related to technical conflicts,
where teams enthusiastically resolved conflict. One interviewee articulated technical conflicts well, suggesting that as engineers, solving problems is our business. The second stream of thought related to interpersonal conflict, which had been greatly diminished through caring and trust. Many employees could not recall the last interpersonal conflict, which as a response answered my question quite well. Conflict which resulted from mistakes was the third stream and consistently resulted in focus on context and process change, rather than blaming people. A mindset change became evident, where teams who used conflict to look toward context for knowledge gain and process improvement, evolved toward high levels of complexity. There were reports that external coaching was available and used in the rare conflict cases.

- “I would say most of the time conflict is handled to where at least everybody has a chance to voice their concerns about it.”
- “We have an employee assistance program . . . that was used for this conflict resolution.”

8. Commit to continuous learning
When mistakes are anticipated as part of everyday activity, then processes are developed to turn mistakes and failures into learning opportunities and knowledge gains. Many times there were quotes form interviewees stating; “I make mistakes all the time . . . never make the same mistake twice,” which provides a great explanation of continuous is learning. A critical aspect regarding high-performance team processes is that the processes were based on the complexity and uncertainty of the
work-flow. Routine processes evolved into rigid and tightly defined procedures which did not require checking to maintain high quality standards. The more complex design processes provided general guidelines, rather than procedures, and included multiple iterations of checking by experienced engineers. Innovative processes were the most free from restriction and bound mostly by time limits and the practice of quickly vetting many ideas such that only the most promising were taken forward.

- “Principals are always very understanding about mistakes. . . . Makes me think it’s a learning experience.”
- “I think there’s a huge culture of learning here. . . . It’s just the nature of the company.”
- “Take it as far as you can, challenge yourself a little bit ’cause it’s the fastest way to learn that we’ve had good experience with.”

9. Team-actualization and peak performance
Team-actualization and peak performance were discovered as a bit of a surprise and appeared together at a career highlight type event. This last theme was discovered during inquiry about recognition. They rarely mentioned individual reward or compensation in their response, while overwhelming responded with comments that associate with shared accomplishment, knowledge gain, and team-actualization. Employees had realized self-actualization in so far as reaching their own peak experiences, through their interdependence of helping their team mate’s achieve peak potential. This level of performance seemed to include all of the preceding steps
where they care and trust each other, where they are able to contribute their individual
strengths and rely interdependently on their teammates, all the while in a continuous
learning environment. No wonder they find their own peak potential! I found a
similar sense of shared accomplishment at all firms as a team-level construct and then
a more cross-team or firm-wide construct at the COE firms. During interviews, I
often went back to probing questions about compensation and bonuses, to discover
that bonus plans were heavily weighted on collective performance of the team and
firm, yet were not a primary motivating factor.

- “One factor of the success would be that everybody feels rewarded to having
  work on it, they’ve learned, they’ve grown, and their happy.”
- “There’s just a bunch of really intelligent people and I’ve just been really
  impressed with the knowledge base. . . . It’s pretty amazing.”
- “We’re working as a team and I guess I don't see a need for individual
  recognition.”

**Validation of Methodology and Data Collection**

This section will present the specifics associated with executing the methodology
plan from Chapter 3. The details regarding firm selection, demographic breakout of
the interviewees, diversity of interviewees, the data collection, and additional
information on the coding process.
Description of the selected firms
My dissertation design was discussed in the methods sections along with three
documents referred to here as reference. Appendix B includes the interview design
details and interview questions, Appendix C is the introduction letter sent to potential
firms, and Appendix D contained a more detailed letter which was sent to firms who
agreed to participate. There were a total of five locations that I traveled to over a five
month period. One location was in Canada and four in the U.S. as follows: Illinois,
North Dakota, South Dakota, and Texas. The general location is provided to show
that there was geographic diversity, yet the specific city will remain confidential.
Three of these firms were between 100 to 175 employees, where the other two
locations were independent offices of 60 to 75 employees and part of a firm over
1000 engineers. These two locations operated as generally independent profit centers,
served different clients, offered some key different technical skill sets, yet would
often partner together on projects, and shared the same corporate leadership. All of
the firms were members of PSMJ and in the construction industry, rather than product
design and manufacturing or other industries. The delivery of professional
engineering services was as a primary business and in most cases the firm’s only form
of income. All of these firms had contracts direct with the owner or end-user of the
services, as well as contracts through third party firms, such as architects, contractors
and owner-reps. A critical point for firm selection was that the professional services
were not subsidized by product sales, construction services, or other forms of revenue
which may change the context of the engineering design process.
Interviews and data collection
There were a total of 50 interviews conducted for this research, as well as various observations documented. 39 of the 50 interviews were conducted within the five participating groups and the other 11 interviews were industry experts. The data used for coding came from 35 formal interviews using the three-way redundancy of audio recording via an Olympus vn7600 device, audio-video recording via a GroPro Hero device and hand written notes. These interviews totaled to approximately 50 hours of audio and video recordings. The audio recordings were translated into 224,067 total words of text, which resulted in 442 pages of single spaced text. Placing this text into the APA-format such as this dissertation would result in over 800 pages of text from audio, therefore making it clear as to why qualitative research is usually limited to a smaller sample size. In addition to the audio, video, and converted text, I recorded 94 pages of hand written notes during the 35 interviews. These 475 pages of text and notes became the data for my first order coding. The breakout of these 35 interviews included 31 degreed engineers in the disciplines of: biological, civil, chemical, electrical, mechanical, and structural, with 22 of the 31 being professionally licensed. The other four interviews included three interviews with environmental scientists and one interview with a project manager of engineering teams with architectural by degree. In addition to the 35 formal interviews, there were four less formal, yet very informative interviews, with an office manager, two HR Directors, and one Managing Principal. Each of these interviews included an office tour and general discussion about the firm, along with general background on the individuals with who I would
be interviewing. I was not able to audio record these four interviews, yet obtained significant insight and understanding about the firms’ culture from walking the office environment and listening to their description of the firm’s history. In addition of these 39 interviews, there were three additional interviews scheduled, where data was not obtained. Communication to prepare for interviews was competed with each of these three individuals and consent forms were completed. Two of these interviews were cancelled and one interview became a brief phone discussion and therefore not meeting the criteria of a formal interview. I conducted an additional eight interviews which were influential and important to my research. Four of these interviews were with my committee members, who each provided guidance and advice as noted in other portions of this document. The next four interviews were subject matter experts, including: a CVDL visiting professor Dr. Northouse who connected me with additional literature, as well as Dr. Yelsma, who are both mentioned in chapter 2. I contacted an article author Jessica Dinh to clarify key points on her article which was cited several times in this document. The fourth expert and last of eight interviews outside the engineering firms, was with Jay Rudberg, PE, who was as executive of several engineering firms Rudberg provided expertise advice with the ranking of conditions as noted in Appendix B and also in chapter 3 on methods. Figure 12 includes the 50 individual interviews, where 39 interviews were completed; three interviews were not completed, which totals 42 individuals from the engineering firms, and then the eight advisory interviews total to the 50 individuals. The electrical
engineers provided technology design on projects, therefore interviews included
scientist, technology, and engineering, which is three of the four disciplines with the
STEM (Science, technology, and Math).

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<th>Consent form</th>
<th>Interview time</th>
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<th>Video files</th>
<th>pages from words from audio</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>2 2 Sr Engineer 9/10 yrs</td>
<td>2</td>
<td>M</td>
<td>Yes</td>
<td>Tuesday 10:30am</td>
<td>Yes</td>
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<td>6,802</td>
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<td>3 3 2yrs + 1 post UG</td>
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<td>Yes</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>10 1 Professional Environmental Science (Masters Hydrogeology) 8yrs</td>
<td>3</td>
<td>F</td>
<td>Yes</td>
<td>Wednesday 2:30pm</td>
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<td>2</td>
<td>F</td>
<td>Yes</td>
<td>Thursday 9:00am</td>
<td>Yes</td>
<td>video only - Est. pages &amp; words</td>
<td>GOPRO130</td>
<td>19</td>
<td>9,467</td>
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<td>F</td>
<td>Yes</td>
<td>Thursday 10:30am</td>
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<td>VN600025.WMA</td>
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<td>11</td>
<td>5,019</td>
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<tr>
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<td>1</td>
<td>M</td>
<td>Yes</td>
<td>Thursday 11:30pm</td>
<td>Yes</td>
<td>VN600026.WMA</td>
<td>GOPRO118</td>
<td>10</td>
<td>5,583</td>
</tr>
<tr>
<td>15 6 Staff Professional Hydrogeology 1 yr</td>
<td>4</td>
<td>F</td>
<td>Yes</td>
<td>Thursday 1:00pm</td>
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<td>VN600027.WMA</td>
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<td>11</td>
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<td>Yes</td>
<td>Wednesday 2pm</td>
<td>Yes</td>
<td>VN600038.WMA</td>
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<td>No</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>18 9 Regional Managing Principal</td>
<td>1</td>
<td>F</td>
<td>NA</td>
<td>Tuesday/Tour lunch</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
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<td>Grp2</td>
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| Total                                         |              |        |              |                |                    |            |             |                             |            |
| Grp2                                          |              |        |              |                |                    |            |             |                             |            |
| 10 1 Professional Environmental Science (Masters Hydrogeology) 8yrs | 3            | F      | Yes          | Wednesday 2:30pm | Yes | VN600023.WMA | GOPRO124     | 21              | 11,603     |
| 11 2 Staff Professional Environmental Engineering 6months | 4            | M      | Yes          | Wednesday 4pm  | Yes                | VN600024.WMA | GOPRO115     | 10              | 4,373      |
| 12 3 Senior Professional Chemical Engineering 14 yrs | 2            | F      | Yes          | Thursday 9:00am | Yes                | video only - Est. pages & words | GOPRO130     | 19              | 9,467      |
| 13 4 Project Professional Biological Engineering 10yrs | 3            | F      | Yes          | Thursday 10:30am | Yes | VN600025.WMA | GOPRO117     | 11              | 5,019      |
| 14 5 Professional Engineer; Firm 5 yrs, Industry 30 yrs | 1            | M      | Yes          | Thursday 11:30pm | Yes | VN600026.WMA | GOPRO118     | 10              | 5,583      |
| 15 6 Staff Professional Hydrogeology 1 yr      | 4            | F      | Yes          | Thursday 1:00pm | Yes                | VN600027.WMA | GOPRO119     | 11              | 4,832      |
| 16 7 Sr Bio Chemist 10yrs = past exp.         | 2            | F      | Yes          | Wednesday 2pm  | Yes                | VN600038.WMA | GOPRO120     | 13              | 6,457      |
| 17 8 Senior Professional Environmental Science | 2            | M      | cancel       | No              | NA                | NA         | NA          | 0                           |            |
| 18 9 Regional Managing Principal              | 1            | F      | NA           | Tuesday/Tour lunch | Yes | NA          | NA          | 0                           |            |

178
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<th>Group</th>
<th>Position</th>
<th>Years</th>
<th>Gender</th>
<th>Yes/No</th>
<th>Date/Time</th>
<th>Interview ID</th>
<th>Duration</th>
<th>Notes</th>
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<td>Yes</td>
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<td>20 min</td>
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<td></td>
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<td>41 min</td>
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<td>Regional Principal and Elect. Engineering 20yrs</td>
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<td>Tues 4PM</td>
<td>VN760033.WMA</td>
<td>40 min</td>
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<tr>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
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<td>NA</td>
<td>cancel</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>-</td>
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<td></td>
<td>HR professional</td>
<td>NA</td>
<td>F</td>
<td>NA</td>
<td>Wedn Tour</td>
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<td>NA</td>
</tr>
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<td>Grp4</td>
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<td>3</td>
<td>M</td>
<td>Yes</td>
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<tr>
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<td>NA</td>
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<td>NA</td>
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<td>NA</td>
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Grand total pages and words: 442, 224,067, 94

Figure 12. Master List of STEM Interviews
In-Case Coding Diversity and Summary of Data

In-case coding and diversity

The first order coding was completed for each interview by conducting two reviews of the text and supporting video. The first pass revisiting each interview was to reacquaint my memory with the interview while underlining key points and making key notations, which correspond with each question. The second pass through the interview text was to discover themes and any hidden meanings. The specific interest was to find the actions people were taking and determine if these actions were consistent with other statements.

The second area to investigate was tacit assumptions hidden within their stories. Tacit assumptions are beliefs or understandings which are shared among the employees, yet do not get talked about, therefore are harder to find for an outsider. Tacit assumptions are usually important clues to understanding the firm’s culture can because discovered by noticing consistent behavior patterns, especially when the behavior does not appear to be logical from an outsider.

The third area that I searched for was implicit meaning in their words and actions. Implicit meanings, like tacit assumptions, are understand by team members and influenced the working and social norms, while being hidden to outsiders. These first order coding themes were then transferred to a matrix with the interviewees on the vertical axis and the eleven questions on the horizontal axis. This allowed me to
compare responses between interviewees from the same firm. This matrix of data was too large to include in this document. The most important themes from each interview were then collected into a matrix as shown in Figure 13.

An important design aspect on my interview methodology was to gather interviews from a diverse group of employees. Diversity for this study was accounted for by the intentional selection of employees by rank, tenure, and gender. I wanted to interview at least one principal at each firm and at least one new employee, with a heavier concentration of small team leaders and larger group or department leaders. Figure 13 is an example of the coding tool which I used. The questions run horizontally across the top, and then the audio number, rank and gender run vertically on the left. Interview quotes and notes were placed in each of the table boxes during the third round of coding, and then themes and hidden meanings were summarized for each person in the two far right columns, as indicated by the horizontal arrow. The quotes and themes were then analyzed for evidence of the test conditions from Table 7. The findings were grouped according to the test conditions as indicated by the vertical arrows and shown in the lower portion of the table.
A specific interest to me in this study was to see if there was consistency or difference among responses of the four different ranks or between men and women. The diversity for both gender and rank was analyzed by collecting themes from Figure 13 into eight categories of rank and gender as shown in Figure 14. There were 10 females within the 35 audio interviews and 14 total females within the total 39 interviews, which is 29% and 36% respectively.

A 2011 report from American Society for Engineering Education (ASEE) has indicated that the engineering female population is 18% for undergraduates and 22% higher degrees with a positive trend; therefore gender diversity was achieved. An interesting point regarding gender is that one of the groups had more females then males, a second group had more males than females, while three of the groups had no

Figure 13. Themes by Individual and Test Condition
females in formal interviews. This allows for comparison of a very small sample as to the potential effect of multigender teams.

The breakout of the formal audio interviews included six level 1 interviews, ten level 2, ten level 3, and nine level 4 interviews. Level 1 was defined as a principal with responsibilities spanning the entire firm. Level 2 was defined as leaders of multiple teams, usually a department, and over 15 years of experience. Level 3 was defined as a team leader and usually with ten years of experience. Level 4 was defined as a new employee with minimal or no responsibility for a team, other than a peer-to-peer relationship and then less than five years, while usually with less than two years.

The primary criterion for ranking of interviewees was their responsibility associated with teams and secondary was their years of experience. The diversity of level was also achieved with a nearly even distribution across the four levels, yet the desired higher concentration at the middle levels.
The following section provides a summary of qualitative findings for each group. Each section will start with the most prevalent themes which are both common, as well as different among interviewees. Then each section will present a summary of findings for each of the test conditions from Table 7. These test conditions were derived from my hypothesis and will be further discussed in chapter 5.

**Group 1 in-case findings**
A comparison of responses by gender and rank indicated significant consistency across the four levels and genders. Group 1 had nearly a one-to-one ratio of males and females and provided the best opportunity to see a gender difference. There were

<table>
<thead>
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<th>Group X organized by rank and gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Themes &amp; thoughts, searching for actions, tacit assumptions, implicit meanings, and gaps, as well as, generative ideas.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Hidden or non-logical issues.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Males</td>
</tr>
<tr>
<td>1 Principals</td>
</tr>
<tr>
<td>2 Sr PMs (15+ years)</td>
</tr>
<tr>
<td>3 Engineers (5-15yrs)</td>
</tr>
<tr>
<td>4 Jr Engineers (0-5yrs)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Common themes</td>
</tr>
<tr>
<td>Different themes</td>
</tr>
</tbody>
</table>

Figure 14. Themes by Rank and Gender
several common themes starting with the value of academic credentials, skill-sets from experience, and hard work was mentioned in most every interview. Collaboration, especially on unique and difficult technical challenges was a common passion discussed by most interviewees. The high transparency of every firm employee was working on, from a new-hire through the CEO, as well as open communication regarding project financial data was commonly discussed. The only difference that emerged from the interviews was the acceptance of risk and conflict associated with innovation. Younger staff referred to several senior level people who were quote, “renowned in the industry,” and basically had a license to be leading edge, while the majority of the firm was bound to client restrictions and government regulations to be quote, “we are risk adverse.” Conflict associated with trying new technology and innovation included higher anxiety (“It was a disaster, so I think there’s a little bit more reluctance”) toward new technology. Technical conflicts were resolved with low anxiety and were even energizing at times, possibly because a critical service to clients is managing their risk, as one employee stated: “Managing risk is a core competency of the firm.”

1. Clear boundaries of team members and non-members
Group 1 was organized into small departments of five to twelve members by technical expertise and educational discipline. Members obtain structured mentoring and training through mentors within the department, while receiving significant additional education by experts across the firm. Department membership and the core
project team members were clearly defined, while project team membership was
dynamic which at times lead to over-load conditions. Project teams are usually three
to four members and range from only two to six and in a few cases, 30 members.
Projects can be sourced from a department, yet will usually include members from
multiple departments and multiple offices. There is a strong technical network that
connects departments in different office, which enables team members to be
dynamically added.

2. Member tasks are interdependent for a common purpose
Interviewees reported working independently between 50% and 80% of the time.
Project tasks were clearly interdependent based on multiple stories about
collaboration. Management takes responsibility for creating interdependence:

• “I think that’s a big part of my job is to make sure people feel close and
  connected.”

• “We need to make sure people are collaborative and respect each individual’s
  contribution.”

• “We really had to pull together a very diverse team from across the company in
different offices.”

Difficulty and diversity cause employees to unify, rather than bifurcate, which
indicates a higher stage of team development. These findings support The Theory of
Group Development, where team members are able to clarify and engage in group-
shared goals (Bennis & Shepard, 1956, p.417).
• “Very difficult client so put that in there and the long hours and everything else, but people still wanted to be together so it was very interesting.”

• “Everybody was pulling together and there was a lot of trust amongst the team members.”

• “So, we do work together quite a bit . . . there’s a lot of different skill-sets needed, and that’s one of the challenges we recognized.”

