PLANNING FOR VALUE-GENERATING COLLABORATION DURING THE DESIGN/PRECONSTRUCTION PHASE

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ABSTRACT

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With the goal of adding to the body of knowledge concerned with improving construction project delivery, focusing specifically on better understanding the relationship between collaboration and value-generation, this thesis sought to explore the question of where, when, how, and why collaboration generates value to construction projects during the design/preconstruction phase. This was accomplished in part by conducting a case study involving an "integrated" project that engaged 20 participant-researchers employed by either the construction manager/general contractor, architect, or owner that played an integral role in the design/preconstruction phase of the case project. Using Morten T. Hansen's concept of "disciplined collaboration" as a framework through which to analyze the collaboration that took place, interviews were conducted with all willing participants in order to find commonly shared feedback and to assemble a rich picture of how the design/preconstruction process was carried out by the members of each respective party to the project. This data was shared during an action learning session utilizing Soft Systems Methodology separately for each entity in order to invoke reflection and subsequent creation of improved-upon models of the process. These activity models were then used to generate questions that might be included in a conceptual model, or decision-making structure, for planning for value-generating collaboration during design/preconstruction. With the goal of viewing the process from the perspective of the project team as a whole, a final action learning session was conducted together with all organizations in order to develop a holistic conceptual model for planning for value-generating collaboration during the design/preconstruction phase of a construction project. First and foremost, this study found that when planning for collaboration that generates value, a project team must first determine what the objectives of the owner are.

When I made the decision to pursue my graduate degree, I hadn't realized that I was ultimately signing up everyone that cared about me for the experience as well. This ride can be very rewarding in more ways than one – mine certainly was. However, I wonder if anyone is truly ready for the frustration, exhaustion, and/or consumption of one's time that can come with the work load and balancing of responsibilities. If one is as fortunate as I am in this life, they are surrounded by an incomparable support system of family and friends – the kind that have taken the time to know you well over the years and love you enough to check in and offer support and encouragement whether or not you asked them to.

To my family and friends – this is for you.

Thank you for the phone calls, letters, visits, meals, and for loving me. I love you all dearly as well.
You are what make this the beautiful life.

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everyone with the intention of learning from them. He is unwaveringly patient, encouraging, and kind. I always felt heard and never felt rushed, which allowed me to be more creative and thoughtful while crafting my thesis proposal and research procedure. This paid off later when it came time to execute the project and finish the thesis in a timely manner. I was afforded the opportunity to carry out research meaningful to me, because I had a committee willing to support that research. For that, I am incredibly grateful.

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1.0 CHAPTER ONE: INTRODUCTION

1.1 Lackluster Performance in the Construction Industry: The Big Problem

Since the 1960s, there has been an ongoing discussion among professionals and scholars in the architecture, engineering, and construction industry regarding how to address the inflation of construction activities, improve the industry's lagging productivity compared with other non-farm industries, and how to address increasing the quality and value of each project delivered to the client (Forbes and Ahmed 2011). It is not a surprise that the construction industry should garner such interest from the business community when it has traditionally been one of the largest industries within the United States. According to the United States Department of Commerce's Bureau of Labor Statistics, the value of new-construction-put-in-place in 2006 was estimated at $1.26 trillion. At the time, this figure represented 8% of the gross domestic product. In addition, the success of the construction industry has serious implications at the household level. In 2007 the industry employed approximately 7.614 million people living in the United States (Forbes and Ahmed 2011).

Interestingly, while there has been an admission across the AEC industry that current processes/practices employed are flawed, clear criteria and methods for measuring performance have not been established and accepted by all professions involved. Forbes and Ahmed (2011) noted that performance in the past has been defined as a combination of productivity, quality, timeliness, budget adherence, and safety. They go on to describe these categories of performance as the following:

- Productivity: Measured as the ratio of outputs to inputs (such as construction put in place compared with dollars expended or labor hours worked), productivity as a criterion for measuring performance looks at how well resources are brought together and utilized for accomplishing a

set of goals. A project delivery system reaches the highest level of performance achievable when the least amount of resources possible have been expended.

- Quality: At this time, quality may be considered meeting drawings/specifications requirements, satisfying the building code – or minimum requirements for a building, fulfilling the needs/desires of the owner, or a combination of these definitions.
- Timeliness: Meeting the schedule promised
- Safety: Minimizing/eliminating the number of lost-time accidents on a job site.
- Budget Adherence: Completing the project within the contract price.