3. Stability of membership sufficient for learning to work together
Employees drew their identity from the stability of department members as previously discussed in, The Social Identity Theory of Leadership (Hogg, 2001, p. 186), where critical aspects of our individual identity are derived from the groups with whom we associate. Therefore team stability creates a newly co-constructed team identity where, “an emergent team impression arises,” (Goffman, 1959, p. 80). Project teams are created by matching skills with project demands: “people who show well,” such that employees work with a wide range of teammates. There is a trade-off of engaging the best technical skills for projects and the learning which occurs from the many, with the efficiency gain of long-term stable teams. “Client teams and department teams that stay together,” while the majority of project teams will be assembled on skill-set and availability. A few specific comments when asked about the number of projects and similarity of the team included:
• “They’re gonna be working for a different project manager and generally they would not be on . . . probably only by chance they’d have one other team members on one project on that project so it’d be a completely different group.”
• “A team . . . would in essence be pretty much dissolved after the project and if it’s the same client, it may be the same team, but more likely it’s gonna be a different mix of people.”
• “Typically three concurrent projects, all with different teams and project managers.”
• “Three to five projects and two different teams.”
• “Two projects, with the same team.”

4. Team composition is small with collective skills and support to achieve goals

Interview responses for team size on typical projects ranged from two to six members, with three to four team members most common. Recalling that smaller teams spend less time in the stages of development, and reach the performing phase much quicker (Tuckman, 1965). These very small teams are supported by a strong technical network and knowledge base with other offices, with statements like:
• “Connection to people adds to my own knowledge.”
• “There’s just a bunch of really intelligent people and I’ve just been really impressed with the knowledge base . . . it’s pretty amazing.”
• “Everyone working toward the same goal.”
5. Clearly defined and communicated team based goals and rewards
A highly structured process is used to communicate weekly updates on individual hours for all employees, along with project status, and then summarized at quarterly meetings. Therefore, “everybody is made to understand how we make money and our clients make money.” Annually there are, “off-site meetings . . . where we want to go, where we've gone . . . [and] what we're doing next.” Individual goals and recognition focuses on professional and personal achievement, where team goals are financial. Employees feel recognition through the enjoyment of the work and sense of team accomplishment;

- “Yeah, like I do feel like there’s a sense of a team accomplishment.”
- “One factor of the success would be that everybody feels rewarded to having work on it, they’ve learned, they’ve grown, and their happy.”
- “They have come to appreciate others working on the project and they would like to work with them again.”

6A. Group norm of psychological safety and values: respect and care
Employees at every interview reported that they were “comfortable enough to speak-up,” and by example of a story where a peer employee was ready to quit the person “feel safe to bring it up to senior management.” Employees also believed that other employees felt psychologically safe: “People feel comfortable enough I think that even if it’s not them. . . . They’ll feel free to talk to people about it.” Regarding new ideas employees were comfortable and even felt obligated;

- “If an idea comes up I definitely feel comfortable to say it.”
“I would almost feel obligated. . . . It’s kind of important to speak your mind.”

“Trust in my peers. . . . I think that embodies respect and being able to rely on people.”

“I’ve never been made to feel bad. . . . It’s been more of in a helpful collaborative way.”

When asked the best aspect of your firm:

“I would say maybe mutual respect. . . . No one’s pontificating, just kind of shared respect.”

“Trust; trust in the people I’m working for, trust in the people that are working for me.”

“I love the people, we have good quality people.”

6B. Conflict and accountability enables continuous learning and innovation

People have the tendency to blame people more than the contextual conditions and circumstances of the situation, (Ross, 1977), and tacitly assume that they know the motivation of others and act on these erroneously assumptions (Argyris, 1993).

Leaders and managers must be careful to consider context and business processes as the initial cause of project problems and mistakes, rather than people, which will be further discussed in chapter 5. Consideration for context and process rather than blaming people was evident in many stories and most clearly stated in the following quote:

Sometimes we’ll have an issue with the team not functioning well… it’s typically not because people don’t do a good job… it’s usually
because we’re over-committed and then we’ll have to make some changes if that’s the case. I’d like to think everybody within our group is good.

I also discovered a peer level accountability present, such that while employees work well together, they also know from their peers when they are not effectively contributing to the team.

- “I guess individuals that haven’t fit with the team kind of either voluntarily or involuntarily weed themselves out.”
- Employees consistently stated that they were comfortable giving voice to their ideas or concerns, yet many also mentioned a difficulty with conflict resolution.  
- “Conflict is not . . . I don’t think it’s dealt with very well. . . . I mean, everybody is so worried about calling people out and offending someone because it violates our collegial culture.”
- “I don’t have a strong feeling that we are good at dealing with or adjudicating conflict.”
- "Don't know how conflict is dealt with. . . . Weird now that you ask.”

7. Unique generative ideas and other findings
There is a strong technical network which bonds employees nearly as much as the reporting structure, such that employees often referred to a “collegial culture,” which drives learning and innovation.

- “I think there’s a huge culture of learning here. . . . It’s just the nature of the company.”
• “My colleagues put together innovations competition.”
• “The opportunity to learn I think is a shared responsibility.”

There is also a very high energy level and employee commitment. When this energy and commitment are challenged by the dynamic nature of projects, then employees talked about overload and burnout.

• Is just the challenges maintaining that high level of responsiveness to the client over such a long period and n I had one staff before I got the other two and we burned them out.”
• “Hard for us to get good talent these days, so staff are overloaded.”
• “Had one staff burn out, so learned from past.”
• “There’s also been people that have been asked to leave the team just because we can tell their burned out.”

**Group 2 in-case findings**
Group 2 was the only firm that had more females then men in formal interviews.

There were three males and five females, which provides an opportunity to compare responses to other firms with a higher male concentration. The comparison of responses by gender again indicated significant consistency for the topics under review. The comparison of responses across the four levels only differed by focus. The more senior engineers discussed leadership and management examples. The most common theme at this firm was the collegial atmosphere which supported their
project focus. The projects delivered by this firm had a higher concentration of studies produced, as compared to traditional design projects, while the employee mix of STEM was similar to the other firms.

1. Clear boundaries of team members and non-members
Group 2 was organized into small departments by technical expertise and educational discipline. Employees had both a supervisor and a technical mentor and also had access to experts across the firm through formally organized committees. Department membership and project team membership appeared to be clearly defined. The interviewees reported to be working on multiple different teams, which at times caused workload concern, yet all stories indicated that the PMs were able to address the schedule conflicts. Project teams range from only two members doing a study to a more typical four to six members for a design. Larger projects were also noted with multiple teams and usually include members from other offices. There is a strong technical network that connects employees of similar disciplines and enables team members access a significant pool of resources.

2. Member tasks are interdependent for a common purpose
Interviewees reported working independently from 70% to 80% of the time, with a newer employee closer to 50%. Regarding interdependence, there were two common themes where employees recognized each other’s unique niche and people enjoyed collaborating these different skills toward a common purpose. One interviewee said,
“I find . . . everybody seems to have a niche and a particular skillset that makes each person unique.” Others commented:

- So there is this real pride within the firm that we generally want to support our fellow practitioners and it’s a very altruistic approach actually, and whether that leads to something which is beneficial for you in the longer term it benefits the wider [firm].
- So if somebody approaches you and asks you a question as for support, the first answer is . . . yes I can help . . . so the firm embraces this culture of helping each other move along and this is one of the areas that really struck me when I first joined the firm.

There is a clear sense of shared responsibility:

All of us only have a piece of the puzzle, and so… we need to pull in a lot of help. . . . I mean, as a project manager you have the financial responsibility and the deliverable responsibility but you shouldn’t have all the technical responsibility.

Networks of people are available for employees depend on:

I have a person that I phone up and I call and I say . . . what do you think, and he’s helped me out of so many situations, and it’s not because like I don’t know, but he has just been in there.

3. Stability of membership sufficient for learning to work together
A strong stability is evident through the number of years which employees have worked together and also that staff seldom leave:

- We are a tight knit crew here . . . been working together with each other for almost twenty years. . . . Our turnover rate is really low because we work really well together . . . all of us, and they really support all of the teamwork environment.
• We’ve got a really good reputation . . . like I said, our turnover rate . . . our staff . . . we stay here. A lot of us . . . consulting is a really . . . it’s pretty tumultuous . . . people change companies all the time . . . that doesn’t happen here.

This stability allows teams to work more effectively and align their strengths with their responsibilities:

Yeah, you know what people are capable of . . . just makes it easier the next time around . . . There’s none of that getting to know you stage . . . Your strengths and weaknesses . . . We’ve already figured that out.

4. Team composition is small with collective skills and support to achieve goals

Interview responses for team size on typical projects ranged from two to six members, with many studies which has two or three people and three to four team members on a design project. These small teams were supported by a strong technical network and knowledge base with others both in this office and other offices.

Employees acknowledge and appreciate their different skillsets as one of the employees commented: “Like it’s just the diversity of the group . . . everyone brought something different to the table and so it was pretty collaborative.” Others said:

• I’ll be working with mostly one or two people, maybe at most like five, so it’s . . . not like too small or too big. I feel like it’s the right size to get enough feedback from everyone and everybody having a good amount of workload to keep us busy and also to progress with the project efficiently.

• You’re amongst a bunch of very bright and very successful people and that can be quite daunting to try and join that process . . . We’re trying to enable that sort of process, so we set up brainstorm meetings.
5. Clearly defined and communicated team based goals and rewards

Every week there are reports sent to every employee with individual hours for all employees, along with project status. The report includes a four week look ahead where everyone can see what work they have schedule and when individuals are scheduled to be available. This allows a shared responsibility between all staff and the project managers, with supervisors providing oversight. Everyone that I interviewed mentioned this system:

I guess being a junior staff . . . one of the things that I’ve been doing is seeking . . . So far it’s been working out well . . . been able to get myself pretty busy with billable work and I feel like as the months progress I feel more comfortable approaching people.

The client and PM create project goals and communicate these goals to the team at weekly meetings and through the proximity of the team workstations. Job descriptions include several common themes for all employees such as responsibility for mentoring and contribution to the business as are part of their sell-manage-do system. Employees take significant ownership in developing their career goals, as one employee stated, “You’re the project leader of your own life right.” An important aspect of career goals is that they align both personal skills and passions, with the needs of the business:

In the ten years that I’ve been here I don’t think my career has ever stagnated. . . . There’s always relatively clear direction and that direction has changed a few times for sure but it’s developed into some like areas that I’m interested in and it also kind of caters to the needs of the office too.
In each interview, I asked about recognition multiple times and received the following comments, yet it was clear that people feel rewarded. Compensation was almost never mentioned in the recognition responses, except when an employee said, “We don’t know much about our bonus structure and things like that.” I discovered an award that encourages people to be good teammates and help others.

“We have a trophy that we give out, and everyone votes for their: who’s got your back. And that is someone . . . who just had your back this year . . . and like went above and beyond.”

6A. Group norm of psychological safety and values: respect and care
Employees are encouraged to bring up new ideas.

Like if I had some idea tomorrow I think I would feel very comfortable making some slides or even in that formal way of bouncing it off co-workers too like, what do you think about this. . . . I think . . . everyone’s pretty embracing of trying to improve things or doing things a new way.

There is a program called the Ideas Generator where all employees are encouraged to write down or bring ideas that get discussed. The conclusion of these meetings is that several ideas gain the interest of a small group who gets funding to further develop the idea. One of the employees told me about a new hire who had an idea that was funded.

- Yeah, he’s pretty new to the company and he had a proposal that he put in with one of the other principals in the office . . . like they got talking and the principal’s like . . . well, if I could do this would you be willing to kind of spearhead it for me. Oh yeah, sure.
• This office is seen as I think an ideas generator. We often introduce new technologies and we probably have more first to field applications of remediation technology perhaps than anywhere else in the firm.”

Working in the science and engineering business can be very rewarding and at the same time be hard work and stress. These opposing forces of pain and difficulty set up a paradoxical situation, as employees have stated:

• “We are stressed a lot of the time.”
• “In general it seems to be that dealing with a lot of people is hard, working in this business is hard.”

I heard many stories about teams came together through hardship, realizing that the difficulties soon ended, while the relationship bonds lasted for a long time.

So the fulfilling part was that we did all work together. . . . People gave up their vacations. . . . I still hear about it from my family . . . and it’s just like oh please—come on. . . . People did things like that and you couldn’t live like that all the time, but it was a good feeling because everybody was doing the same thing.

Many employees mentioned the encouragement of finding a work-life balance:

One of the things that they really sell here . . . work-life balances and we really feel it’s very important. We are busy just like everybody else . . . but you know what, if you have to leave because your kids need you or something like that . . . nobody’s giving them a hard time cause they’re not at their desk . . . like they trust their employees to meet their goals and we do . . . we do!
An important way firms help employees find a work-life balance is through flexibility and programs to help employees become the best that they can be.

We have a mentoring program that is specific to junior mid-level staff. . . . We have a women’s mentoring program that’s company-wide. . . . They’re happy to do things like give you some time with a life coach or a career coach or something like that.

6B. Conflict and accountability enables continuous learning and innovation
Employees are willing to openly discuss mistakes when they know that the benefits of learning out-weight the pain of exposure and the goal of the organization is to find and fix problems fast. Leaders at all levels can help to create an open culture of continuous learning as was evident at this firm. According to one employee:

I make mistakes all the time . . . never make the same mistake twice. . . . My boss is really good at explaining why . . . not just telling me the answers . . . but taking the time to explain why that is a mistake or why that doesn’t . . . the implications sometimes of our mistake are hard to grasp.

Another said, “Total failure would have been very, very difficult . . . but there were little failures all over the place and they just have . . . they persist . . . figure it out fast and then fix it fast.”

Accountability is a shared responsibility where individuals collaboratively make decision and fix mistakes as this employee states, “It’s never one individual who’s making the decision. . . . Like everyone buys into it.” One of the ways that employees
are mutually held accountability is the openness of project information. A productivity report visible to everyone from a new hire to the CEO on a weekly basis:

“We have an employee productivity report that goes out company-wide . . . every single week. . . . It shows you the billable hours . . . your target, it shows you everything. It is sent to every individual every week.”

Mistakes and failures get addresses quickly and become learning when there are guideline which guide the process: “There’s decision trees that we try to make for all projects regardless of what they are to help you as you gather data come up with the next step.” Accountability is an important conditions as to how and why people leave the firm. There is peer compassion and care for other as noted, yet there is a pressure for accountability at the team level of analysis which is just as strong. These dialectic forces of compassion and accountability lead to individuals either flourishing or self-selecting out of the organization. This type of accountability saves significant time and also creates a sense of fairness among the staff as compared with terminations:

I think it’s a bit of an organic process. . . . If it’s not working out the person just doesn’t get work and eventually they just . . . we’re all hard on ourselves so we all think I can’t say that about somebody cause that’s mean . . . but I think in general people just get unhappy and they leave.

“There’s very few people we had to actually fire . . . but not that many. . . . It’s at least ten to one. . . . I think I can only think of three people that we actually fired in my (over fifteen) years.
7. Unique generative ideas and other findings
Engineers and scientists typically entered their specific technical field due to a passion for solving problems. The traditional way for careers to develop is on the business side of the firm and as a practitioner, as well as, through these interviews, I heard the message that engineers find themselves missing the technical challenges and mentoring of young engineers. Firms may consider the value of technical leadership by allowing business leaders to return to teaching younger engineers and solving client technical problems as this firm has done, where a senior business manager transitioned into a technical role and has made a significant impact on driving innovation, as well as inspiring the technical minds of the staff.

Group 3 in-case findings
The group 3 formal interviews included all males and one informal interview with the female HR Director, therefore no gender comparison could be made. A comparison of responses by rank indicated significant consistency across the four levels. There were several common themes starting with: employees were at the firm for decades, a strong sense of family which extended beyond the workplace, and employees felt informed through regular communications to all employees. Every interview mentioned the value of the Monday forecast meetings and Friday huddle discussions. One of this firm’s employees stated it quite simply, “Communication leads to trust.”

While responses regarding general communication and project kick off meetings were consistently high, the communication of project budget was different. A few
comments can be best summarized as follows: “I don’t think it gets passed far enough down the line for everybody on the team to understand.”

1. Clear boundaries of team members and non-members
Departments were organized by discipline and region with approximately three to eight members. These departments have very stable membership. The department managers were team leaders responsible for project assignments, workload support, and technical oversight. Department members were usually paired for mentoring and project support. Projects included members of each department. Team members for each project were usually named at the start, even if some of the team members did not need to be engaged. The project members from each discipline would continue to work together across all their projects, while the other disciplines may change. The result was that each engineer worked with a rather limited mix of team mates and had clear boundaries.

2. Member tasks are interdependent for a common purpose
Interviewees communicated a very high level of interdependence, based on the investment they make in each other, such that they either will or loose together.

- “We’re invested in each other’s success, there’s no doubt about it.”
- “We’re all aligned together, if we knock it out of the park, we all succeed, if we don’t, then we all go together.”
- “The guy I report to was there every hour. . . . I actually had a lot of fun. . . . We could feel that team work thing.”
"They were team focused and had each other's back!"

“Because I do good, don't mean the company is doing good . . . but if I and this person do good, that's going to be better.”

This investment and commitment to each other, built mutual trust among their teammates, where as they were not going to let each other down. Employees regularly used the family metaphor to explain their personal bonds that extended beyond work.

"There's a high level of trust in who you’re working with …they're not going to let you down, and you feel you can't let them down, …family."

"We're a family, we've got each other's back. . . . We're accountable to each other. . . . It's very hard to explain, we're a team."

"There are folks we go to church with, see at baseball games."

3. Stability of membership sufficient for learning to work together

The stability of teams and the security of employment is very high in this firm.

Employees have worked together for long periods of time and learn how best to work together. Senior technical staff takes ownership of teaching and mentoring younger staff, taking special notice that knowledge transfer happens best through stories, where they can transfer context with solutions. Staff then learns best by doing, making mistakes, and being coached:

“They recognize that they need to bring the next generation up to basically fill in behind them.”

“I think a lot of learning just by doing,” was quoted a least three times.
"I think the more beneficial training comes from within."

Stability is something that is often earned over long periods of time when co-workers can depend on each other.

Folks that have been here a long time understand that that’s how they learn. . . . For a lot of us, our mentors and our supervisors are still here working side by side with us and so you trust that . . . and you want that next person to trust you along that same way too.