Research has found that while the above described criteria for measuring performance are indeed considered, the industry at large tends to be satisfied with finding "success" at the project level in terms of completing projects on time, on budget, while meeting code. Stated differently, meeting the bare minimum requirements of a contract and statutory regulations counts as a success. Many industry professionals have taken quality, cost, and time as performance measurement criteria and placed them at points on a triangle. With a prevailing sentiment that there is a "zero-sum" relationship between the three criteria, it is believed that achieving the maximum potential of one criterion must come at the expense of the others (Forbes and Ahmed 2011).

However, although productivity and quality initiatives for improving performance have not been emphasized in prevailing industry practices at the project level, those interested in improving upon the flawed status quo of the AEC industry have used productivity and the associated cost of waste as the basis for the argument that current processes and practices must be revised or replaced (Forbes and Ahmed 2011). It is a well-covered statistic that until 1964, construction paralleled manufacturing in productivity gains measured in contract dollars expended/number of hours worked. After 1964, construction began

to see a decline in productivity compared with manufacturing, resulting in a 275% gap between manufacturing gains and construction declines by 2003 (Miller et al 2009). This statistic was reinforced by another study conducted in 2007 by Paul Teicholz at the Center for Integrated Facility Engineering (CIFE) out of Stanford University. Teicholz calculated that between 1964 and 2004 labor productivity within all US non-farm industries doubled while labor productivity within the US field construction industry had declined by 10% compared to where it was in 1964 (Smith, Mossman & Emmitt 2011). Smith, Mossman & Emmitt (2011) noted that labor has historically represented 40-60% of estimated construction costs. The data indicates that in 2004, owners were paying 5% more than they would have paid for the same building in 1964.

The concern over inflation of construction costs has been alive and well since at least 1969 when a group of business executives formed an organization called the Construction Users Anti-Inflation Roundtable in response to the outrage they were feeling over what they considered to be the rapid inflation in the cost of construction. One might infer this perceived inflation was in fact due to productivity gains slowing. In 1972 this group merged with two others in order to form the Business Roundtable, joined by executives representing the 200 largest US companies at the time. According to Forbes and Ahmed (2011), the Business Roundtable initiated the Construction Industry Cost Effectiveness project in order to promote quality, efficiency, productivity, and cost effectiveness in the construction industry. In January 1983 the CICE published a report that claimed more than half of the time wasted in construction could be attributed to poor management practices. They suggested that if owners made the choice to pay a greater upfront cost to support better project planning and delivery methods they would see a greater return on investment in the amount and quality of construction received. The report stated that wasted time typically occurred during the interaction between the trades. Finally, the report concluded that $10 Billion

could be saved of the $300 Billion spent annually at that time if recommendations of the CICE were even moderately applied.

These findings have held true leading into the present 2010s. Forbes and Ahmed (2011) cited an article published during January 2000 in *The Economist* entitled "Construction and the Internet" that claimed up to 30% of construction costs are due to inefficiencies, mistakes, delay, and poor communication between the project team. Within their textbook *Modern Construction: Lean Project Delivery and Integrated Practices*, they cited additional supporting statistics including that losses to the tune of $17-36 Billion are also incurred when translating designs to actual construction due to communication difficulties and inadequate software interoperability; an estimate provided by the Construction Industry Institute claims that within the US, 10% of project costs are spent on rework; and worse still, between 25-50% of construction costs are lost to waste and inefficiencies in labor and materials control (Forbes and Ahmed 2011). This statistic was also reported by Miller et al (2009) who referred to the waste as the "$500 billion black hole" caused by "simple inefficiency and not-so-simple bad behavior."

1.2 A Brief History of Construction Project Delivery in the United States – Or How Did We Get Here?

In the United States, construction as an organized industry dates back to 1724 when the Carpenters Company was established in Philadelphia, Pennsylvania. This has been credited as the first formal establishment of the master builder concept within the United States, a concept where one entity is responsible for designing, surveying, laying out, and managing construction in accordance with contract documents. This method of delivering construction projects trended into the beginning of the 20th Century, after which the master builder fragmented into specialties focused on either design or construction (Yates and Battersby 2003).