A truly special bond appears when the bonds extend beyond the workplace to include the families of employees:

They’ve watched my kids grow up and come through the office and be at trick or treats . . . and so you go to their kids weddings and you . . . we try to do a lot of things together that bring the family members here . . . so I think when you get that feeling of understanding who people are and who they belong to, I think that makes it a lot easier to trust and want to make sure you don’t let them down.

4. Team composition is small with collective skills and support to achieve goals

Teams are defined as a department of four to seven people, and then project teams will have four to seven core team members. Project teams will typically add a few support people for short durations and may reach ten team members. This firm understands the value of small teams, along with the complexity that larger teams cause: “If you get like ten people, you start getting side conversations. . . . People stray off topic."

5. Clearly defined and communicated team based goals and rewards

Project goals are most often communicated through project kick off meetings, which were reported by both mid-level and junior staff to be “most of the time” and two
interviews indicated that 90% of the time they occur. A common theme of these great firms is that the leadership were focused on continuous improvement and often provided a more humble assessment than employees did, as indicated in this leader’s response regarding communication of project goals: “I would admit to varying degrees of success.” He continued:

> We’ve found a number of projects where . . . we have struggled we didn’t know who was in charge of this piece or this piece, and there was confusion as to who was the project manager . . . the principal in charge . . . the client contact was, and what the schedule was and . . . there was confusion.

Another common theme I discovered is that accountability often came from two equal forces, rather than a top-down directive. This was the case for the firm’s high percentage of kick off meetings, as indicated with this employee’s statement: “We put our foot down sometimes on projects, that we say we’re not starting until we have a kick off meeting.”

Continuous improvement of financial performance is evident through the communication of project goals.

- “People have learned that financial performance is based on the whole.”
- “We've become more financially successful if we get buy-in from each discipline.”
- “I think there’s been a real good buy-in, from the discipline leads and the project managers and the staff regarding a new project work plan process.”
• “The culture is very open. . . . I think everybody’s extremely open to listening to other people’s thoughts and ideas.”

• “We talk all the time . . . help each other out, we work together pretty closely”

One of the ways that employees are recognized, which appears to be effective is through certificates issued by their peers, which are then read at the weekly all-hands meetings.

• "You kind of recognize somebody that went above and beyond. . . . I guess most people are proud and appreciate when they receive one.”

• “We got these little cards . . . saying they did a good job and they get read in front of everybody . . . which is cool.”

6A. Group norm of psychological safety and values: respect and care
Employees feel psychologically safe when they feel respected, when they have a voice, and when the leaders genuinely care about their well-being:

• “Everybody's ideas are important, everybody has a voice.”

• “Principals ready do care for them as people.”

• “There is no cutting somebody down behind their back. . . . We're all in this as one.”
Employees also feel psychologically safe when firms struggle with layoffs and not that layoffs don’t occur, but rather that significant efforts are made before laying off employees:

- "It’s a business, but it’s a family, you don't get rid of your family!"
- "Some would say in this organization that there is maybe not as much accountability on failure as what should be. . . . There are definitely views that maybe we are light on accountability."
- "We’re not quick on the draw to get rid of a core performer. . . . Hey, we’re gonna work with you and we’ll do what we can to help you correct what you’re doing to make it right . . . give ’em training, give ‘em help. . . . Someone needs to do their job."

6B. Conflict and accountability enables continuous learning and innovation
As was noted previously, conflict has a natural tendency for people to blame others, rather than the context and the processes. Great firms know that conflict is not easy to deal with, while have a deep unrest until conflict is discussed and resolved. They realize that the reward for working through conflict is continuous learning and innovation:

- “We succeed as a team and we fail as a team . . . and so singling out somebody for a potential failure or whatever isn’t going to do us any good or solve the problem anyway, so let’s figure it out together and proceed that way.”
- “There's one person who's perfect and you hung Him on the cross.”
• “We've got to talk about it and we need to talk about it . . . uncomfortable, but
dang it, we still need to talk about it.”

• “Principals are always very understanding about mistakes. . . . Makes me think
it’s a learning experience.”

7. Unique generative ideas and other findings
The final question asked to each firm was to name the one word which best describes
their firm’s success and why they are proud to be an employee. The overwhelming
response was the people. A few of the responses are as follows:

• "People, hands down it’s the people."

• "That’s the number one reason why . . . I get up every morning and come in."

• “It comes down to people . . . like people trusting them.”

The most generative and energizing finding is that people were respectful. Positive
messages were publically communicated and negative messages were communicated
privately:

• We communicate mistakes, without being hurtful.”

• If somebody makes a mistake we make sure that they know that they made a
mistake but it’s not . . . it’s not presented in a way to make them feel bad or put
blame on them.”

• "This may sound cheesy, but I just like going to work!"
Group 4 in-case findings
The group 4 formal interviews included all males and one informal interview with the female HR Director, therefore no gender comparison could be made. A comparison of responses by rank presented a unique organizational transition that the firm has undertaken. Each of the interviews contained comments regarding the former structure, the new plan, and progress. The most impressive common theme is that there was a very high understanding of where the firm was going and the justifications associated with the change. The organizational structure for teams at one firm will most likely not fit other firms due many factors such as the size of the firm, availability of resources, and market conditions, which is what I believe Hackman discovered as to the focus on conditions (Hackman, 1987). This firm has seen significant growth and determined that continued success required dedicated leadership focus on technical solutions and training, separate from business operations and client delivery.

1. Clear boundaries of team members and non-members
This firm had reached a plateau after significant growth period of five years where they doubled in size. The strategy and operational tactics which were fundamental in obtaining this success were no longer working effectively. “We operated in a department silo and we were less structured in getting that buy-in because it was small.” As a larger firm they realized that “we’ve outgrown our structure, and . . . need somebody to help us with process . . . systems . . . [and] with a structure that will . . . accommodate the projected growth.” The firm separated technical and business
operations to gain high levels of focus on each. Departments were formed by technical discipline and department managers were focused on project quality delivery, training, and balancing the work load. Project managers were assigned a more focused role directed at client satisfaction, communication between the client and design team, and also the financial performance. A significant challenge was changing previous perceptions and creating two equally important focuses of technical and business: “How do you get the company to acknowledge the value that we put in technical leadership as opposed to project management?”

Consolidating the engineering design teams by discipline was seen as “one gathering point and I think that’s helped a lot,” as an interviewee reported. A critical message is that people naturally resist change and therefore change must be built on trust and keep all employees engaged in the success of the organization:

It’s the fear of the unknown, change. . . . It’s like . . . okay I hope this is right. . . . I’ll trust you . . . what appears to be best . . . and it is gonna be perfect. No, it’s not gonna be perfect. Then the challenge (is) to keep people engaged in the success of the organization.

One of the important objectives was to get people into role which fit their skill sets and passions, where can thrive, rather than in positions of perceived value:

But I think it goes back to aligning roles and responsibilities with passions and skill sets . . . that individual checked out for a while. When we realigned this individual to better fit with your skills . . . and so it worked. . . . I’m seeing the thriving going on. So that’s a success story, but it was not without . . . it’s a challenge.
2. Member tasks are interdependent for a common purpose
The organization has created interdependence through a symbiotic relationships, faith, and trust.

- “You’ve got PMs and you’ve got all the production groups . . . technical side, business side. . . . There’s a symbiotic relationship between the two and both of them have to have buy in on the project.”

- “So . . . have faith and trust that your team will make this happen. . . . When everybody is doing my work for me . . . it’s pretty easy to have that faith and trust.”

Young engineers are taught to push their limits and challenge themselves, knowing that there are senior engineers to guide them and a system to check their work:

You’re probably expected to work pretty independently on your task with help if that makes sense . . . take it as far as you can, challenge yourself a little bit cause it’s the fastest way to learn that we’ve had good experience with.

One engineer commented: “I know I’ve been stuck at times and that’s where my first supervisor. . . . I really, really enjoyed working for him, but he would just say . . . you’re smart, have some confidence. . . . That really forced me to think.”
Engineers who are individualistic and struggle with learning interdependence find that their behavior is not in line with team norms:

- “But if we feel that somebody is . . . maybe doing something to advance their own career and not being at team player, that stuff will get communicated through... those situations are dealt with and there have been cases where we’ve had to let go of people . . . but there’s not a lot of that type of stuff.”

- “So it’s hard to be that individual out there, and when you are . . . you’re causing some headache for some others and you find out pretty quick. . . . On one particular person . . . no one’s gonna want to help you or work with you cause you’re not going about it in the right way.”

3. Stability of membership sufficient for learning to work together
This firm has been able to maintain high stability through their growth, as one employee told me: “Turnover has been fantastic . . . very low . . . usually when we hire someone they stick around.” While they are in the process of changing their organizational structure, employees stated that they would be working with the same teammates. Employees were just happy, as a rather new employee stated.

- “Really I guess . . . really the company treats their employees well always providing opportunities for growth and good compensation.”
• “I think people generally like each other that work here and so . . . one, it’s a pleasant relationship so you’re more apt to walk over and bounce ideas off each other.”

Young engineers are taught from the very beginning of their career to give voice to their ideas. This message is reinforced when these ideas result in action.

We’ve got a graduate engineer that just came the last few weeks and . . . she said, I really feel like we need somebody trained on this. . . . It was well received and that’s actually the class we’re going to train five or six people on ’cause it’s that important.

4. Team composition is small with collective skills and support to achieve goals
There are five engineering design departments, and project management group, and other support groups, all of which are typically less than ten members. The team composition will typically include three to six engineers and a project manager.

Success of the organization starts with building teams where members engage their skill sets and passions, therefore their interdependence results in the non-linear performance previously discussed:

• “One of the objectives . . . is put right people in right positions where their sets and passions are.”

• “Not, oh my gosh I’ve got to be a . . . just because that’s gonna satisfy me in my career. . . . Well, it doesn’t. . . . It puts you into a position where you may not thrive.”
One engineer commented,

> Find the best use of your time and try to focus their energies and their activities in a way that spend their time for what they’re focused purpose is for the success of the organization because we all have to do our part.

Firms build process that guide the design efforts, which are based on the type of work. The more routine the task, then the tighter the process, such as appearance of drawings. The more complex or innovative the design task, then process requires an iterative approach, such as the over-sight of a senior engineer. This follows the Process Knowledge Spectrum (Edmondson, 2012, p. 33). One engineer commented:

> It’s easy for us to share resources because we have a consistency in process . . . and that builds trust also because . . . I can’t send it to office X because it doesn’t even look like a [firm’s name] product . . . what the heck were these people doing . . . consistency across the organization and if everybody’s adhering to practices and policies that we’ve put in place, all looks the same.

Others said,

- “We have . . . work plans where it’s actually written out, you put dates on thirty, sixty, ninety percent reviews, who’s doing the review, what is the plan upload date.”
- “Engineers are smart people; if you don't tell them, they'll develop their own unique process.”
5. Clearly defined and communicated team based goals and rewards
Employees stated that they had regular performance reviews where they provided self-ranking along with goals and objectives for next year, meet with their manager for coaching. The bonus structure for entire firm included a heavy weight on corporate performance, then team performance, and then least on individual performance. Compensation was not a significant factor raised during interviews as noted in the following comments:

- "We're working as a team and I guess I don't see a need for individual recognition."
- “We probably don’t do enough. . . . If I know something was good and we want them to keep doing the thing over and over, I make sure I say something but I’m not a hundred percent on that.”

Sharing financial information with all employees and helping them understand that an important metric is productive hours, is seen as critical for high performance: “We try to focus more on productive hours, not just utilized hours because upper management completely recognizes the fact that it’s okay if you’re gonna push utilization a person can gain that.”

6A. Group norm of psychological safety and values: respect and care
Many firms talk about values such as trust, integrity, and loyalty, yet talking about values will seldom have much impact on culture. Culture emerges from the underlying assumptions and artifacts (Schein, 2010), which are discovered through
stories that employees tell. The following quote came from a young employee who witnessed an event as an intern and came to understand the true meaning of honesty, loyalty, and integrity:

The loyalty component and when I was a college student . . . one of our inspectors was getting completely thrown under the bus by the contractor and (our senior leader) went right at him. “You do not talk about my guy that way. . . . That is not respectful.” He was lying. “You’re a liar and I will see you at the client meeting and you can tell them this, and I’ll tell them.” The way that he defended our inspector was eye opening to me. . . . That really impressed me and made it where I wanted to work.”

This same employee offered this advice: “Just tell the truth. If the truth is different next month it’s because you learn something, but if you tell the truth you don’t have to remember what you said. Just always tell the truth.”

Living values can create a generative feeling which is often hard to articulate, yet the action of living these values produces a unifying clarity of mission and loyalty. A loyalty that places priority on the employee, their family, and well-being. As one employee put it:

It’s just hard to articulate a feeling. . . . There is this feeling of togetherness, there’s this feeling of caring, there’s this feeling of comradery, there’s people want to do the best that they can for the success of the organization, there’s a loyalty here, and it goes both ways.

I’ve heard stories that this is a hard job. People work hard . . . you put in lots of hours . . . you’re away from your family . . . but one your
child gets sick... boss comes up and says... you will leave... and be gone for as many weeks as you need to take care of your child.

Leadership must emerge from many levels of the firms and this dissertation’s focus is on teams; therefore I wanted to include quotes that specifically came from small team leaders regarding their teaming culture.

- I’ve seen people adapt to the culture... It’s something they hadn’t thought about and they did actually adapt the way they thought about that to the culture, as well as how you treat people... ’cause values driven culture isn’t something that the public sector is putting on the wall.

- I’ve never heard that so and so is dragging down the team... Typically that’s unacceptable and I would just say... they really didn’t fit the culture of the company... Our teams have always worked together really well and as soon as there’s a team member that doesn’t, the only two I can think of off-hand had to get let go.

- It was our values... so I’d say those are just words on the wall but they’re not. I’ve noticed we follow those very well. I’ve been here (many years) and I would say those drive most of the decisions we make... and if kindness sounds like a fluffy value but it’s just how you treat people.

- Integrity, accountability... if you’re not accountable, those mistakes you found, if you don’t take accountability for those you’re not fitting the culture of our whole team and those people stood out right away... very obvious that they did not fit our culture... and it was actually too detrimental to have them.

The best firms place a much higher value on cultural fit and ability to being a team player when hiring, than they do on technical excellence:
I was involved in the hiring process... the resume was unbelievable... and I thought for sure this person would be working for us within a month... [my supervisor] said, “I can’t hire him, there was a question... do you like work on teams” and he said, “Generally teams hold me back, I like to work by myself.” That meant a lot to me... I really needed to hear that they stuck to their guns on hiring and encouraged me to do the same as I moved into that role.

We’re gonna hire technically competent people number one. And number two, we’re not gonna hire you if you don’t fit into our... if you don’t honor our values and if you don’t believe in our mission, you don’t fit and that’s okay cause you fit somewhere.

Great firms have programs in place to help employees and are slow to terminate people. When terminations occur it is usually not for technical competence, yet rather for behavior and not fitting into the cultural values, according to one employee: “We have an employee assistance program... that was used for this conflict resolution and they both wrote their proposed ideas (on how) to deal with it.” Another told this story:

There was an employee... His personality didn’t go well... he was kind of over-bearing and whatnot... kind of scold people for no reason and the office manager dealt with it... mentioned it to him, that’s not the way we do... what are you doing there... that’s not okay type thing... He ended up going to a different company... He got better... but then he had kind of issues and whatnot.”

6B. Conflict and accountability enables continuous learning and innovation
These firms understand that conflict is part of solving engineering problems, part of everyday business, and employees must be taught to constructively embrace conflict.

As one of the employees told me, “There’s not time to not deal with things, they have
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to deal with them so we can move past them.” The firm’s most senior engineers lead
by example as demonstrated in these quotes:

- Senior and the most respected (engineers) do it first. . . . This is what
happened. . . . This is what I would do different next time . . . so we
breed that culture of oh my gosh (person A) can stand up and do this
and (he/she’s) perfect, well then it’s okay . . . it’s okay for me to
acknowledge that I made a mistake.

- So I’m encouraging this direct communication right now because
before passive aggressive natures would not even talk about it. We just
gonna blow up and then we’re gonna let it go. No we’re not. We’re
gonna talk about it. There’s a problem. I want to get it before it blows
up.

- If you’ve got a problem with me, I expect you to go and engage me.
And I don’t care whether that’s up, sideways or down. It doesn’t
matter. You don’t like something that’s going on, let’s voice it
otherwise it starts to fester and it becomes a cancer.

These firms understand that they need to deal with conflict within their firms, as well
as external to their firms, which starts with engaging clients in constructive discourse:

- “Don’t be afraid to get the client engaged right away even if it’s an issue… it’s
better to keep them engaged and they’ll be willing to work through a solution with
you versus fight what the outcome was.”

- I feel like we do a good job communicating with clients on what the challenges
are.”

7. Unique generative ideas and other findings
Great firms have an interesting paradox; they are critical to their own performance
and self-benchmark, while not being critical of other firms or people who want to
leave for a better opportunity. They are glad for competitive firms to innovate as it raises market place. One person noted, “So that’s been really, really positive to see other local firms taking leaps. It doesn’t sound like it would be a good thing.” Another said:

- It’s okay if . . . he’s got a better opportunity, then . . . go kill it man. . . . We appreciate everything you’ve done, now go crush it over here man, ’cause this is about you, it’s not about us. . . . We’re not gonna worry about it cause you want to stay here cause I care about you . . . it’s not a false care.”

**Group 5 in-case findings**

Group 5 was the third firm where the formal interviews included all males and one informal interview with the female Office / HR Manager, therefore no gender comparison could be made. A comparison of responses by rank indicated significant consistency across the four levels. There were several common themes. The first theme discussed by all interviewees is the very structured departments of multiple disciplines, which form self-reliant teams. These department-teams evolve over time and range from six to as high as twelve members. The team members develop deep interdependence and friendships, which has been foundational to their success. A second common theme aligned with their core values, which place the client service ahead of profit both in spoken words and action. Group 5 has seen significant growth over the past several years, which employees were proud of, while expressing a few differences. The first difference was related to critical gaps in the structure of one discipline, which was quite different that the other disciplines. The second was that the growth had caused several individuals shift toward less effective or desirable
roles, which might be best in the long run for the individual and firm, while something to consider.

1. Clear boundaries of team members and non-members
Group 5 has created very high team clarity through the creation of departments which operate rather independently from each other. This department-team structure has significant advantages as noted in the following conditions, yet these team boundaries can be difficult to cross for work load sharing, regarding project priorities:

- “I can tell you that almost without fail, when that team gives work to another team, that team is not gonna give that project as high of a priority.”
- “Borrowing people . . . it’s more of a tug of war sometimes.”