From this juncture, the AEC industry has continued to specialize and further fragment. By the 1950s the design-bid-build (DBB) method for delivering construction projects had become the most commonly used delivery system, reinforced through the establishment of distinct phases of a project including conceptual/schematic, design development, construction documentation, and construction administration by the American Institute of Architects. Miller et al (2009) described DBB as a "logical linear progression" that involves designing a building, assembling the team to build it, and implementing the plans. The DBB project delivery system not only made sense but also found success for a number of years until the 1960s when it began to run into a series of problems, not least of which a decline in productivity gains. Miller et al (2009) suggested a number of factors have been involved over the years that can explain both the divergence between productivity gains in the construction industry compared with those in other non-farm industries as well as what some would agree is the diminishing argument for the validity of the DBB delivery system. These factors have included the following:

- Transition to the Information Economy: During the 1960s, at the height of the post-World War II expansion and baby boom, the US economy underwent rapid changes, with the information economy beginning to surpass manufacturing. By the 1970s, Miller et al (2009) claimed the rules with regards to the economy had changed. With an economy beginning to become ever increasingly based upon information and driven by change, there was a newfound "need for speed" with regards to production. Miller et al (2009) argued that the DBB system was not designed for speed and that its linear process does not allow for flexibility.
- Recession of the 1970s: Miller et al (2009) claimed that beginning in 1973, the recession influenced the choice of architects and engineers to move from a craft practice model where they fulfilled somewhat of the master builder role by both designing and lending a hand in supervising construction to a professional services model. Under this new model, architects adopted a

specialist mentality focused solely on design, implementing fee structures similar to lawyers and accountants.

- Increasing Fragmentation: In order to deal with shrinking margins and higher risk, contractors began subcontracting increasingly greater portions of the work rather than engaging in self-perform (Miller et al 2009). This of course has increased the need for coordination/collaboration as well as additional mark up in the cost of construction.

Often referred to as the "traditional" delivery system, DBB is still the most widely used delivery system today. This highly fragmented system completely silos the design and construction industries, leaving program creation and design entirely in the hands of the owner, designers, and their consultants. Using this approach, the general contractor is never provided an opportunity to inform design with regards to constructability and cost. This may pose problems for all parties, in particular the owner, if the design team does not have a strong understanding of construction methods.

In an effort to accommodate the need for speed-to-market, the design-bid-build project delivery system has been reworked resulting in other delivery systems that seek to accommodate this demand. Among the most used delivery systems born from DBB are design-build, construction manager at risk, and multiple prime. Each have a different advantage depending on the wishes of the owner. Multiple prime provides the owner with the greatest amount of oversight and control because the owner holds the contract for each subcategory of work on the project, making it in the interest of each trade contractor to please the owner. Construction manager at risk allows an owner without vast construction knowledge or that lacks the desire to manage construction the option of entering into a contractual relationship with a professional construction firm who will manage construction operations and carry the risk of the project, holding all trade contract agreements procured through a competitive bidding process. At the owner's

request, the CM firm may become involved during the design phase, working with the A/E team to inform design from a cost and/or constructability standpoint. Under design-build, either the architect or construction manager is assigned responsibility by the owner to design and construct a project. All other service providers and trade contractors involved work for that entity (Miller et al 2009).

While each of these delivery systems seek to assign risk differently, may increase the amount of oversight an owner has to the construction planning/delivery process, and arguably forces collaboration in some instances among relevant parties, at their core, they operate under the same paradigm of project delivery as DBB. Miller et al (2009) claims that owners have bought into an incorrect myth that they can control cost and risk by simply choosing the correct system. However, each delivery system mentioned still promotes a "linear" design phase and competitive bidding process to seek out the lowest bidder. The paradigm for thinking about construction project delivery remains unchanged. In response to this sentiment, there is a school of thought that believes greater dividends with regard to cost, time, and quality will only be found by reconsidering the delivery system altogether.

1.3 Philosophically Rethinking Construction Project Delivery: Lean/Integrated Project Delivery

As a response to the lackluster performance of the AEC industry and failure of the various iterations of the DBB project delivery system to rectify issues while maximizing all performance criteria, some practitioners and scholars alike have chosen to pursue a different way of thinking about project delivery, referred to as Lean Construction. Those who adopt a lean way of thinking endeavor to overcome inefficiencies in projects by identifying sources of the waste, determining methods for removing sources of waste from the system, and replacing them with value-added possibilities (Smith, Mossman & Emmitt 2011).

The inherent differences in approach when comparing traditional project delivery with lean project delivery in its purest form, otherwise referred to as lean/integrated project delivery, can be explained using three domains proposed by Will Lichtig. These domains include organization, operating system, and commercial terms. The traditional construction delivery system is characterized as one that is "dominated by transactional and adversarial commercial terms" between parties whose bottom line is tied to fulfilling the interests of the party they have entered into an agreement with which may not necessarily translate into fulfilling the best interests of the project. These relationships are supported by a Critical Path-based operating system. The lean production system for construction projects seeks to "dissect the physics of design and construction" in an effort to remove waste by aligning a collaborative project organization with its Last Planner operating system. Last Planner is a commitment-based management system centered on trusting relationships between people that seeks to improve production predictability within a project's environment. The success found in engaging Last Planner relies upon project partners making reasonable promises regarding how much progress they can make within a given period of time and fulfilling those commitments. Integrated project delivery satisfies the need for a reconsidered set of commercial terms, providing a relational legal framework that aligns the interests of the project participants with that of the owner in order to maximize the potential of a project. This is done using a multiparty contract in lieu of a bilateral, transactional contract. Multiparty contracts on construction projects typically tie the interest of the owner, architect/engineer, and general contractor/construction manager together in order to encourage the collective sharing of risks as well as cost savings found. Subcontractors and consultants that greatly affect scope may be added to the contract through a joinder agreement (Smith, Mossman & Emmitt 2011).

The delivery system variations based on traditional DBB have endeavored to increase collaborative efforts between the parties at design to increase efficiencies and mitigate the need for change orders in the field, namely design-build and construction manager at risk. However, with regards to collaboration the lean/IPD approach is characterized as taking it to the next level by engaging all parties that affect the success of the project (owner, CM/GC, architect) from the onset of the programmatic phase in order to work out the best possible options that result in the best design for the client. The subcontractors and design consultants that deeply affect the scope are brought on early in the design to assist with determining the most intelligent constructability choices, for the least cost/time. Rather than waiting for construction to begin, true lean projects work out the kinks on the front end (Forbes and Ahmed 2011). Smith, Mossman & Emmitt (2011) noted that the conventions of conceptual/schematic, design development, and construction documentation are not used within a lean/IPD project because they tend to create barriers in workflow. Lean/IPD recognizes and accepts that certain aspects of the design and construction process must happen in parallel. This way of thinking about construction projects as more of a complex system contrasts with the ordered, linear approach that is embraced by traditional delivery.

Once in the field, projects that employ lean seek to reduce variation in work to ensure field management and all trades can count upon work that is promised to be completed in a given amount of time and avoid rework through open communication and coordination. What is truly different from typical field operations is that each activity is viewed as part of an overarching operation – the team seeks to maximize the operation, not just one activity (Forbes and Ahmed 2011).

At the surface, the purist version of the lean/IPD approach described above contrasts greatly with that of DBB and those delivery systems that have spun off of this primary method of accomplishing construction projects.

Perhaps this is why the true primary difference between the two paradigms for thinking about construction project delivery seems to be overshadowed, or at least underwhelmed, in both practice and research by our understandable infatuation with exploring the effectiveness and efficiency of the strategies and/or characteristics associated with lean/IPD. The primary difference between traditional delivery and lean/IPD lies in the philosophy that bread the strategies to begin with – the belief that an organization and its people must continuously seek to eliminate waste while simultaneously improve operations with value-added possibilities. This is in contrast to the goal of traditional delivery which is simply to construct a project on time, on budget, in line with the drawings and specifications.

If one is to agree that the objective of Lean Construction is to eliminate waste while adding value as defined by the owner and/or parties to the project team, then one should note that practicing lean/IPD does not mean to engage in all strategies associated with it (although those highlighted time and again are likely done so due to their success in adding a desired value to the project). Instead, the delivery process and the methods/strategies included should be deliberately chosen in order to maximize the success of the project at hand. Said differently, the process chosen for each project should be carefully considered so as to eliminate waste while generating value.

1.4 Collaboration: Generating Value or Creating Waste?

In the practice of construction, this author would argue that we tend to focus our attention on managing the tangible aspects of our day-to-day jobs at the expense of understanding how to maximize the most complex, and yet most expensive, resource in our business – people.

In the quest to eliminate waste and increase value, arguably one of the most important and recognized differences between the lean paradigm and that of traditional project delivery is the emphasis placed on collaboration between parties throughout the project. In fact, one may observe that the alterations to the traditional design-bid-build delivery system over the past sixty years in the effort to achieve more efficiencies and better value have ultimately sought to cut out waste by encouraging greater collaboration between the major players of the project team (owner, architect/engineer, construction manager/general contractor).