The firm has worked through the issue of sharing resources to determine that if resources are needed for more than a few days, then it is best to relocate the entire project and work out the PM and client relationship.

- “Borrowing an individual person for a day or two here and there to help fill in… that usually works successfully.”
- “If I’m borrowing labor from another team to complete the work it’s hard for that team sometimes to just start working on my project over theirs, whereas if I can actually successfully pass a project off to another team.”
• “Passing a project off completely works significantly better because the other PM will prioritize their own work . . . it works significantly well if the other PM also takes control.”

2. Member tasks are interdependent for a common purpose
Every interview confirmed the depth of team member interdependence, which starts with a dyadic relationship on their first day, as “all new employees are given a mentor.” Project managers and team leaders could easily articulate these benefits toward the team’s effectiveness, which they believe is driven by the department size, friendships, and personal bonds.

To me that’s the strongest benefit of this team size . . . the relationships and friendships that they form . . . They’ll go ask them for help on something and I don’t even necessarily initiate it . . . Yes it’s easier for me to manage project load and things like that, but just the way they rely on each other and the way they interact with each other. I think is almost just as positive a benefit . . . working with a different . . . designer every time, you don’t really have that same bond.”

Interdependent teams acknowledge their differences as individuals as a motivational factor, which results in higher levels of team member caring of others, accepting of each other, and also more flexible.

• “Everybody’s very understanding, flexible, etc., to where as long as you’re doing what you need to be doing and getting things . . . getting your work done you’re pretty much let be to do what you need to do.”
• “They work with these guys so often . . . they more care about what their team thinks, so they don’t want to let one of their teammates down. . . . That's the motivating factor.”

• “We got it in on time, made a good profit, but that was just because . . . I think . . . because of the fact that all the members on the team, they knew each other so well, we were able to work very efficiently.”

3. Stability of membership sufficient for learning to work together
Stability of teams requires an investment of both time and discipline, (Katzenbach & Smith, 2015, p.41), as was discussed in Chapter 2. Each of this firms interviews were filled with stories from employees of only three years to over 30 years, where teams flourished together because of their longevity. Many of the interviewees told me that they were at the firm “my whole career.” One told me: “We are with individual teams that continually work together on all projects . . . so you build that relationship with everybody and you understand how everybody works, how they like things, and how your personalities mesh . . . the most efficient way.” Another said:

Essentially for the first four years I had the same (team). . . . One of the things that really drew me to this company was the fact that there were so many young people and there were relationships that could be born basically out of the office that carried into the office . . . so with that team structure that we had built and of that rapport with each other . . . that basically we knew each other’s style and everything was consistent.

The turnover of this firm was reported to me as being low, I did find it interesting that when people leave, they leave on good terms and often return:
• “He was on that first team with me, and then left and came back again. . . .

There’s quite a few. . . . Most people leave on fairly good terms . . . not everybody but . . .”

• “He left for a year and a half and then came back.”

• “The longer that they’re together, I mean my team . . . [the more] they’re very reliant on each other.”

4. Team composition is small with collective skills and support to achieve goals

The ideal team was consistently communicated through the interview, where there was a project manager (PM) as the team leader, then two members for each of three disciplines, plus a construction administrator (CA) and usually a secretary for support. Therefore the core design team is five to six members and total of nine members. The PM is out of the office with clients roughly 50% of the time and usually has one of the core team members lead the design effort. The firm operated with three larger teams in the past and then consciously decided to transition into seven or eight smaller team several years ago: “We went from really big teams to smaller teams to be a more manageable size and be able to handle the workload and get the interaction that you need to have with everybody.”

Smaller team composition encourages members to help each other be successful.

He decided to stay late and help me and I say . . . okay, great . . . the small team structure I think really encourages that. . . . I saw that a lot when I was a designer, we would always work late and work for each
other and had a great relationship. . . . That’s the strongest benefit of this team size.

As the firm grows, teams expand to as many as twelve and then split into two groups of six. This growth cycle can create weaker teams without a team leader when the PM is out of the office, or a specific discipline skills gap. These skill gaps increase the difficulty with cross-team sharing:

- “Some teams are stronger than others to where they might not have . . . a person that they go to, to help them . . . that kind of depends team to team.”
- “I do have a younger team. . . . don’t know if it’s a millennial thing, but it tends to be pretty easy for designers to get off path…”
- “There’s a definite lack of mid-level electrical guys around. . . . We struggle with is consistency in the electrical discipline for sure.”
- “I can just tell you . . . to those guys it’s a downer. They think they’re wasting time. . . . They’re going to blow the budget on their project and yeah, it’s bad.”

5. Clearly defined and communicated team based goals and rewards

There are production meetings on Monday with each department, which includes a one month look ahead, then the PMs and Operational Manager meet Monday at lunch to workout staffing support. PM in the AM, then lunch time resolution: “We’ll talk about this in the Monday production meetings where we kind of go over everybody’s schedule and track manpower.” One interviewee describes meetings this way:

Monday we have our production meetings . . . so every team sits down separately and when it gets to the point of our own team can’t do it, all
of the managers have a meeting around lunch time to try to get help from other teams.

The response from interviews was that project kick off meetings were usually held with the entire team and one PM puts a strong emphasis on these team meetings due to a story he told me, where poor communication caused client issues:

I schedule a kick off meeting with my team on probably ninety . . . ninety five percent of my projects . . . [the former PM] would email me the next day and tell me . . . oh crap, we’ve got something due. . . . I’d have go into his office and find where he left all his notes and kind of try to catch myself up. . . . I know it’s not possible to get started without really much information… my team likes and appreciates that so we try to do that formally.”

There was also a common message that client satisfaction and quality took priority over profits, where “client loyalty is our biggest goal,” also summarized as follows.

They’re implied goals all the time with completing the project on time. At the end of the day have a good design and successful project with a happy client. I mean, that’s pretty much a goal. And then secondary but still important is hopefully that we made money on the project as well.

There was a common message that project budgets are the responsibility of the PM and are not shared with the team to not burden them and ensure that time is charged accurately.

- “Don’t really share it with the rest of the team because I don’t want to overwhelm them with other things to think about.”
• “I’ve budgeted this many hours but we want truthful of how many hours are going to that job.”

• “We just do the work to get the job done right and then we hope that the fee was enough. . . . We’re not going to shortchange a client. . . . We know that we want the next job and the next job.”

• "We share a lot more stuff with the project managers than we ever had before.”

When a PM was asked if there was significant variation in profit, the response was yes and that “you can always cheat the numbers. . . . I don’t see any benefit to that.”

A few potential concerns were raised regarding the communication of hours:

• “We have had known of a couple people that have either been laid off or moved teams because they took too many hours.”

• “The people that are slower and that’s just more emphasized when we have our reviews.”

When asking most firms about recognition, I heard the very common response that “there is not a lot of recognition.” I did discover from several interviews that that this firm has a budget for team recognition where the team leaders celebrate project success with a lunch or dinner.
6A. Group norm of psychological safety and values: respect and care
Psychological safety starts at the top of the organization and the leadership team set the tone of the organization as several employees articulated. Senior Leadership regularly discusses the firm’s core values in actionable terms, “from the way that our guys answer the phones, I want them to be polite and be helpful.” Employees know if the leadership team is invested in them as individuals, as this employee states:

Whereas I know that the partners and the senior staff do care about us . . . they try to do a lot of things . . . regards to health insurance and benefits that we get, to the different parties that they’ll throw . . . all those kind of things, so there’s a lot of effort put in by the partners and senior staff to making it an enjoyable place to work.

The most important step in psychological safety is giving employees a voice and building trust:

- “I would say most of the time conflict is handled to where at least everybody has a chance to voice their concerns about it.”
- "They do a good job of picking me up when I'm down, and I do the same… we have a good trusting relationship."

The significant growth and expansion of teams, which leads to the split of a team into new teams, seems to have changed the culture in a few outlier comments: “I feel like praise is private, but when there’s a mistake made it’s not so private . . . so I feel like we’re a little bit too heavy on the negatives than we are on the positives.”
The process which people join the firm and leave a firm can play an important role in psychological safety. A common trend appears to exist among these firms as to how people are hired and let go, which will be further explored in Chapter 5. In almost every interview I was told stories of hiring people for cultural fit and professionally executed terminations that reinforce accountability. A consistent process emerged to help struggling staff before they are dismissed. First is that if an employee makes the same mistake multiple times, then they are formally notified. I was often told of additional training and mentoring provided and that employees often move to other teams. There were many stories where these first steps helped the employee get back on track, yet other stories ended in respectfully executed terminations:

- “If you start to build and you can determine the character of the person you can determine if they’re a good fit.”
- “There have been people who have been let go because of either they just don’t care or they just can’t get it. . . . There are consequences eventually.”
- “I desperately want things to work out but . . . because you know if it doesn’t work out then you’ve got to go through the whole training period again . . . so you definitely want to try to make it work out if you can, but sometimes there has to be a change made or else you’re beating your head up against the wall.”
There was one story of a resignation, where a former employee knew that he was struggling and after getting additional help, determined on his own to leave, and the firm assisted him with a dignified transition. Here is a quote from the manager:

That this wasn’t working out for him . . . and (we) were having discussions about this . . . and then the next week basically he put in his two weeks . . . [and said] “Hey, I’m just being fair to you guys.” . . . and I thought that was one of the most professional moves I’ve experienced in my career.”

6B. Conflict and accountability enables continuous learning and innovation
A psychological safe environment supports constructive conflict and increases employee accountability (Edmondson, 2012, pp. 144–145), as previously discussed. Therefore an important finding is that firms expect to encounter conflict and look to the contextual situation for process changes. Here are a few comments anticipating conflict with a lens into how conflict becomes a learning tool.

- “I want them to be kind of a messy little family, that they're not afraid to have a fight and at the end of the day can still respect work together.”
- “Just our people that . . . I’m really proud of. . . . We all work together well, we have our conflicts but there’s no knock down, drag out. . . . They’re all very honest guys, trustworthy.”
- “There’s a lot of conflict when you’re really, really busy and you got deadlines and this and that and there’s people that don’t know which project’s working first and just on and on.”
Leadership takes responsibility for working things out and believes there’s no point in blaming others: “With the workload we have there is gonna be mistakes. . . . I’m not gonna throw anybody under the bus. . . . If it was a mistake that was maybe I didn’t tell them clearly enough.” One person said:

I’m under the belief of I don’t really try to really get hard on someone or yell at them or anything like that. That doesn’t usually get you anywhere. So it’s all about constructive criticism or letting them now. . . . Hey, we need to do things a little bit different.”

Another commented that “it might just be a trickle down affect . . . that there isn’t anybody being hard on someone but has tried to help them when they need help and let them know better ways to do things.”

A common finding in these firms is that they anticipate mistakes and create “multiple checking processes” where mistakes and failures constructively become process changes of continuous improvement. There is a quality department that reviews all of the major projects and 75% of all projects, and then uses the feedback to communicate lessons learned at departments meeting and to update the specifications.
7. Unique generative ideas and other findings
A unique comment that I heard at several firms and witnesses as a practitioner is that engineers get promoted and sometimes find themselves missing their previous work or team relationships. One of the other firms told me similar stories and had a senior person return to a technical role and made a significantly positive impact.

- “To be honest, I don’t get to do the things that I want to do . . . and I mean, I say this all the time to some of the folks, but I mean I could do that but I wouldn’t be doing what’s best for the firm.”

- “But I just . . . I guess I needed the nudge. But now that I’m here it’s not so bad.”
Chapter 5: Discussion

Team Research Discussion
Chapter 5 will provide further evaluation and interpretation of the results in Chapter 4. The first discussion will focus on how I needed to iteratively continue to go back through the data and live with it for periods of time before hidden truths became apparent. As I presented my findings and 65 themes to two of my committee members, Kate Allen and Gus Gustafson, nine major themes emerged. It was at this same all-day meeting with them in the Denver airport that they recognized similarities to the scholarly model in Collins’ 2001 book *Good to Great* and the practitioner-based model in Lencioni’s 2002 book *The Five Dysfunctions of a Team*. A preliminary team-centric model was developed, yet as my committee helped me to realize, additional research on the causal chain of performance is required. My intent is to separately pursue the development of this model after completion of this dissertation. The second section of this chapter will provide further discussion on the nine major themes and six operational differentiators connecting my data results with literature. The third section will directly address my hypothesis statements. The last section will then focus on the dialectic forces which create culture balance through the overlap of psychological safety, interdependence, and shared accountability.

Criticality of an iterative process
The value of the text, audio, and notes were tremendous from multiple perspectives. During each of the interviews I took notes and caught many of the big ideas, yet was
surprised at how much that I would have missed without the audio and video recordings. The missed information from my notes can be categorized into two areas. I recorded what I believe to be rather good notes and attempted to capture key words, yet my notes contained far less words and often missed specific words which would turn out to be critical during coding. Having full interview text, derived from the audio, greatly assisted in maintaining the integrity of the specific wording which interviewers used. The second category of missed information was voids within stories from the text and my notes; holes which I had not noticed during the interview. Several of these pieces of information became critical to understanding deeper meaning within the responses and stories. The best example of this information void would be the difficulty many interviewees had responding to inquiry about conflict.

The video was important for the several times when the audio was not clear or one interview when the audio failed. I went through the audio converted to text six to eight times and each time found different information. The first time which I went through the text as part of first order coding, I found myself focused on the contextual response as to understand the specifics of the story. The second and third time back through the text, I was catching things which were much less obvious, such as parts of the question which appeared to be avoided. My interview questions address topics such as innovation and conflict through a series of questions. Sometimes the initial
response changed with additional probing and stories provided much greater insight into hidden artifacts and assumptions within their culture. Using the inquiry about conflict or failure again, the initial response was often that we really don’t have that here, yet additional probing in several interviews, revealed a story and specific actions taken by employees or management. Actions provided context which often was not consciously recognized by the interviewee and further discussed in the next section. The audio converted to text was the primary source of discovery and yet the video provided a unique perspective. Tacit assumptions and hidden meanings emerged directly from the words of the text, yet a more enriched meaning came from watching the video. The video recording allowed me to relive the interview in a more realistic setting by watching the body language, seeing facial expressions, and observing periods of pause, when the interviewee appeared to struggle with articulating a response. Through this cognitive struggle, they appeared to be traveling back to the time of their story and take on the emotional state which they were experiencing at the time of each event.

Integration of Major Themes and Operational Differentiators

Research contribution and summary
The unique contribution that I believe this research will make is regarding the STEM context. Many other studies have created team-centric theories, while only a relatively few research projects contain empirical data on teams (Dinh, 2014), yet I could not find a single study focused on the STEM industry design team contextual
environment. Unique to the STEM design industry is a paradox where projects require a very high level of collaborative integration of knowledge and skills from the engineering and science based fields of study, yet engineers and scientists in general score lowest on socio-cultural and emotional intelligence (EI) competencies required for effective collaboration (Joyner et al., 2012; Taylor, 1997). Engineers alternatively scored for personality traits associated with the negative emotions of fear, anxiety, and anger (González-Pinto et al., 2003) as previously discussed in Chapter 2. Therefore engineering environments may need external coaching and additional structure to initiate socio-cultural activities such as collaboration, and then achieve higher levels of success dealing with conflict due to their high resilience to negative emotions such as anxiety.

Chapter 4 presented the detailed in-case findings, and then discussed the major themes and the operational differences associated with COE firms as separate findings. The following section will discuss these major themes and operational differentiators together, expand on the interconnectedness between the themes, as well as refer to previously sited literature. Table 11 includes the major themes and aligns the operational differentiators.

**Integration of themes, differentiators, and literature**
This section will integrate and summarize the major themes and operational differentiators, as well as connect these finds back to literature. Most of the references
and citations were previously unpacked in Chapter 2, while additional literature has been integrated into the discussion based on the data results.

Table 11. Themes and Differentiators

<table>
<thead>
<tr>
<th>Major Themes</th>
<th>Operational Differentiators</th>
</tr>
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<tbody>
<tr>
<td>Structure</td>
<td></td>
</tr>
<tr>
<td>1. Structure of small stable teams and external support</td>
<td>2. Technical leadership is symbiotic and equal in stature to business leadership.</td>
</tr>
<tr>
<td>Goals</td>
<td></td>
</tr>
<tr>
<td>2. Team-centric performance goals</td>
<td>1. COE firms entrust their employees with financial performance information.</td>
</tr>
<tr>
<td>Care</td>
<td></td>
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<tr>
<td>3. Care for mission and others leading to mental value formation</td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>4. Trust and values alignment</td>
</tr>
<tr>
<td>Interdependence</td>
<td>5. Team member interdependence</td>
</tr>
<tr>
<td>Accountability</td>
<td>6. Shared accountability</td>
</tr>
<tr>
<td></td>
<td>3. Team-level accountability drives the process of joining / exiting of members.</td>
</tr>
<tr>
<td>Conflict</td>
<td>7. Conflict resolutions were constructively achieved through discourse.</td>
</tr>
<tr>
<td></td>
<td>4. Conflict unites and energizes teams rather than bifurcating them</td>
</tr>
<tr>
<td>Continuous Learning</td>
<td>8. Commit to continuous learning</td>
</tr>
<tr>
<td></td>
<td>6. They target the more complex end of their markets.</td>
</tr>
<tr>
<td></td>
<td>5. Recognition emerged through team-actualization and peak performance.</td>
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</tbody>
</table>
Small stable team with external support conditions

The foundation of performance in these firms started with fundamental conditions and a structure (Hackman, 1987). I have seen as a practitioner the value of small teams and how stability is essential to create a bond between the members, which has been reinforced through both my findings during this research. As one interviewee stated: "If you get like ten people, you start getting side conversations . . . people stray off topic." The value of small teams is also supported by Chapter 2 literature review citations (Gibb, 1951; Hackman & Vidmar, 1970; Kameda, Stasson, Davis, Parks, & Zimmerman, 1992; Wheelan & McKeage 1993; Katzenbach & Smith, 1993, 2006, 2015; and Wageman, 1995, 2001a). Analysis of over 40 interview responses revealed an effective team size range from only two to three members to as high as eight members and a project manager. The most common response for effective teams was between four to six members, which exactly matched Wageman’s (1995) findings. Small teams spent less time in the stages of development, reaching the performing phase much quicker (Tuckman, 1965), and therefore be more responsive to their clients. Design projects across these firms would often necessitate a working group of 20 or more members. Large working groups reported having multiple teams where some members sit on multiple teams for communication. The lead electrical for example, would have a team of 3 to 4 members focused on the electrical design with one of the members also part of the Revit team, (Revit is a software tool), and another member responsible to collaboration with the mechanical team.
The critical finding for COE firms is that technical leadership created a network of support which allowed teams to remain small and yet obtain support when required. The technical networks were symbiotic and equal in stature to business leadership. It’s important to note that these external resources are not part of the core team as they did not go through the developmental stages from the start and will probably not be present at the end of the project. When team members are removed or added, then the team must go back through the developmental stages and therefore increase the risk of failure. Stability of teams requires an investment of time and discipline, (Katzenbach & Smith, 2015, p.41); therefore trying to integrate new members will usually disrupt the team’s effectiveness. External support will work best if this added person connects to the core team through one of its members. Team members reported being on multiple teams and multiple projects, while maintaining their original roles and responsibilities. My personal experience as the general manager of nearly 300 engineers and working with hundreds of other firms over 30 years, suggests that that changing team members is the most violated of all 12 of Hackman’s conditions for effective teams. One of these firms confirmed the need for small teams: “We went from really big teams to smaller teams to be a more manageable size and be able to handle the workload and get the interaction that you need to have with everybody.”
Team-centric performance goals
The next foundational conditions discovered in these high-performance teams is that they collectively understood the firm’s over-all mission, as well as team-centric performance goals with common comments from interviewees, such as: “Everyone’s working toward the same goal.” Interviewees clearly articulated their own identity as an integral part of the team as defined in *The Social Identity Theory of Leadership* (Hogg, 2001, p. 186). The operational actions observed within the COE firms is that they taught employees the business side of the firm: “Everybody is made to understand how we make money and our clients make money” and financial performance information metrics were communicated to all employees on a weekly basis, as one interviewee stated, in a “productivity report that goes out company-wide . . . to every individual every week.”