In McGraw Hill Construction's Smart Market Report edition entitled "Lean Construction: Leveraging Collaboration and Advancing Practices to Increase Project Efficiency" the concept of collaboration is certainly given its due attention. Within the recommendation section of the report, among the two "Overall Recommendations[1]" given, it was stated that collaboration is "essential" to the success of various lean approaches and that in response, the industry should be creating software that supports the need for more effective internal and external communication. Among the "Contractor Recommendations", the first recommendation included taking a collaborative approach to maximize gains. A comment from one of the in-depth interviews from this report was paraphrased, where the interviewee said that when he works to increase the "relatedness" felt between workers, including the understanding of what the work of other trades on the job entails, the overall project is improved as well as his workers' experiences (McGraw Hill 2013).

[1] All this aside, the McGraw Hill Construction survey also found that of their contractor panel respondents, 63% are familiar with a lean practice (which begs the question, what of this percentage is aware of the overarching philosophy behind the practices) while 37% are not. Of that 37%, 55% of the respondents find the construction industry to be either efficient or highly efficient – a potentially frightening statistic when there is a plethora of supporting data suggesting otherwise (2013).

The results of the McGraw Hill Construction survey found that while none of the practices were widely known by survey respondents, the greatest level of awareness for various lean practices were for those that emphasized collaboration. This isn't surprising considering the lean experts with which McGraw Hill Construction conducted in-depth interviews recognized collaboration as a key tenant of lean. These practices that encourage collaboration included target value design, the use of multiparty contracts; and co-location or use of a "big room."

There is an understandable tendency within all industries to focus upon "how" to implement a new idea that has brought success elsewhere on a similar task at hand rather than asking "why" the idea and/or process realized such great results. However, while the AEC industry focuses on methods for achieving greater collaboration, or levels of "integration", among parties to a project, perhaps the focus should instead be on when the time and resources spent on collaboration generate the most value and just as importantly what cultivates team synergy – where the whole is greater than the sum of its parts. There is a tremendous difference between a group of people working toward the same goal and a "team." Said differently, we shouldn't assume that collaboration always generates value.

Keeping this in mind while embracing the Lean Construction mantra that AEC practitioners can add value to our projects by eliminating waste, the overarching goal of the proposed research project is add to the body of knowledge concerned with improving construction delivery while focusing specifically on understanding the relationship between collaboration and value generation during design/preconstruction.

With the above in mind, the following exploratory research question was offered:

Where, when, how, and why does collaboration generate value to construction projects during design/preconstruction?

In posing the above question, a research project was proposed that endeavored to fulfill the following objectives:

- Synthesize a list of contemporary practices associated with collaborative practices and fostering team synergy on projects ranging any and all industries. This list was to take the form of an extended literature review that would complement that which was carried out during the proposal stage of this Master's thesis.
- Develop a conceptual model for planning for value-generating collaboration during the design/preconstruction phase of a construction project in the effort to produce the greatest value for the project from the time/resources spent on collaboration.

1.5 Learning for Theory and Practice: An Argument for the Action Research Paradigm

Lawler (1985) made the case in *Doing Research That Is Useful for Theory and Practice* that the goal of research concerned with improving organizations should be twofold: 1) contribute to the theoretical and scientific body of knowledge concerning organizations, and 2) assist practitioners with understanding organizations in a way that improves practice. Traditionally, the assumption in scientific research has been that the expertise in the problem being studied is held by the researcher, not the subjects of the research (Lawler 1985). Lawler (1985) noted this may be appropriate in most cases, but questioned whether this is always the case when studying organizations and the individuals who compose them. He suggested that managers and members of organizations are often very aware of the situational context

within which they work and that while there is a common belief that theory precedes practice, perhaps one should consider that the innovations in practice precede the theories born from them.

With this in mind Lawler (1985) charged that if we endeavor to carryout research useful to both theory and practice, in designing studies for exploring organizations, perhaps we must change the way we view the roles of the investigator and the subject. He argued that the investigator in such a study brings the expertise with regards to theory, past research on the theory/subject being studied, and credible methods for carrying out the study. However, the investigator relies on the practitioners of the organization being studied to provide the expertise related to practice. This creates the need for these practitioners to be involved in the study at "more than a superficial level."

Keeping Lawler's case for designing studies relevant to both theory and practice in mind, it was argued that the research paradigm of action research would offer a suitable framework for designing such a study. Engaging both quantitative and qualitative methods, action research differs from conventional research in the lens it puts forth through which to carry out an investigation. Described as an "attitude of inquiry," action research endeavors to link theory with practice where "scholar-practitioners explore a social situation by posing a question, collecting data, and testing a hypothesis through several cycles of action (SAGE 2010)." The SAGE *Encyclopedia of Research Design* (2010) charges that action research fundamentally differs from conventional research in three ways. These include the following:

- The primary goal of action research is to influence social change.
- Members of the sample population studied actively engage in the research process, accepting responsibility alongside the researcher for finding solutions to the problem at hand.
- As hinted above, the relationship between the researcher and those studied is less "hierarchical." Those studied play the role of "participant-researcher" rather than simply a "subject."

The *Encyclopedia* expands upon three characteristics of action research, including reflection, "iterancy", and collaboration. It notes that in most action research models, focused reflection is carried out in several stages including "learning for practice" where researchers and participant-researchers collaboratively carry out investigatory activities aimed at learning about the problem; "learning in practice" where the team makes sense of relevant data collected, subsequently planning and implementing strategies for improvement; and "learning from practice" which includes reflecting upon the results after implementing strategies from the previous phase (SAGE 2010).

"Iterancy" refers to the cyclical and continuous nature of action research studies. An action research study typically takes the researcher and participant-researcher through a series of "learning loops" that involve the team carrying out a spiral of activities including "planning, acting, observing, and reflecting." During this series of iterations, participants continue to collect and make sense of data until an agreement can be reached on the most appropriate action (SAGE 2010).

Finally, collaborative partnerships are formed between the researcher and participant-researchers where structures are put in place in order to share both power and voice; opportunities for the construction of common language and understanding are sought; a code of ethics and principles are adhered to; an agreement is put in place regarding the shared ownership of data; the sustainability of community involvement and action are considered; and methods are discussed for assessing how effective the process is. The collaborative partnerships leveraged in action research are done so in order to generate feasible and sustainable opportunities for improving upon a problem, in that those solutions are collaboratively determined with the help of practitioners. In addition, theory can continue to be tested and refined through practice (SAGE 2010).

With the goal of contributing to the practice of construction delivery, focusing specifically on understanding the relationship between collaboration and value-generation during design/preconstruction, it was argued that this paradigm, whose primary concern is bridging theory and practice, was the most appropriate under which to design and conduct a study for the offered goal, research question, and objectives.

In addition, while defending the procedure used to carry out the research project featured in this Master's thesis, it was noted that construction is a field where expertise is hard won. Those veterans of the practice that have both planned for and ran successful projects are given their due respect in accordance with their years in the field because those in the business understand that the tacit knowledge and instinct necessary for foreseeing and mitigating potential issues and solving problems when the unexpected arises cannot be learned from reading a book. While the most astute may find ways to accelerate their development, it still takes years to become familiar with the plethora of circumstances one may run into on the job. With this in mind, it only seemed fitting that a study concerned with improving the construction industry be carried out in a manner that recognized the practitioners involved as more than "subjects" but as participant-researchers, as most of them, if not all, were more veteran in practice than the author/researcher that conducted this study.

Lastly, action research is concerned with exploring and better understanding social situations – a goal of this study – endeavoring to employ this increased understanding resulting from data collection to develop feasible, sustainable processes for continuous improvement, which fulfills the primary objective of this study.

1.6 Overcoming Concerns with the Qualitative Tradition of Inquiry: Realizing Objectivity through Validity and Reliability

The SAGE *Encyclopedia of Research Design* (2010) notes that the emergence of action research illustrates a shift in focus from the positivist paradigm of research that favors the statistical testing of hypotheses to one that values "empirical observations, case studies, and critical interpretive accounts." The *Encyclopedia* goes on to state that the support for research grounded in the action research paradigm is born out of the following reasons:

- It is believed that theories born from positivist research have been inadequate in explaining social interactions and cultural phenomena.
- Other forms of research have not provided the insight necessary for appropriately examining organizations such as schools, hospitals, and corporations.
- As noted previously, action research actively endeavors to bridge the "perceived gap" in understanding between practitioners and scholars (SAGE 2010).

However, despite its potential usefulness, it is argued that the qualitative aspects of action research can yield it unreliable because the certainty of causation is difficult to discern due to the number of uncontrolled contextual variables (SAGE 2010). In response to this understandable accusation, one may respond that the tradition of qualitative inquiry receives the same criticism whether it is its being performed under the paradigm of action research or that of conventional.