Care for mission and others leading to mental value formation
The employees from all of these firms were passionate about the type of work. The word love was used 29 times with a few examples: “we’re here because we love this stuff”; “people fight to get on this project . . . they love working on the project so that would be my best example”; “they love doing it ’cause it’s different and it’s fun”; and simply “I just love what I do.” Employees cared about successfully completing their mission and they also cared for each other: “I love the people, we have good quality people”; “They more care about what their team thinks, so they don’t want to let one of their teammates down . . . that's the motivating factor.” Caring started with leadership: "Principals ready do care for them as people." When I asked how they
knew they cared about others or the mission, responses usually included that they were thinking about how to help each other: “I’m thinking I wasn’t involved in this but I know.” Care is a motivating factor and also can be framed as interpersonal commitments and an accelerator of performance: “Fueled by interpersonal commitments, team purposes become even nobler, team performance goals more urgent, and team approach more powerful” (Katzenbach & Smith, 2015, p. 64).

I found that care for mission and team mates initiate mental altruism where people become aware of the needs beyond their own. These team mates reported thinking about what is good for the team and what they value as positive influences toward success. These cognitive ideas emerged into discussions as they begin to socially construct a better reality and align mentally formed values into group norms. Interviewee stories informed me of their commitment to voice opinions: “In our profession it’s kind of important to speak your mind,” and “I would almost feel obligated . . . we’re in kind of a world where ethics are . . . important.” Giving voice to one’s ideas and driven by ethics to building trust among the members: “Communication and transparency . . . leads to trust.” Trust was then reinforced through the action of open communication: “People who are going to entrust you with that kind of communication,” and “it’s pretty easy to have that faith and trust.”
**Trust and values alignment**

Trust is foundational to these firms who often referred to team members using a family metaphor: “There's a high level of trust in who you’re working with. . . . They're not going to let you down, and you feel you can't let them down . . . family”; “when you get that feeling . . . understanding who people are and who they belong to, I think that makes it a lot easier to trust.” Trust becomes a legacy: “Our mentors and our supervisors are still here working side by side with us and so you trust . . . and you want that next person to trust you along that same way too.” As the teams communicated and built trust, a newly co-constructed team identity emerged (Goffman, 1959, P80) and value were aligned. “It was our values . . . so I’d say those are just words on the wall but they’re not. . . . I’ve been here (many years) and would say those drive most of the decisions we make.” Trust and values alignment lead to experiences of success and mutual successes then give the team energy which reinforced their commitment to each other and formed a culture was built on values and trust. These strong cultures formed employees: “I’ve seen people adapt to the culture. . . . They did actually adapt the way they thought about . . . how you treat people . . . ’cause (we have a) values driven culture.” Not everyone can adapt to these cultures as one leader informs employees: “If you don’t honor our values and if you don’t believe in our mission, you don’t fit and that’s okay ’cause you fit somewhere.”

**Team member interdependence**

The projects these firms deliver require a wide diversity of skills: “there’s a lot of different skill sets needed” and “everybody seems to have a niche and a particular
skill set that makes each person unique.” The work requires a high level of sequential iterations, defined as a structural type of task-interdependence in *The Meaning of Interdependence* (Wageman, 2001a), which leads to team cooperation and then behaviorally interdependent as a non-linear step function (pp. 17–18). Leaders of these firms create structural interdependence through alignment of people and positions: “So one of our objectives here was to be able to analyze skill sets and where strengths are . . . put people in the right positions”; “I think that’s a big part of my job is to make sure people feel close and connected”; and “We need to make sure people are collaborative and respect each individual’s contribution.” Teams depended on their extended technical network of support based on the skill set strengths of each other: “need a certain skill and you know the people in the office that have those skills you just kind of reach out to them.” Teams then “interpret the demands of their environment and act instrumentally to meet those demands” (Wageman, 2001a, p. 19). I observed at times as a practitioner and also in these firms, an extremely important and pivotal point where teams became more efficient by aligning tasks which best fit their skills. This synergy of skill sets and sharing of tasks further increased their effectiveness and efficiency.

**Shared accountability**
Stories were told where design decisions were made collectively as no one person had all of knowledge or information: “All of us only have a piece of the puzzle.” Employees then reported collective decision making: “We had a group meeting and
collectively solved the issue” and “at the end of the day came up with a handful of options that we collectively selected the best,” which led to shared accountability. “We're a family, we've got each other's back. . . . We're accountable to each other. . . . It's very hard to explain.” Their collective disposition and strong cultures drove accountability: “Those mistakes you found, if you don’t take accountability for those you’re not fitting the culture of our whole team and those people stood out right away. . . . Very obvious that they did not fit our culture.” Employees with a collective disposition were molded by culture to integrate into their collaborative processes while others with individualistic disposition could not adapt (Wageman, 2001a, pp. 23–24) and usually resigned or were terminated. When I asked the over forty interviewees about accountability and who was to blame when mistakes occurred; they overwhelming responded that mistakes were a result of several events including several members. A critical operational observation of accountability in the COE firms came through stories of how employees were hired based on culture fit: “That meant a lot to me. . . . I really needed to hear that they stuck to their guns on hiring and encouraged me to do the same as I moved into that role.”

Conflict resolutions were constructively achieved through discourse
Conflict is often considered a negative event and something that most teams avoid. People naturally have a tendency to blame other people more than consider the contextual conditions and circumstances of the situation, (Ross, 1977), and then tacitly assume that they know the motivation of others and act erroneously (Argyris,
1993). These firms demonstrated the benefits of psychological safety, driven by trust, where employees spoke up, engaged in constructive conflict, and demonstrated higher levels of accountability (Edmondson, 2012, p. 126). “I would say most of the time conflict is handled to where at least everybody has a chance to voice their concerns about it.” Observing employees unified through conflict and diversity indicated a higher stage of team development. These findings are supported by Bennis and Shepard (1956) in *The Theory of Group Development*, where team members are able to clarify assignments and engage in group-shared goals (p. 417). Discussed in Chapter 2 and briefly at the start of this section, the personality traits associated with engineers and other STEM disciplines will most likely increase the difficulty of initiating collaboration as a result of lower socio-cultural skills (Joyner et al., 2012; Taylor, 1997). Conversely, engineers will naturally overcome negative emotions of anxiety and anger when dealing with conflict (González-Pinto et al., 2003). Avoiding conflict becomes a barrier to learning and higher levels of performance. Care and trust become mediating factors such that members realize that conflict is not personal and look at conflict through a different lens. Other interviewees were completely oblivious to conflict as one employee told me: “I don’t know. . . . I obviously haven’t seen a whole lot of conflict.” Then after several more probing questions and hearing how this person’s team makes collaborative decisions, this person was surprise that they had not concisely considered conflict: “I haven’t had . . . kind of weird now that you mention it.” I believe this interviewee demonstrated the *fish-in-water*
phenomenon. The fish-in-water phenomenon, a metaphor for an individual’s environment that has become so routine and constant, that the individual doesn’t realize the existence of the conditions or events.

Commit to continuous learning
Trust and care appear to remove interpersonal anxiety usually associated with mistakes and conflict in these firms. “Principals are always very understanding about mistakes . . . makes me think it’s a learning experience.” Interviewees reported conflict resolution . . . as learning new skills, as one person referred to new skills as tools: “I call it my personal tool box.” This hunger for learning appeared to facilitate higher levels of behavioral interdependence where employees reported embracing conflict “daily.” Teams in a high-tech and ever evolving environment, who were able to see conflict, mistakes, and failures as ways to improve process and gain knowledge; evolved into a sustainable continuous learning stage. Continuous learning was operationalized by COE firms over time as they attracted the brightest people and targeting the more complex end of their market, which further attracted the brightest people and the cycle continues. “There’s just a bunch of really intelligent people and I’ve just been really impressed with the knowledge base. . . . It’s pretty amazing.” They developed tightly controlled processes for routine work efforts and more interactive processes for complex work efforts as evident in the Process Knowledge Spectrum, (Edmondson, 2012, p. 33), discussed in Chapter 2. Design processes are most often complex and iterative and COE-firm staff learned to work beyond their
comfort and then engage in coaching for fast learning as this young engineer explains, “take it as far as you can, challenge yourself a little bit ’cause it’s the fastest way to learn . . . that we’ve had good experience with.”

Team-actualization and peak performance
Employees became animated as they told stories about amazing teams they were part of and reported being at their personal best achieving self-actualization. These stories included events of self-sacrifice and self-denial, where a team-centric identity emerged and yet their own identity becomes more salient (Bennis & Shepard, 1956). Examples included finding better work-life balance after these events. The most uplifting finding from my research was realized when many of the interviewees recognized that their greatest personal reward came through helping others and achieving a collective goal. Responses to my inquiry about recognition and reward in COE firms were fill with personal growth and helping others: “One factor of the success would be that everybody feels rewarded to having work on it, they’ve learned, they’ve grown, and their happy.” The reward of learning and collective achievement removed the conscience motivation for personal reward: "We're working as a team and I guess I don't see a need for individual recognition." I observed through these stories a mental framework of Servant Leadership where employees were initially in service of others, and then through the act of service they found personal growth (Greenleaf, 1977, p. 21). I referred to this as team-actualization.
Hypothesis Statements Revisited

Complex interdependent engineering context
The hypothesis statement at the conclusion of Chapter 1 is restated: Teams, as opposed to an individual or the organization, are the fundamental units of performance.

This dissertation focused on the complex environment of engineering firms where the design input-tasks are near the high end of structured interdependence. In Chapter 2 the socio-economic factors were presented suggesting that companies are shifting toward a more collaborative style of business in a global economy. Socio-economic factors presented included: asset shift to human intellect, generational cycle back toward collectivism, career choices focused more on meaning and purpose, up-cycle employment driven by STEM disciplines, and shared leadership. It is within the context of these environments where I propose teams to be the fundamental unit of performance. Chapter 2 also discussed the need to groups in companies where individuals work more independent and the effort required for team development is not worth the investment. Organizations of the past functioned primarily with work-groups and a lesser number of teams. I believe there will be a significant shift in the 21st Century where organizations will dominate by teams due to the above mentioned trends. There will always be the need for work-groups and independent tasks within organizations. Teams will not be the fundament of performance for organizations where the majority of work-tasks are not interdependent.
Are teams an organization's fundamental unit of performance?
This first section will present favorable response to this question and the following three sections will respond to each of the three hypothesis questions and variables. The hypothesis statement suggests that teams, as opposed to an individual or the organization, are the fundamental unit of performance. I believe that this research provides strong support that teams have a mediating influence on individual members and also the firm, whereas the mediating team influence exceeds individual influence. These mediating factors are shown in Figure 15.

Figure 15. Individual, Team and Organization Mediators
Individuals and individual-actualization
All five of these interview groups had developed successful teams and the team members usually reported having a stronger identify with their team than they did with the organization, as proposed by Barker and Tompkins, (1994). There was a very strong influence of the team on individuals who reported reaching self-actualization as a result of being a team member. There were several stories where individuals changed teams and became successful, therefore changing teams and not the organization resulted in individual success. These findings therefore support a strong mediation of team influence on individual flourishing as represented by ++ and support a low mediation of individual flourishing by the organization as represented as a zero in Figure 15.

Organizations and organizational performance
The COE-firm employees reported that individual goals and metrics were educational and skills based, where project team goals were primarily financial and aligned with the overall firm goals of performance. Employees also reported that individual mistakes were anticipated, yet team-level processes were in-place to ensure individual mistakes were corrected by the team. These finding strongly support the proposition from Chapter 1 that individual goals and metrics are too small and granular to drive organizational performance when compared to team-level goals and metrics.

Team level goals and metrics operate at a functional level which can be independent. For example, one project executed by a team is an independent work product
compared to an individual’s work product which is interdependent of other work-products. Team-level goals and metrics are also proposed to be more influential than organizational factors based on teams being a smaller unit to control. These firms created and monitored more team metrics and performed better than the median firms, therefore the data supports team metrics as mediating organizational performance, yet there are no additional compelling findings comparing team metric influence to organizational metric influence shown with a + in Figure 15. The data therefore supports a low mediation of organizational performance by individuals as represented as a O in Figure 15 and also supports a strong mediation of team influence on organizational performance as represented by ++.

Figure 16 provides a conceptual graphic where COE firms are referred to Great firms and indicate a high level of team and organizational performance metrics and a lower individual level as noted above. Cappelli (2015) supports these findings (p. 59) where companies like Microsoft, PwC, and Deloitte are moving away from employee rankings and individual performance reviews, as discussed in Chapter 2.
Poor performing firms are shown with moderate level of firm metrics and a much lower level of metrics at the team and individual levels. Median firms indicate an increase in both firm-level and individual-level metrics yet lower team level metrics. These conceptual curves are supported by five independent sources. The first source is the data of this study. The second source is PSMJ’s findings (PSMJ Summit, 2015) where firms who benchmark against the industry and their own performance from previous years will out-perform firms who do not. The third source is using academic research as a surrogate measurement for a median firm’s use of metrics; where
organizational and individual empirical studies exceed team-centric studies (Dinh, 2014) as indicated by a U-shaped median-firm curve. A forth source of support is where a clear set of team goals and team rewards were found to be the two of the top three factors of team performance (Wageman, 2001a), therefore supporting the higher team-centric goals and metrics shown for the Great firm. The fifth source supporting all three conceptual curves is nearly 100 years of practitioner experience shared between me and advisors, where individual metrics are in conflict with organizational performance and team-centric metrics were rare.

**Hypothesis test variables: Small stable team with support**
Hypothesis question number one is repeated below and the following discussion has been entered into Table 12.

1. **Firm structures where members develop interdependence, with small stable teams and dynamically managed support to obtain sufficient skills and capacity, will perform better than firms with project teams where members work more independently with less team boundary definition.**

This first question has several variables associated with team boundary influence of firm performance: interdependence, small team size, stable environment, and sufficient support. The data collected showed strong support for team size. There were many specific quotes in Chapter 4 where team members and project managers reported the benefits of a core team of four to six members, while the suggestion of too big of a team was with ten members. Stability was also supported by the interview data. Employees often commented on having the same mentor their entire career. The
few times when reports were given where employees changed teams often, there were corresponding negative reports of burnout. Sufficient support likewise strongly supported by the teams were additional production capacity and technical expertise was available, compare the interviews where cross-team support was not available.

Table 12. Test Variable Summary

<table>
<thead>
<tr>
<th>Test Variable</th>
<th>Findings</th>
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<tbody>
<tr>
<td><strong>Teams are fundamental unit</strong></td>
<td><strong>Strong support for individual, possibly firm</strong></td>
</tr>
<tr>
<td>1.1 Small team size</td>
<td>Strong support</td>
</tr>
<tr>
<td>1.2 Stable environment</td>
<td>Strong support</td>
</tr>
<tr>
<td>1.3 Sufficient support</td>
<td>Strong support</td>
</tr>
<tr>
<td>1.4 Interdependence</td>
<td>Strong support and barrier to high-performance</td>
</tr>
<tr>
<td>2.1 Psychologically safe</td>
<td>Strong support</td>
</tr>
<tr>
<td>2.2 Accountability</td>
<td>Strong support, especially shared</td>
</tr>
<tr>
<td>2.3 Continuous learning</td>
<td>Strong support</td>
</tr>
<tr>
<td>2.4 Innovation</td>
<td>Support</td>
</tr>
<tr>
<td>3.1 Clearly defined team goals</td>
<td>Strong support, highlighting regular status communication</td>
</tr>
<tr>
<td>3.2 Team goal alignment</td>
<td>Strong individual &amp; team alignment</td>
</tr>
<tr>
<td>3.3 Recognition and reward</td>
<td>Strong support for collective achievement</td>
</tr>
</tbody>
</table>

I believe the last variable in hypothesis question number one is the most critically supported variable of interdependence. The team and cross-firm teams who worked independently, demonstrated a much high degree of difficulty associated with conflict resolution, which became a barrier to high performance. The teams which shared
tasks with cross-firm teams, had a very positive attitude toward their contribution and indication behavior interdependence based on friendships and family type bonds.

**Hypothesis test variables: Psychologically safe, accountability, and continuous learning**

Hypothesis question number two is repeated below and the following discussion has been entered into Table 12.

2. **Firms who establish norms of a “Just Culture,” where psychological safety enables cognitive space for developing new ideas and a continuous learning environment at all staff levels, and also where conflict and failure become an integral part of innovation and accountability, will achieve better firm performance.**

This second question has several variables associated with team relationships and firm performance: psychologically safe, accountable, continuous learning, and innovation. A psychologically safe environment was strongly supported by the interviews based on the comments where employees felt unusually free to give voice to their ideas and concerns. Accountability was supported from a shared perspective where processes and team dynamics accounted for anticipated individual mistakes. Almost every interview gave evidence to accountability as a shared construct when related to technical performance, social norms, and hiring. Individual accountability was less evident, yet apparent in many of the stories and specifically terminations of individualist employees. Continuous learning was actually more evident than I anticipated, especially the interviews within COE firms who included clear learning patterns from past mistakes and an evolution of quality checking and quality assurance program improvement. Innovation was evident in only a few interviews
and stronger in one of the COE firms. There was clear evidence to support innovation being a factor toward firm performance while not evidence of strong support.

**Hypothesis test variables: Clearly defined team goals, alignment, recognition and reward**

Hypothesis question number three is repeated below and the following discussion has been entered into Table 12.

3. **Firms who clearly define team goals, that are in harmony with both individual and firm wide achievement goals, then recognize and reward collective team performance, will achieve better firm performance than firms who emphasize only individual and/or firm metrics and rewards.**

This third question has several variables associated with the team’s motivation: clearly defined team goals, team goals not in conflict with individual and firm goals, recognition and reward team performance. Clearly defined goals was strongly supported through the responses that COE firms were very open with both firm and team performance metrics. The additional comment is that the regular communication of the status of these goals and metrics were stated to be a motivating factor toward performance. Individual goals and responsibilities were very clear to employees and were usually based on educational and skill based, where team goals were stated financially as the firm goals were. This indicates a very low potential for individual and team goals conflict. The team goals and the firm goals appeared to be coordinated, yet the depth of my interviews could not confirm this. Recognition and reward was probably the most difficult to access. It was clear that individual recognition was evident for educational or years of service, while not for project
achievement. Project achievements were consistently responded to in a team or firm perspective. An inspiring discovery within my research was that a majority of the high-point projects included self-sacrifice and servant leadership with the motivation being a collective success shared with teammates.

**Team Culture Balance**

The final discussion for Chapter 5 will attempt to capture the widest of all perspectives. My undergraduate studies in electrical engineering required two areas of concentration; one of these two areas was the study of control systems. Control systems engineering is an interdisciplinary area of study within the physical sciences dealing with control variable inputs, feedback inputs, and outs as dependent variables. The common control system has two inputs of equal and opposite force potential. The gas pedal and brake pedal in your car is a simple example where the operator maintains control of their vehicle by applying each of the inputs at different times. An important notation is that the engineer designing the gas-brake control system must allow the user to apply either input for various durations and in any order, therefore actual control is achieved by the skill of the operator. I see this simple physical science system as quite similar to the dialectic behavior forces which keep a team in balance.

A concept which continued to resonate with me during these interviews was how teams maintained balance through paradoxical statements. An example is where
interviewees told me that the mistakes made by individuals were accepted, how hard
they worked to help struggling employees, and yet how their culture of peer pressure
resulted in employees self-terminating.

As I further inquired about these contradicting statements, I began to see two opposite
and equal forces. Observing the gas-brake system at discrete moments revealed the
use of only one input. Observing one employee event likewise revealed only one of
the two contradictory actions: some employees were receiving help while others were
resigning. Observing the behavioral system through many stories advanced my initial
thought of paradox to a systems view of dialectic forces. Inherent organizational
contradictions were explained using a behavioral science lens by Orton and Weick
(1990) as the underlying puzzle with loosely coupled systems theory (p. 205), where
uncertainty and rationality are both observed.

One of the first dialectic forces appeared through team size dynamics. Employees
realized the benefits of a small team while periodically needing additional resources.
If these resources were added to the team, then the team got too big, yet if these
resources were not available, then the team’s performance suffered due to lack of
capacity or skill. Teams that are too large and small teams without support are
common in the design industry. Successful firms create a dynamic system where
small teams obtain external support as previously discussed. Figure 17 includes these opposing needs for a small team and external support.

The second pair of dialectic forces observed was the care for mission and the care teammates. Employees were passionate about their work which drove a commitment to the mission, resulting in sufficient peer pressure, such that people who were not committed to the mission would self-terminate. Employees also cared for their team mates and created inter-personal bonds where additional coaching and training was provided to struggling team mates.

The determination as to when employees were catered to verses when they self-terminated, appeared to be based on their culture and values. A Just Culture was evident where employees felt psychologically safe and obligated to speak up, while also being accountable. Similarly, leaders were unusually accepting of individual mistakes and yet held teams accountable through team level processes.
The last dialectic pair of forces included in this discussion will include the symbiotic balance created by technical leaders who focus on the issues like training and quality, which are most often critical in the long term, creating dialectic balance with business leaders managing cash flow, profitability, and issues which tend to be more immediate.
Chapter 6: Implications

Team Research Implications

This dissertation chapter will focus on the applications of the results discussed in the previous chapters, along with future research opportunities. The first section will explore the research limitations as a single study and associated bias as a practitioner. The second section will discuss possible applications where this research might benefit academic researchers or practitioners and contribute to the team-centric knowledge base. The third section will provide additional research considerations using the audio and video interview data. The methodological approach of Appreciate Inquiry (AI) was used for data collection where open questions were developed to capture stories. I believe this interview data can be further analyzed because these stories went deep into the firm’s culture and far beyond the specific test variables of this study. The final section includes areas of literature which I had hoped to explore for this dissertation and will hopefully be revisited by me someday or taken on by another researcher to continue to build team based scholarly research.

Research limitations and researcher bias

The research limitation that I’ve struggled with the most is how to present, in black text on white paper, the colorful passion and heart-felt sincerity portrayed by the people who so openly told me their stories. As I write about these stories and people; words like care, trust, and kindness appear empty on my pages. Therefore the most significant limitation of this study is that I am not sure that justice has been paid to
the depth of honesty and emotion behind these words. I have gained a profound respect and awe associated with the appreciative inquiry process of asking for stories, rather than responses to questions.

The initial question of each topic during my interviews was often answered with simple responses; quite similar to a quantitative survey. While I believe initial interview responses were sincere, different meanings would often emerge through their stories. A few interviewees realized that their initial belief was different than their action in the story and realized their conscious belief was from a previous reality. This phenomenon was most apparent with questions about conflict. Initial responses often included periods of silence, caused the interviewee to stare into space, or deflected the question. These gestures became clues to hidden message, which I followed up with probing questions. Interviews at times would then reveal a subconscious revelation, not previously apparent. This topic actually came out in a story one interviewee told of his CEO: “If the truth is different next month it’s because you learn something, but if you tell the truth you don’t have to remember what you said. . . . Just always tell the truth.”

A second limitation of this research is that the sample size of four firms was small compared to the estimated 1500 U.S. design firms. PSMJ has over 1000 firms in their 35 year data base, with 300 to 400 firms participating each year. Therefore while
firms drop out of business and other firms’ start-up each year, PSMJ’s 2015 survey data has a very high statistical confidence level of 95% and only a 5% margin of error as shown in Table 13.

My qualitative data was not collected in a format to calculate statistical accuracy; yet using this quantitative process provides a general sense that my data collected within each firm generally represents the firm, while the sample size of only two COE firms and two Median-firms does not represent the field of 66 firms well. These results therefore stand as theory until future research confirms, voids, or modified my conclusions.

<table>
<thead>
<tr>
<th>Table 13. Statistical Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
</tr>
<tr>
<td>PSMJ survey</td>
</tr>
<tr>
<td>COE Median</td>
</tr>
<tr>
<td>Employees</td>
</tr>
</tbody>
</table>

Throughout this document I have noted my 30 years of experience as a practitioner and nearly 100 years of collective experience when adding my two engineering advisor. I believe this level of experience greatly assisted to determine what median firms do and how they operate. The concept of a median firm requires general knowledge of the industry and cannot be observed by visiting a small sample of
firms. These 30 years of experience also provided researcher bias. The blind selection of firms and issuing my results to industry experts for comment assisted to reduce research bias, yet the difficulty with self-evaluation is that bias is hard to find.

Two examples of bias became evident during my research. The first bias came during the initial coding process, where I found myself concentrating on the issues, rather than observation. Therefore it took six to eight times through the text to discover hidden meanings. The second bias appeared during early discussion with my advisors where I had not documented nor was I explaining the design complexity and task interdependence associated with the projects these firms delivered. My experience had been likewise with very complex designs; therefore this context was a hidden assumption I had made. The fish-in-water phenomenon was mention at two separate meetings with my advisory team and this concept helped me to uncover and document the complex conditions.

Other such hidden assumptions may be still unknown to me. Many of my findings were in line with my anticipations and some findings were a surprise as noted in Chapter 4; therefore, a recognized potential bias is that I cannot be 100% confident as to where my experience assisted to discover better results or where my blinds spots remain.
Team Results Application

Immediate application with practitioners
At the time of completion of this dissertation there are several committed uses of this research. A report summarizing these findings and has been sent to PSMJ for review. After final committee approval of my dissertation and PSMJ’s approval of this report, it will be issued to the five participating groups. I have also committed to provide a confidential report for each firm which summarizes the collective findings within their firm, while not disclosing any single employee’s comment. Next I am scheduled to present these findings at PSMJ’s National Industry Summit in December 2016 as part of the key-note with David Burstein. Dr. Gustafson and I have been approved to present these finding at the National ILA conference in November and several other forums are under consideration as well.

Application of family as a team
The Synod of Bishops met October 24, 2015, to discuss The Vocation and Mission of the Family in the Church and in the World. The final report of the Synod of Bishops to the Holy Father Pope Francis included 358 references to the family unit as the fundament and primary source of a better life. Similarly, the United Nations “recognizes the family as the basic unit of society” (“United Nations Global Issues,” n.d.). My research focused on teams and teaming in a corporate business world, yet there is direct application of these team concepts into society. The most influential literate ever written is arguably from ancient times and creates the foundation for the world’s major bodies of faith. What I find fascinating is that the ancient writings from
Christianity, Judaism, and the Muslim faith all support the family as a fundamental human need. The one example I will include is that the book of Ecclesiastes can be found in the Bible, Torah, and the Quran with similar translation to English. It is my hope that the common values and virtues found in the family as society’s fundament team will be a uniting force across the world and religions. I have included only one reference to support this proposal: “Two are better than one, because they have a good return for their labor: If either of them falls down, one can help the other up. But pity anyone who falls and has no one to help them up” Eccl 4:9–10 [New International Version (NIV)].

**Additional Research Analysis of Qualitative Data**
The 50 interviews which were translated into 224,067 total words of text and 442 pages of single spaced text have created a significant resource of data which allows for further research. Previous research conducted by each of my committee members is supported by the results and findings in this data; therefore my hope is to co-author future articles using this data. Examples for future data analysis are then as follows.

**CVDL ROV project**
The Center for Values-driven Leadership at Benedictine University created the PhD program which this dissertation has been written. The CVDL is also leading the Return on Values (ROV) research project in partnership with the Small Giants Community and with help from the Center for Positive Organizations at the University of Michigan. The ROV project is exploring factors of culture and business
strategy can help privately-held companies achieve and even exceed growth expectations, while consistently maintain strong gross margins. These factors are directly addressed in this dissertation: COE firms achieved nearly 200% of the profit and over 300% of the employee growth and Median-firms, through cultures driven by values such as: trust, caring, kindness, and others-actualization.

**Team interdependence**

Team interdependence is a complex construct ranging from task driven interdependence to behavior interdependence. These design firms in the STEM industry provided a unique context worthy of further analysis after the completion of this dissertation. One of my dissertation committee members, Dr. Wageman, has done extensive research into team interdependence. The following overview is based on the context and findings, as well as *The Meaning of Interdependence* (Wageman, 2001b). There are two primary drivers of interdependence. The first driver of interdependence is defined as structural-interdependence where task-interdependence refers to input work efforts and output work efforts are defined as goal-interdependence (pp. 4–5). The second driver of interdependence is behavior interdependence (p. 16).

**Design team context**

The projects these firms do are at the high end of structural task/input interdependence to the point where at least the knowledge of four engineers or scientists are required to complete a design. Project Groups will typically have 12 to 20 members with one core team of three to five members and several discipline teams
with two to three members. Design elements evolve through four phases such that many design elements may iteratively change 20 to 100 times. This level of collaboration is structural type 3 task-reciprocal interdependent (Wageman, 2001a, p. 4). The project members have unique and deep technical knowledge, yet have lower than average social-emotional skills (Taylor, 1997) (i.e. alexithymia is high with engineers - difficulty expressing or perceiving emotion).

Problem statement
Work is highly task/input, continuous, and reciprocally interdependent due to special skill sets. The outcome mandates highly collaborative decisions. The unique social challenge is that engineers often don't collaborate ("a" observed) and are poor communicators, which commonly results in design mistakes. Mistakes often result in bureaucratic check-list type processes that are not efficient. A common leadership error is that managers often reward and promote the project manager (an individual) for an outcome-interdependent of a team effort.

My findings
The COE firms hire people with collective dispositions and the culture further molds them to align with collaborative design processes. Conversely, individualistic people are not able to adapt and feel sufficient peer pressure to resign. Teams start with structural-task interdependence and cooperate (Wageman, 2001a, p. 17), then become behaviorally interdependent emerging as a non-linear step function increase in performance (p. 18). Skill based task input is continuous during the project, yet
behaviors can be discontinuous. The firm’s culture and employee disposition mediate behavior toward being continuous, and then teams “interpret the demands of their environment and act instrumentally to meet those demands” (p. 19). The observable action is that team mates then help each other with the common tasks to speed-up delivery. People were molded by culture to be collaborative (p. 24), yet Individualistic people could not adapt (p. 23) and usually resigned or were terminated.

**Mediating factors**
The mediating factors associated with interdependence emerged from structural skill based task interdependence as seen in Figure 18. Structural interdependence drove behavioral interdependence observed as team member perception and higher work product quality. As teams continued to work together, they helped team mates meet project schedules. This was most evident toward the end of the project where effective time management and increased capacity were critical. The success of meeting client schedules further increased the team’s interpersonal acknowledgement of their interdependence. Team reported that the longer they worked together, the more effective they became. Their interdependence evolved into informal social norms, as well as, formal processes. The very best teams reported shared decision making and shared accountability, which led to continuous learning and continued performance improvements.
The data from my research included significant support for the Just Culture and Knowledge Spectrum developed by Edmondson (2012). All seven benefits of Psychological Safety were found. Employees were encouraged to speaking up, cognitive space enabled clarity of thought, constructive conflict was observed, mistakes and failures were mitigated, innovation was promoted, obstacles between goals and performance were reduced, and accountability was increased (p. 126). These firms developed processes which uniquely fit the spectrum of routine, complex, and innovating work efforts as defined in the Knowledge Spectrum (p. 231).
and discussed in Chapter 2. It is my sincere hope that this data will be further analyzed specifically in support of these two construct such that Dr. Edmondson and I can co-author these findings.

**Team centric model**
The nine major themes which emerged from my research contained what I believe to be significant evidence linking the themes together. A draft model was created based on these linkages, unfortunately there were two critical issues not able to be resolved as part of my dissertation. The most significant issue was that my team-centric model was constructed in a sequential manner where teams had to complete one step or phase before entering the next phase. Team development models from Chapter 2 require a sequential process where the preceding phase moderates passage forward. Many of the nine themes were mediators of other themes such as caring and trust as mediators to the performance causal chain rather than being a mediator within the chain. The complexity of interdependence was also not addressed and requires the separation of structural and behavior factors as discussed in a previous section. Dr. Wageman shared with me a model with Richard Hackman and she used during classes at Harvard University, yet never published. We believe my data supports this model and it is my sincere hope that Dr. Wageman and I will integrate their model and my result for future publication.
Gender difference and team performance
Verdi and Wheelan (1992) conducted a T-group gender study which indicated that multi-gender teams performed better than single-gender teams. As a practitioner I found that teams with both male and female members collaborate better, which is also supported in the mentioned study. The data from this study provides an opportunity to further consider the influence of multi-gender teams compared to all male teams, because two of the interview groups were multi-gender and three of the groups were all male. My data analysis looked for response differences by position and also by gender. The results were presented in Chapter 4 in the in-case findings sections.

Extended Team Influential Literature
My literature research followed six streams of literature across academic, practitioner, and contemporary venues. The following areas of literature were discoveries made during these my literature research and yet not fully explored. The hope is that these thoughts, ideas, and references will assist other researchers and be a source for my future exploration.

Teams viewed as Complex Adaptive Systems (CAS)
During the past twenty years there seems to be a significant amount of research on social systems and complexity. As an undergraduate systems control engineer, I naturally view life as a system; mechanical systems, software systems, the ecological systems of nature, and also people as part of the sociological system. During my literature review I did not found many references which specifically addressed teams and teaming through a systems perspective. This leads me to believe that a gap might
exist in the research area of analyzing teams as independent functional units within a larger system. One of the most successful methods of research came through the exploration of citations and reference lists used by the authors of my existing references. I reached a reasonably high level of confidence that I had not missed any major pools of literature because the citation from these six steams of literature only referred back to previous sources. The following four resources emerged for the sated reference list and would be my point of departure for further CAS investigation.


POS and interpersonal commitment

The work of Professor Kim Cameron, Center for Positive Organizations at University of Michigan, who was a visiting scholar to the CVDL program, and Professor James Ludema, cofounder and director the CVDL program at Benedictine University, heavily influenced my research especially in the area of Appreciate Inquiry. My original research intent was to integrate more POS and AI into a team construct. The following quotes and references would be my point of departure for further synergy with team research.

1. Positive Leadership. (Cameron, 2012) and A study of organizational effectiveness and its predictors (Cameron, 1986).

2. Care and compassion through an organizational lens: Opening up new possibilities (Rynes, Bartunek, Dutton, & Margolis, 2012). This article expands on the influence of positive organizations and has synergy with my discoveries on care.

3. “Strong interpersonal commitments drive a number of aspects that distinguish high-performance teams… Fueled by interpersonal commitments, team purposes become even nobler, team performance goals more urgent, and team approach more powerful” (Katzenbach & Smith, 2015, p. 64).
4. Professor Paul Yelsma interview. “Of the 25 dynamics for teams, the best are culture and care for group . . . must be mindful of the needs for each member . . . [and] forgiveness.” (personal communication, November 18, 2015).
Appendix A: Topics, Goals, and Themes

This appendix included the collection of topics and ideas for my dissertation.

Topics of Original Interest

The seven topics of original interest the past 18 months were as follows:
Dual organizational structure in the Catholic Church allowing the separation of theology and operations. This area of interest started a few years before the values-driven leadership program and drawn from conversation with Bishop Sartain, Abbott Austin, and Father Ernie Norbeck. The issue being address was the great demands placed on clergy, as well as the limited education and experience which clergy have in operational duties.

Second chances. Study the people who made radical life changes well into or late in their career such that they found an authentic-self and alignment with who God wanted them to be. This topic was very personal for me after having a near death experience on November 6th, 2010, therefore investigating the antecedents as to why people made these changes was very intriguing.