In their book *Reliability and Validity in Qualitative Research*, Kirk and Miller (1986) sought to address this claim that the qualitative tradition of inquiry is unreliable, or lacks "objectivity" - defined as the idea that "everything in the universe" can be explained "in terms of causality." They argued that while the tradition often involves "sustained interaction with the people being studied in their own language, and on their

own turf," this does not mean that "innumeracy" should be associated with qualitative methods nor should it be synonymous with field work. Rather, they noted that the basic strategy of qualitative inquiry is to appropriately reconcile diverse research tactics – which may be more appropriate for investigating complex problems - in the pursuit of achieving objectivity. Furthermore, they charged that the evaluation of objectivity in a qualitative study should be done so in terms of validity and reliability.

Kirk and Miller (1986) defined validity as the extent to which a measurement procedure provides the correct answer. They described reliability as the extent to which the procedure yields the same independent answer free of influence from accidental circumstance "however and whenever" it is conducted. They noted that while perfect validity (which is unattainable) entails reliability, the converse does not do the same.

While there is an argument against academia's preoccupation with achieving objectivity, or producing generalizable knowledge, the position assumed in this study was that this argument is moot. This study was carried out understanding that objectivity is the essential basis of all good research in that it makes the case for why conclusions by an investigator are worthy of acceptance (Kirk and Miller 1986).

Heeding the warning provided by Kirk and Miller (1986), this research study focused first and foremost on ensuring the validity of the data captured, keeping in mind that a common error in ensuring validity in qualitative studies is a Type 3 Error: asking the wrong question. However, Kirk and Miller (1986) noted that while it has been disregarded to the detriment of the qualitative tradition, reliability is still a necessary component in achieving objectivity as it provides other scientists with the opportunity of carrying out the same experiment in order to test that the results of a study are replicable.

With regards to the second objective of this Master's thesis, it should be noted that the intended contribution to the overall goal was not to provide a one-size-fits-all plan of methods with a recommended sequence for the design/preconstruction phase. Rather, the proposed conceptual model was to endeavor to act as a "learning system" for assisting project teams with creating a plan for purposeful collaboration between parties to a project during the design/preconstruction phase that renders value to the project.

While oversimplifying can lead to adhering to standardized practices that do not create the best fit, one might argue that we still must find a way to organize complex ideas, projects, etc. in a way that we can render them legible. With this in mind, the objectives described were carried out using Morten T. Hansen's concept of "disciplined collaboration" as a framework through which to consider and understand value-generating collaboration and how we achieve it during both construction project design/preconstruction and project management within other industries.

2.0 CHAPTER TWO: LITERATURE REVIEW

A survey of construction literature was conducted with an emphasis placed on finding previous research focused upon collaboration between parties responsible for designing/constructing a project, and in particular, the integration of these parties into a unified cross-organizational team. Not surprising, much of this literature on "integrated teams" was associated with Lean Construction. In addition, it was the hope of this author to find literature where the research results and conclusions found pieces to the puzzle of what value-generating collaboration brings to a project, when and where it occurs, and what must be at play in order for synergy to be achieved. This last quest – to determine how the AEC industry can better leverage collaboration to generate value, how synergy is achieved, and gain a better understanding of group dynamics at play – took the literature review into bodies of study including business management and organizational behavior psychology.

2.1 Integrating Project Teams: Previous Research

In the search for relevant research, two sources focused upon what they referred to as an "integrated project", with one seeking to answer what makes a project integrated and the other concerned with overcoming the barriers of implementing "integrated project delivery."

In their article "What makes the delivery of a project integrated: a case study of Children's Hospital, Bellevue, WA", Yong-Woo Kim and Carrie Sturts Dossick (2011) posed the research question "what makes the delivery of a project integrated?" They commented that in order to overcome the problems that arise during construction project delivery due to fragmentation, the industry must move toward the coordination of project participants and utilize approaches that foster collaboration. They defined an integrated project team as one that brings together "different disciplines or organizations with different

goals" where "needs and cultures merge into a single cohesive and mutually supporting unit with collaborative alignment of processes and cultures." Kim and Dossick suggested that the degree of integration achieved during a project is reliant upon "Contractual, Organizational, and Technological mechanisms." They mentioned that in previous research, they have found that the culture of the organization formed to complete a construction project plays an important role in realizing success. In addition, conflicting company interests with regards to elements of the project impede the success of inter-organizational collaboration.