Well-being as a global metric similar to GDP (gross-domestic product). The interest here was to look at happiness and fulfillment of the whole person while taking specific focus on individual fulfillment through God and spirituality as both a comparison to and integrated with success in the business world.

Relationship of inequality to social stability, crime, and community wide happiness. A study of affect at the social level with two specific items learned during class. The first interest was to more deeply understand the benefits of limiting inequality across the community, especially on the upper echelon, which in utility benefit as inequity grows. The basic idea here is to study of “doing well by doing good.” The second interest was exploring access to education, jobs, and advancement which we learned were contributing factors associated with minimizing inequality.

Social entrepreneurship of driving profit through socially vision-centered mission. The mindset change for me during the entrepreneurial leadership classes was that philanthropy is not the same as social entrepreneurship and while the mission might align with philanthropy, the process and methodology are very much business like. Professional service firm inflection points. This topic was rooted in both my career as a general engineering leader, as well as the class discussions. I discovered as a practitioner that service firms reach an inflection point near the 200 to 300 person size
where systems dynamics must change, such as, migrating from a more centralized to a decentralized locus of control. This topic continued to appear throughout multiple classes like transformational leadership through the most resent strategic leadership class.

High performance team development in an engineering environment. This topic was the last one to be added to my list and became a bit of a revelation in the sense that there was minimal content in my class journal about teams, yet I had started a separate journal at work where many of the things learned as part of the team-leadership classes were captured in the creation of a team model.

The first two topics related to the structure of the Catholic Church operations and then second chances, were areas of interest that attracted me to the VDL program. The next three topics of well-being, inequity, and social entrepreneurship, came directly from early class discussions and matured over several later areas of study. The latter two areas of professional firm inflection points and high performance teams were equally founded in my interest as a practitioner and student. The last two topics became most appealing when considering a strong desire to apply this research into practical application.

**Intuitive Goals: Passion Driven**

- Meaningful and applicable to current industry
- Ideally used to launch my new career
- Integrating diverse areas of knowledge; ex. engineering science and human behavior
- Answers the question: what can I contribute – a paying it forward philosophy
- Building on past success and new passions
- Must be ethics and moral based

**Themes**

- Spirituality and human happiness,
- Harmonious success of both business and people,
- Teaming: all topics from dyadic relationships to nonlinear performance, and
- Change: building, growing, and entrepreneurial expansion.

**Journals and Topics from Qual1**

The following list of topics of interest from class readings and discussions which assisted in the topic selection. (Bold topics have higher priority.)

- **Networks & change** by Bill Pasmore.
- **Small Giants**: Return on Values study.
- Understanding and integration of Northouse models.
- Dyadic team relationships
- Servant leadership & strength-based team building
- Proverbs 4:23: Watch over your heart with diligence, for your life flows out of your heart.
- Humility & honest create space.
- Team theory: Schein, Bion, etc.
- Team stuck-ness.
- Strong & HP teams – engagement.
- POS revolution & flourishing.
- Groups as a unit of performance.
- **P/N ratio & science**, Fredrickson & Losada.
- Moral & Ethical case studies.
- Aristotle & Plato to Friedman.
- Phases of transformation of firms, Schein.
- Cameron’s discussion on positive deviance & performance.
- Culture told through stories.
- Resonance and neuro-feedback.
- Change, chaos & complexity theory, and loosely coupled systems.
- Larry Griener’s small business, 5 stages of development.
- A.I. process of finding positive strengths, discovered through stories.
- Strengths synergy at team level of analysis.
- Why change fails from Kotter, Fry, and others.
- **Innovation** & Maddock’s idea monkey.
- Joanna-Beth Tweedy’s flourishing and the theology of the body.
- Regenerative human systems.
- Tell me what you do and I will tell you your values.
- Levels of moral reasoning.
- **Transformational leadership** from individual to organization.
- Heartmath and coherence.
- Entrepreneurial business.
- **Inequity’s effect** on all of society.
- Global cultural mindset difference.

**Journals and Topics from Qual1**

- Qual #1 list of journals with topics of interest: (Bold journals have higher priority)
- AMJ – Governance, knowledge, and organizational efficiency.
- AMP – Team relations.
- **AMR** – Organizational theory, change, and development of team.
- ASQ – Theory based organization & academic research.
- HBR – Wide range of current events.
- JAP – Team development, team performance and virtual teams.
- JCC – Innovation, design process, and design thinking.
- JLOS – EI, LMX, performance, POS and reinforcement.
- SMJ – Knowledge transfer, innovation, and performance management.
- OSci – Decision making, group identity & affect, and performance.
- JCM – Change in org. / teams, knowledge, ethics, and “fabric metaphor.”

**Literature Streams of Review from Qual2**

- Developing and Leading High-performance Teams: Literature Review
- Introduction
- HPT Definitions, Theories, and Models
- Defining Working Groups, Real Team, and High-performance Teams
- Theories of Team Development and Performance
- Team Models
- Phases of Development in Teams
- Team Measurement Tools
- Major Factors and Affect for HPT
- Individual and Group Identity in Teams
- Team Member and Leader Relationships, and Shared Leadership
- POS, Gratefulness, Guilt, and other Team Enablers and Detractors
- Ethics, Integrity, and Spiritual Inspiration
- Team Conflict
- Debates and issues

**Personal Value Based Mission Derived from Qual1**

The following statement was developed at the conclusion of Qual1:

Where do I go from here? As an engineer and then engineering manager the scientific method has been a guide for finding natural truth and solutions. My knowledge base of the physical sciences were gained through (5) years of organic slow academic growth followed by almost 30 year of practice. On the converse side of our world is the social sciences of organizational development, behavior science, and psychology. I avoided these classes in college and paid little attention to their value as a young engineer until the point where I was managing teams, where I quickly determined that the times we succeeded and the times we failed were much more determined by humanistic factors related to the social science perspective. The (7) months or more descriptively the 213 days invested in readings over five-thousand articles along with the bi-monthly team discussions have gained much respect, knowledge, and
awareness of the social sciences. As Cohort 2 reaches the end of our first year and with the completion of Qual1, I reflect on the learning experience as quite different that the organic knowledge through collage in my twenties, such that in (7) months I have absorbed and hopefully will retain a similar knowledge based of the physical science that previously took (5) years. Therefore with a strong foot-hold in the physical sciences and this new foundation recently built in the social sciences, my personal goal and mission is to contribute to the bridge between the physical and social science, realizing that the task is so immense and daunting I will need to research for the area where my expertise is unique such that I am able to add a critical piece to this puzzle.
Appendix B: Interview Design

The following document was created as part of my interview redesign based on consultation from my committee and most specifically my trip to Harvard.

**Interview Design Notes**

Interview outline questions are built on the following theories: DRAFT; July 26, 2015

- **Grounded Theory;** where interviews will evolve from an initial hypothesis, based on learning throughout the research. (Glaser & Strauss, 1967)
- **AI (Appreciative Inquiry),** searching for underlying assumptions and beliefs discovered through story-telling (Cooperrider, 2002)
- **Generative theory;** intended to create new and innovative possibilities rather than predictive and traditional (Gergen, 1978)
- **TDS (Team Diagnostic Survey);** testing for the five conditions of team effectiveness (Wageman, 2005)
- **A “Just Culture”** built on psychological safety and accountability. Conflict and learning (Edmondson, 2012)

**Data collection:**

- Case study comparison of three COE (great) firms with three Above-average (good) firms. A minimum of two is required per Eisenhardt methodology.
- The good verses great firms will be selected by PSMJ’s lead research director Kate Allen where the firms will have similar demographics to reduce contextual impact, such as: type of engineering firm, primary customer industries, number of employees, and multi / single office locations.
- Plan to interview 5-6 firm members during a single day set of interviews:
  1- Principal, 2 Project/team leaders (min. 4yrs w/firm), 1-2 mid-level (4 - 8yrs at firm), 1-2 Jr engineer (1-3yrs with firm)

**Narrowing the Interview Questions**

The interview questions were based on the five conditions of effective teams (Hackman, 2002) as well as the Team Diagnostic Survey (TDS) (Wageman et al., 2005). These five conditions are listed in Table B1 as 12 subconditions, which were ranked from highest to lowest concern on a scale of 1 to 12, as related to the engineering services industry. My ranking is based on my 30 years of experience and noted as “My Rank.” I requested an independent ranking from a personal friend who held various engineering firms executive level positions and has significant experience with team dynamics. His ranking is noted as “Other Rank.” The Wageman (2001a) column contains the primary findings from Dr. Wageman’s research at Xerox.
where the boundaries of a real team are required to be a team and the table below contains most, yet not all conditions noted as NA. The underline and bold designations indicate support of the usage.

The three-dimensional concepts that define an effective team for the purpose of this study come from the TDS as follows:

1. The deliverable or output of the team meets or exceeds the standards and quality as defined by the team’s client.
2. The social process of the team enhances member capabilities to work interdependent, such that they are more capable after completion of work.
3. The work contributes positively to the learning and well-being of individual team members.

### Table B1. Five Conditions Considered in Interview Questions

<table>
<thead>
<tr>
<th>Condition 1. Real Team</th>
<th>Wageman 2001a</th>
<th>My Rank</th>
<th>Other Rank</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Clear boundaries of members and non-members.</td>
<td>Required</td>
<td>3</td>
<td>9</td>
<td>Yes</td>
</tr>
<tr>
<td>1.2 Members tasks are interdependent for a common purpose.</td>
<td>2</td>
<td>11</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>1.3 Stability of membership sufficient for learning to work together.</td>
<td>NA</td>
<td>2</td>
<td>3</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Condition 2. Compelling direction

<table>
<thead>
<tr>
<th>Condition 2. Compelling direction</th>
<th>Wageman 2001a</th>
<th>My Rank</th>
<th>Other Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Challenging (to energize), clear (for orientation to purpose), and consequential (engaging full range of talents).</td>
<td>1</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>2.2 Defined start and end, while leaving the means and methods for team development.</td>
<td>NA</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

### Condition 3. Enabling structure

<table>
<thead>
<tr>
<th>Condition 3. Enabling structure</th>
<th>Wageman 2001a</th>
<th>My Rank</th>
<th>Other Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Well designed task; whole and meaningful work enabling team autonomy and judgment to effect knowledge results.</td>
<td>6</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>
Establishing group norms of a Just Culture is the foundation firms need for sustainable high-performance, where a Just Culture contains the two interdependent elements of psychological safety and accountability. Research on psychological safety reveals seven specific benefits: it encourages employees to speaking up, supports constructive conflict, creates cognitive space enabling clarity of thought, then promotes innovation, while mitigating failures, moderates the relationship between goals and performance, and increases employee accountability, (Edmondson, 2012). These seven benefits are likewise key indicators of employee engagement.

**Interview Theme and Hypothesis Questions**

The following sets of questions create basic theme and hypothesis for the study. The first set of questions will test for the three conditions of team effectiveness. Two questions have been added to expand the third question regarding learning to include conflict, failure, and innovation.
1. Did the deliverable or output of the team meet or exceed the standards and quality as defined by the team’s client? How was this determined?

2. Did the social process of the team enhance member capabilities to work interdependent? Were team members more, less, or about the same in capable after completion of work.

3. Tell me about the learning opportunities of individual team members. Is individual well-being of members, better, worse, or about the same after the project?

4. Tell me about a time when the project goals and objectives were in conflict. How was the conflict resolved? What did you learn?

5. Tell me a story about accountability. Was it the team leader or a member of the team who initiated responsibility? How are mistakes or failures treated? How are new ideas developed? Tell me if either mistakes or new ideas are considered part of innovation on your team.

The second set of questions will test for the most probable success differentiators as determined by ranking the conditions on the previous page. The highest ranking item will remain a single question, while the three next highest relate to the dynamic nature of team formation, size, and composition, therefore will be integrated into two questions as follows:

1. Are there team based incentives or recognition for collective achievement? If so, then tell me about them. Are the individual incentives, like raises and promotions at times in conflict with team or firm goals or incentives?

2. Tell me about the team composition from start to finish. What is the size of the team at the start, peak, and end? How do members join and leave the team and was it clear to other members when they joined or left?

3. How many of these members did you work directly with or enough to improve future project collaboration? Where there sufficient skills on the team and how were these skills obtained? (Include production skills through specialty technical and design knowledge skills.)
The following statement and three supporting hypothesis statements are the basis for my study: Teams, as opposed to an individual or the organization, are the fundamental unit of performance; therefore:

- Firm structures where members develop interdependence, with small stable teams and dynamically manage support to obtain sufficient skills and capacity, will perform better than firms with project teams where members work more independently with less team boundary definition.

- Firms who establish norms of a Just Culture, where psychological safety enables cognitive space for developing new ideas and a continuous learning environment at all staff levels, and also where conflict and failure become an integral part of innovation and accountability, will achieve better firm performance.

- Firms who clearly define team goals, that are in harmony with both individual and firm wide achievement goals, then recognize and reward collective team performance, will achieve better firm performance than firms who emphasis only individual and/or firm metrics and rewards.
Appendix C: Letter of Introduction

To: Potential HP Team Study Participant
Subject: COE study of “high-performance teams”
Date: ___________________
Dear: _______________________

We would like to thank you for participating in the past # of Circle of Excellence surveys. After 40 years of conducting quantitative surveys, including over 1000 firms, PSMJ is excited to expand this year’s research by conducting a qualitative study of high-performance teams. We are passionate, as we know you are, regarding the pursuit of excellence, therefore (your firm) is one of only six selected to take part in this study. We are requesting your firm’s participation based on achievement of excellence in multiple areas (as a multiyear COE winner -or- based on your COE responses). This experience will greatly benefit your firm, as well as, all stakeholders of the A/E/C industry.

What specifically are we asking?
We are requesting one hour interviews with 5 to 6 employees. These interviews will be conducted face-to-face in your office on a single day. All interviews will remain strictly confidential and be coded to ensure anonymity of individual names and firm identification. There is no cost to participate, except for the investment of 5 to 6 hours of time.

How will your firm benefit?
Your firm will receive verbal feedback and a confidential written report, of both cross-firm findings, that correspond to building and maintaining high-performance teams, as well as, a collective brief of your firm’s interviews. Information on any specific firm’s collective findings will only be available to pre-selected individuals of that firm. Information from any individual interview will NOT be available.

Who will be conducting the research?
Kate Allen PE, Director of A/E/C Benchmark Surveys, at PSMJ leads the COE survey collection and analysis, and will oversee the study and ensure that your firm’s confidential information is secure. Michael Kuppinger PE, is a long time member of PSMJ, former engineering firm GM with 30 years of experience, and will be conducting all interviews, as a PhD student at Benedictine University.

Please indicate your response by email to MKKupinger@gmail.com or Kallen@PSMJ.com.

Sincerely,
Michael Kuppinger, PE
PhD Student, ABD
Benedictine University

Kate Allen, PE
Director, PSMJ

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Appendix D: Detailed Letter to Participant Firms

PSMJ Engineering firm & potential participate:

Re: Interview questions and basis

This letter will provide a brief overview of my research intent and hope to answer most questions regarding the interview process. My research interest is to further understand team dynamics and test for conditions of high performance teams. My research and interview design is based on the late Dr. J. Richard Hackman’s (5) enabling conditions for effective teams, as well as, Ruth Wageman’s Team Diagnostic Survey (TDS).

Building on the work of industry giants: Similar, team-centric research and consulting has been conducted by my dissertation advisors Dr. Amy C Edmondson and Dr. Ruth Wageman, (both students of Dr. Hackman, a professor at both Yale and Harvard University). Dr. Edmondson is currently the Novartis Professor of Leadership and Management, at Harvard. She is list in the world’s most influential management thinkers, (#7 by HR Magazine & #15 by Thinkers50), with cases-studies including: Arup Engineering, IDEO, GM … Etc. Dr. Wageman is a Harvard Associate Professor and The Hay Group’s Director of Research, with hundreds of team-centric case-studies. Dr. Gus Gustafson is my dissertation chair, an Adjunct Benedictine University Professor, and an industry expert in Social Responsibility Leadership.

Current case-study design: I will be conducting a case-study of approximately 40 engineers across 6 to 8 engineering firms. My intent is to meet with 5 to 6 firm members for 60 to 90 minutes each, during a single visit. I am requesting interviews at multiple levels as follows: 1 Principal, 2 Project/team leaders (min. 4yrs w/firm), 1-2 mid-level engineers (4 - 8yrs at firm), and 1-2 junior engineers (1-3yrs with firm). The interview format is based on: Appreciative Inquiry, as well as, Grounded and Generative theories; searching for underlying assumptions and beliefs discovered through positive story-telling intended to create new and innovative possibilities. In other words, my journey is to find a correlation between “what’s going well” within your teams and positive firm performance. All interview information will remain confidential, shared only with the originating firm, as a collective summary. See attachment for additional information on (5) enabling conditions and research theory.

Interview questions, following a short introduction and discussion on confidentiality: Can you tell me about a time when your team really came together? (Added probes - Possibly a major challenge handled successfully. What was your role and what specifically did you do to be successful?)
Tell me about a typical day. How independent is our work or interdependent? Tell me about a time your expertise enabled others. (Then others enabled you.)
Tell me about the team composition from start to finish. What is the size of the team at the start, peak, and end? How do members join and leave the team? Is it clear to all members when others joined or leave?
Tell me about project support. Consider work-load, as well as, specialty skills and coaching.
How long have you worked with this team? How many of these members did you work directly with? Tell me about your formal and informal learning opportunities. After completion this project, tell me about the changes in team synergy and effectiveness.
Tell me about times where individuals were recognized. How did you feel? Likewise tell me when the collective team was recognized. How was this feeling different?
Tell me about a time when the project goals and objectives were in conflict. How was the conflict resolved? What did you learn?

Very truly yours,

Michael K. Kuppinger
PhD Student of Values-Driven Leadership
(Former; Engineering GM, EVP, & Managing Principal)
Five Conditions of Effective Teams:

Condition 1. Real Team
1.1 Clear boundaries of members and non-members.
1.2 Members are interdependent for a common purpose.
1.3 Stability of membership sufficient for learning to work together.

Condition 2. Compelling direction
2.1 Challenging (to energize), clear (for orientation to purpose), and consequential (engaging full range of talents).
2.2 Defined start and end, while leaving the means and methods for team development.

Condition 3. Enabling structure
3.1 Well designed task; whole and meaningful work enabling team autonomy and judgment to effect knowledge results.
3.2 Team composition; small group with sufficient collective skills to achieve their purpose.
3.3 Core norms of conducts are established to determine what is and is not acceptable behavior.
**Condition 4. Supportive organization**

4.1 Team based rewards for collective achievement, while not in conflict or competition with individual development and recognition.
4.2 Educational systems available at the team’s initiative.
4.3 Information appropriate for the team’s task and situation.

**Condition 5. Available expert coaching**

5.1 Motivational at start, strategic near middle, and feedback; including technical and operational.

Interview outline questions are built on the following theories:

*Grounded Theory*; where interviews will evolve from an initial hypothesis, based on learning throughout the research. (Glaser & Strauss, 1967)

*AI (Appreciative Inquiry)*, searching for underlying assumptions and beliefs discovered through positive story-telling (Cooperrider, 2002)

*Generative theory*; intended to create new and innovative possibilities rather than predictive and traditional (Gergen, 1978)

*TDS (Team Diagnostic Survey)*; testing for the five conditions of team effectiveness (Wageman et al., 2005)

*A Just Culture* built on psychological safety and accountability, where continuous learning is achieved through open discourse. (Edmondson, 2012)

Qualitative case-study rigorous methodology. (Eisenhardt, 2010).
Appendix E: Informed Consent to Participate

To: Interview Participant  
From: Michael Kuppinger  
Subject: Informed Consent to Participate in Study

Dear: ________________________                    Date: ______________________

Hello, my name is Mike Kuppinger. I am a PhD student at Benedictine University, in Lisle Illinois, as well as, a practicing professional engineer. I am researching team performance within engineering firms and particularly interested in the conditions of team effectiveness, which mediates both individual flourishing, as well as, firm financial performance. PSMJ has agreed to participate in this study and more specifically, Kate Allen, P.E., PSMJ’s Director of Research, will be assisting and advising me. We have selected your firm to participate because of your sustained positive performance.

This research will be useful to practitioners, as well as, add to the body of academic knowledge, as an extension of research initiated at Harvard University by Dr. Richard Hackman and my advisors: Dr. Amy Edmondson and Dr. Ruth Wageman. My research hypothesis predicts that effective teams follow systems theory, then proceed and predict firm performance. Therefore, leadership focus on team metrics, enhances both firm performance, as well as, individual engagement and development.

Thank you for your willingness to participate in the interview. Your participation is voluntary and you do not have to answer any questions you do not want to answer. If at any time you do not want to continue with the interview, you may decline. Your time and involvement is profoundly appreciated. Our entire discussion will remain confidential and your comments coded to ensure anonymity as explained below. The entire interview will take approximately sixty minutes, yet no more than ninety minutes. To ensure accuracy and maintain the essence of your words for the research, I will record the information. At any time you may request to see or hear the information I collect.

The recording will be transcribed and kept confidential in a password-protected computer. All individual identification will be removed from the hard copy of the transcript. Required for University accredited research; participant identity and confidentiality will be concealed using coding procedures, then transmitted to a Benedictine University faculty member for secure and ultimate disposal after a period of seven years. Dr. Gus Gustafson is my dissertation chair and the Benedictine University faculty member who will secure and ultimately dispose of the information. His information is at the end of this form. As the researcher, I will also maintain a copy of the data on a password-protected computer.
The goal of this study is to discover patterns and correlations across team members within a firm, as well as, across teams at other firms with sustained performance achievement. Under no circumstances will your name or identifying characteristics be disclosed beyond my research team of Kate Allen, Gus Gustafson, and myself. Excerpts from the interview may be included in the final dissertation report or other later publications. A summary of your firm findings will be provided to your firm’s leadership, without disclosure of individual comments. All firm names will likewise be coded and remain confidential. Firm names may only be used in the final dissertation report or other later publications upon strict adherence to the three following conditions; first is that a principal of the firm has provided written approval. Second is that PSMJ has also provided written approved. Then, third is that my research is concentrated on positive conditions, therefore firm names will only be used to highlight exemplary achievement.

I would be grateful if you would sign this form on the line provided below to show that you have read and agree with the contents. Please return it by email to me at MKKuppinger@gmail.com. An electronic signature is acceptable. I will schedule our meeting and interview by work through your HR department / Office Manager. (edit based on specific firm requests).

__________________________________________________
Your signature above

This study is being conducted in part to fulfill requirements for my PhD in the Valued Driven Leadership program at the graduate school of Benedictine University in Lisle, Illinois and has been approved by the Institutional Review Board of Benedictine University. The Chair of Benedictine University’s Institutional Review Board is Dr. Alandra Weller-Clarke. She can be reached at (630) 829 – 6295 and her email address is aclarke@ben.edu. My dissertation chairperson is Dr. Gus (Jim) Gustafson. He can be reached at (515) 577-0198 or email address is gus@cvdl.org or jgustafson@ben.edu, for further questions or concerns about the project/research.

Sincerely,

Michael Kuppinger, P.E.
PhD Student, ABD
Benedictine University

cc. Kate Allen, P.E.
Dr. Gus Gustafson
Appendix F: Interview Questions and Interview Guide
by M. Kuppinger 10/23/2015

Pre-Interview Check
Questions, AV equipment ready, letter with details, & (3) hypothesis questions

Interview Introduction, Confidentiality, & General Questions
Confidential—only interviewee and research team will have access to statements made.
- A summary of the “collective” feedback will be provided to firm leadership
- Per consent, you can stop at any time and not required to answer any question
- Introduction – your firm was selected by PSMJ as a sustainable, stable, and good performing firm
- My research focuses on high-performance teams & correlation to both firm and individual.
- Looking for the “generative things” that sustainable engineering firms are “doing right,” not unique or confidential secrets nor mistakes by your firm or office.
- General—Name: ___________, Position ____________
- Years with firm: ____________, Years in industry ____________
- (For me only) Coding: firm/office – level or position – experience
- Key research words: Interdependence, small, bounded real team, clearly defined purpose and objectives, open / psychologically safe culture, continuous learning, conflict & failure, innovation, accountability, recognize and reward collective performance, defined team goals

Interview Questions
I have approximately 10 open questions, similar to the pre-interview letter. Many of them will ask for a story, so please feel free to elaborate. We have about 50 minutes, so please take your time and really think about specific events.

<table>
<thead>
<tr>
<th>Question</th>
<th>Hypothesis Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Can you tell me about a time when your team really came together?</td>
<td>Interdependence</td>
</tr>
<tr>
<td>(* Added probes - Possibly a major challenge handled successfully. What was your role and what specifically did you do to be successful?)</td>
<td>Conflict &amp; innovation</td>
</tr>
<tr>
<td>2. Tell me about a typical day. How much time do you spend working independently (alone) compared to with others?</td>
<td>Interdependence</td>
</tr>
<tr>
<td>Question</td>
<td>Hypothesis Focus</td>
</tr>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------</td>
</tr>
</tbody>
</table>
| 3. Tell me about a time you enabled others; they needed your input.  
(Then others enabled you. You needed their collaboration.)                                                                                                                                         | Interdependence        |
| 4. Tell me about the team composition from start to finish.  
What is the size of the team at the start, peak, and end?  
How do members join and leave the team?  
Is it clear to all members when others joined or leave?                                                                                                                                             | Bounded real team & size|
| 5. Help me understand how your team manages the dynamic nature of client schedules and demands.  
Tell me about project support. Consider work-load, as well as, specialty skills?  (What about mentoring and coaching.)  
How are team goals determined? Communicated?  
How are individual goals determined? Communicated?  
What happens when goals are met or exceeded?  
What about not met?                                                                                                                           | Interdependence        |
| (halfway—30min.)                                                                                                                                                                                                                                                 |                        |
| 6. How many teams are you typically part of at any one time?  
(based on projects, internal assignments)                                                                                                                                                           | Bounded real team      |
| How long have you worked with this / each team?  
How many of these members did you work directly with?                                                                                                                                                 | Time & size interdependence|
| 7. Can you tell me about a recent learning or growth opportunity?  
Tell me about your formal and informal learning opportunities.  
Who is responsibility for it?                                                                                                             | Learning, conflict, psychologically safe |
| How do you feel about trying new ideas? How often do you?  
Is innovation important?  
Who is responsible for innovation?                                                                                                         | Innovation             |
<table>
<thead>
<tr>
<th>Question</th>
<th>Hypothesis Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiments or controlled failures early in the design process are learning opportunities and can enable innovation. Is failure ever celebrated as being entrepreneurial?</td>
<td>Failure &amp; Innovation</td>
</tr>
<tr>
<td>A very different type of failure is routine failures or mistakes. These are typically process related and often due to human error. Do you believe that team members are held accountable?</td>
<td>Failure &amp; accountability</td>
</tr>
<tr>
<td>8. After completion of a project, tell me about the changes in team synergy and effectiveness. Is it the same, better, or worse? Do you want to work together again or change teams? (3/4 way—45 min.)</td>
<td>Continuous learning, Real team interdependence</td>
</tr>
<tr>
<td>9. Tell me about times where individuals were recognized. (Is it public or private?) How did you feel? Likewise tell me when the collective team was recognized. Was this feeling different? Why?</td>
<td>Rewards and recognition</td>
</tr>
<tr>
<td>10. Tell me about a time when the project goals and objectives were in conflict. How was the conflict resolved? What did you learn? Could you apply it in the future?</td>
<td>Conflict, learning, psychologically safe, Continuous learning</td>
</tr>
<tr>
<td>11. If I were to ask you to pick only one word (or thing), that defines the very best of why your team / firm is successful, what would it be?</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix G: Qualitative Themes

### Findings of a team-level construct:

<table>
<thead>
<tr>
<th>Structure small stable teams &amp; external support</th>
<th>Grp1</th>
<th>Grp2</th>
<th>Grp3</th>
<th>Grp4</th>
<th>Grp5</th>
<th>All firms</th>
<th>COE</th>
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</thead>
<tbody>
<tr>
<td>1/2. small team loosely connected to other teams</td>
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<td>2. Stability over time builds dependableness &amp; trust</td>
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<td>2. Strong technical network</td>
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<td>X</td>
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<tr>
<td>2. Sr Leaders move to / in technical roles (Business / Tech balance)</td>
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<td>x</td>
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<td>3. Loosely coupled system of teams</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>3. small teams for focus</td>
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<td>x</td>
<td>x</td>
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<td>4. Technical and business are symbiotic</td>
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<td>4. People into roles by skill and passion</td>
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<td>Dept by discipline, team members come from dept.</td>
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### Team-centric performance goals

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<th>Team-centric performance goals</th>
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<th>Grp4</th>
<th>Grp5</th>
<th>All firms</th>
<th>COE</th>
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<tbody>
<tr>
<td>1. Individual goals were personal &amp; prof, team were financial</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>2. Share performance metric info to all employees</td>
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<td>x</td>
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<td>4. Metric of productive hours, rather than utilization or not at all.</td>
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<td>4. Cheer completion; raise market &amp; self-benchmark (not zero-sum)</td>
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<td>5. Service &amp; client repeat before profit</td>
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<td>x</td>
<td>x</td>
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<td>5. Firm communication via weekly meetings</td>
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### Care for others & mental value formation

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<th>Care for others &amp; mental value formation</th>
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<th>Grp5</th>
<th>All firms</th>
<th>COE</th>
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<tr>
<td>2. Work-life balance via schedule flexibility and backup</td>
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<td>2. Employee benefit programs (inc. 3rd party coaching)</td>
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<td>2. Altruistic -self sacrificing for good of the whole</td>
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<td>2. Lack of culture fit is how and why people leave firm</td>
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<td>x</td>
<td>x</td>
<td>x</td>
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<td>4. Living values provides clarity of mission, enabling action</td>
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<td>x</td>
<td>x</td>
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<td>4. Hire people for cultural fit over technical excellence</td>
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<td>x</td>
<td>x</td>
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<td>4. Culture molds people, or they self-terminate</td>
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<td>5. Team relationship extend beyond work environment</td>
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<td>x</td>
<td>x</td>
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<td>5. Leaders really care for staff</td>
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<td>5. Process to help struggling staff</td>
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### Trust and values alignment

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<th>Grp5</th>
<th>All firms</th>
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<tbody>
<tr>
<td>1. comfortable to voice opinion</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>x</td>
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<td>2. Employees encouraged to give voice</td>
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<td>x</td>
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<td>2. Fulfillment comes thru hard work and self sacrifice</td>
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<td>3. Open communication leads to trust</td>
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<td>x</td>
<td>x</td>
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<td></td>
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<td>3. Family metaphor for trust</td>
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<tr>
<td>3. Trust extends beyond work-environment</td>
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<td>x</td>
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<td>3 Psy safe via efforts not to layoff</td>
<td>x</td>
<td>x</td>
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<td>3. Everybody has a voice.</td>
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<td>x</td>
<td>x</td>
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<td>4. Young engineers voice new ideas that get executed</td>
<td>x</td>
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<td>4. Culture of trust emerges from stories (action)</td>
<td>x</td>
<td>x</td>
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</table>
## Interdependence

1. Mgmt takes responsibility to help create interdependence.  
   - x x x x x x
2. Combine niche skills toward common purpose  
   - x x x x x x
5. Self-reliant teams  
   - x x x x x x
5. Work "for each other" via small teams  
   - x x x x x x
Cross-team / firm interdependence  
   - x x o x o x

### Shared accountability

1. Peer level shared accountability  
   - x x T x T T
2. Shared responsibility via clear roles and back-ups  
   - D T D x T T
2. Shared construct via buy-in of key members  
   - D x D x T D
3. Shared responsibility via "have each other's back"  
   - x x x x T P
4. Individualism not cultural fit, warned then terminated  
   - x x x x x x
1. Financial & Ops metrics to all employees regularly  
   - x x o D/T T P x
5. Employee self-select out  
   - x x o x x P

### Conflict, constructively through discourse

1. Unites verse bifurcates (norming to performing)  
   - x x T x T x
2. Open to discuss mistakes  
   - x x x x x x
2. Mistakes result in process change not people  
   - x x x x x
3. Positive communication publicly and constructive / neg. in private  
   - x x x x T P
4. Mistakes lead by most respected, allows others to be open  
   - x x x x T P
5. Conflict leads to learning (due to honesty and trust)  
   - x x x x x x
5. Leaders look at process and self as responsible for mistakes  
   - x x x x T T

### Continuous learning

2. Innovation via specific programs  
   - x x o o o P
3. Pay it forward, tech next generation  
   - x x T x T T
3. Humble leaders taking a critical view toward conti. improvement  
   - x x x x P P
4. Young eng. push beyond capability, make mistakes, and learn fast  
   - x x T x T T
4. Processes developed by topic (system) maturity and complexity  
   - x x o x o x
5. Conflict & stability enables higher effective via trust and knowledge  
   - x x T x T T
5. Mistakes are anticipated, so multi integrated "QC-process"  
   - x x T x x x P
Focus on complex end of market  
   - x x o x o x

### Team-actualization and recognition

2. Comes from team accomplishment, not comp.  
   - x x D x T T
4. Compensation heavy weight by firm contribution  
   - x P o x o x
5. Recognition came via team and shared accomplishment  
   - x x x x x x

### Key:

- x = yes all interviews
- o = no, minimal or not at all
- T/D = partial, team, or dept construct.

<table>
<thead>
<tr>
<th>All</th>
<th>COE</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
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### Total:

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<tr>
<th>Financial &amp; Ops metrics to all employees regularly</th>
<th>65</th>
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<th>65</th>
<th>65</th>
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<th>41</th>
<th>27</th>
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<tr>
<td>Employee self-select out</td>
<td>59</td>
<td>62</td>
<td>43</td>
<td>61</td>
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<td>31</td>
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Appendix H: PSMJ Survey

PSMJ’s Circle of Excellence: 2015 Best Practices Benchmark Summary

BENCHMARK COMPARISON SUMMARY RESULTS

In order to determine which of the 328 participating A/E firms were eligible to become members of *PSMJ’s 2015 Circle of Excellence*, each firm was ranked against the other 327 firms in the overall survey with respect to 13 individual benchmarks. See Table 1 for a comparison of *PSMJ’s 2015 Circle of Excellence* to the overall survey results.

<table>
<thead>
<tr>
<th>BENCHMARK</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
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<tbody>
<tr>
<td>Net Direct Labor Multiplier (Achieved)</td>
<td>2.85</td>
<td>3.11</td>
<td>3.38</td>
<td>3.69</td>
<td>4.06</td>
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<tr>
<td>Operating Profits (EBIT) (% of Net Revenues)</td>
<td>20.7%</td>
<td>23.4%</td>
<td>28.4%</td>
<td>33.4%</td>
<td>36.9%</td>
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<tr>
<td>Operating Profits (EBIT) per Total Staff</td>
<td>$27,367</td>
<td>$34,499</td>
<td>$42,669</td>
<td>$53,073</td>
<td>$64,569</td>
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<td>Staff Size Change</td>
<td>0.0%</td>
<td>4.8%</td>
<td>11.8%</td>
<td>20.3%</td>
<td>28.1%</td>
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<tr>
<td>Return on Overhead (ROO)</td>
<td>12.9%</td>
<td>27.4%</td>
<td>43.2%</td>
<td>69.6%</td>
<td>91.6%</td>
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<tr>
<td>Labor Utilization Rate (Payroll Dollars)</td>
<td>55.4%</td>
<td>58.5%</td>
<td>63.6%</td>
<td>68.5%</td>
<td>72.9%</td>
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<td>Operating Overhead Rate Before Bonus/Distribution</td>
<td>101.0%</td>
<td>120.3%</td>
<td>144.6%</td>
<td>157.9%</td>
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<td>A/R Collections (Days)</td>
<td>36</td>
<td>47</td>
<td>58</td>
<td>77</td>
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<td>Net Revenues Backlog (% of Annual Net Revenues)</td>
<td>28.8%</td>
<td>53.1%</td>
<td>79.6%</td>
<td>104.4%</td>
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<td>Return on Working Capital Assets</td>
<td>26.7%</td>
<td>47.5%</td>
<td>74.5%</td>
<td>101.2%</td>
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<td>Gross Revenues Change (Growth Rate)</td>
<td>3.3%</td>
<td>11.1%</td>
<td>18.5%</td>
<td>31.0%</td>
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<tr>
<td>Staff Turnover Rate</td>
<td>4.2%</td>
<td>6.2%</td>
<td>10.2%</td>
<td>13.8%</td>
<td>17.1%</td>
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<td>Net Revenues per Total Staff</td>
<td>$123,380</td>
<td>$138,619</td>
<td>$156,003</td>
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<td>$118,240</td>
<td>$134,839</td>
<td>$154,653</td>
<td>$171,356</td>
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References


Cooperrider, D. L. (2002). Appreciative inquiry: Releasing the power of the positive question. Unpublished manuscript, Case Western Reserve University, Cleveland, OH.