Kim and Dossick (2011) chose to engage in a case study in their endeavor to further investigate the components that make the delivery of a construction project integrated when using contractual, organizational, and technological tools to encourage integration. The project they chose for study, Children's Hospital and Regional Medical Center, utilized an Integrated Form of Agreement to satisfy the commercial terms, engaged in Lean Construction practices, including target costing, set-based design, and the Last Planner System, beginning early in the design phase, and used BIM. In order to complete their case study, Kim was afforded the opportunity to work as an embedded participant in the preconstruction group of the general contractor over a six-week period. During this time Kim utilized the participant-observer method to observe what the authors described as "observable details" including the attitude of project participants. In this role, he observed the majority of meetings and had both formal and informal conversations with project managers, architects, consultants, and subcontractors. To verify the participant observations, Kim and Dossick (2011) also conducted a series of interviews with an owner representative, architect, general contractor, and structural engineer. Questions were asked with regards to the attributes of the project, the role of the member interviewed, collaboration, how the participant used lean and BIM, and their characterization of the IPD process. Kim and Dossick (2011) noted that

questions were open ended in order to encourage interviewees to elaborate and freely share their perspectives.

Through their research, Kim and Dossick (2011) concluded that five elements contribute to making the delivery of a project integrated. Those elements include contract type, culture, organization, Lean Construction, and building information modeling. They went on to mention that in the case of these elements, the whole is greater than the sum of its parts – that these elements when used in combination enhance the effectiveness of one another.

With regards to the contract, the Children's Hospital project used the IFOA joining the client, architect, and contractor. A Guaranteed Maximum Price was set along with a statement of intent and guide to standard work that was agreed upon by all parties. The contingency set for the project was managed collectively. Testimony collected by Kim and Dossick (2011) indicated the opinion that the contract assisted with tying the interest of the parties to acting for the betterment of the project and leading to the acknowledgement of design ideas from all parties involved. Interestingly, although subcontractors and consultants were not parties to the project IFOA, the architect chose to share the risks and rewards of the project with the consultants while the contractor entered into traditional bilateral contracts with its subcontractors. The owner mentioned that the trades involved tended to look out for their bottom line first and foremost – that combining the traditional culture was disruptive to the target value design process.

Kim and Dossick (2011) stated that organizational alignment takes place when "strategic goals and cultural values are mutually supportive." It was noted in their discussion of culture that strategic alignment was achieved on the Children's Hospital project team by placing the focus of the contractor and architect on

the same bottom line, by tying their interests together. Cultural alignment – values, practices, and behaviors – was achieved by coming to shared understandings and due to the leadership team continuously reinforcing the project goals and participatory culture. This included calling attention to the need for one to get out of one's "silo" when necessary and by asking the question "are we making the project better?"

When organizing an integrated project team, Kim and Dossick (2011) claimed two issues arise. Firstly, one must ask who is in the room. And second, the culture that is set and reinforced. Although the strategy was not used on the Children's Hospital project, Kim and Dossick (2011) mentioned that co-location, or the Big Room, is one of the most powerful organizational strategies. They state this is because co-location allows for informal communication to take place between parties, crossing the "formal divisions of project organizational hierarchies" and allowing for a sense of teamwork to be built across members from different companies. Although the Children's Hospital did not use co-location, they did bring members of the project team together once a week for a day-long meeting to discuss progress on each member's specific scope that was being carried out at their respective offices. Kim and Dossick (2011) stated this was effective due to the size of the project and proximity of the team member offices in relation to one another. Without using co-location, the project team worked to establish a common vocabulary across the owners, users of the facility, designers, and builders while creating a project-specific culture, in order to ensure the day-long meetings resulted in meaningful dialog. On the topic of the appropriate time to bring the trades and design consultants to the table, Kim and Dossick (2011) said that if a culture of mutual respect is present throughout the project and the participant's expertise is used in the decision-making, those individuals feel compelled to work in the best interest of the project. When parties are not involved in the overall decision-making but rather are confined to their scope of work, they tend to become protective of their scope, or said differently, what they have control of.

With regards to incorporation of lean strategies to achieve integration, the Children's Hospital used target costing, set-based design, and the Last Planner System. Of importance to this discussion on integration and collaboration, Kim and Dossick (2011) observed that using LPS contributed to integrating the project team in two ways. First, they found it improved workflow reliability which in turn, assisted members of the team with building trusting relationships with one another. Second, it allowed for all members on the project to participate in the planning of the work, giving them a sense of ownership.

As a result of their research, Kim and Dossick (2011) made the following claims:

- The development of a team's orientation, culture, and processes of working together are the pillars to achieving effective integration. Tools, including BIM, support integrated teamwork. However, they themselves do not create the integrated team.
- Use of an IFOA, lean, and BIM strategies and tools reinforce the integration of the project team and lead to better results with regards to the design and construction deliverables.

It seems pertinent to mention that this research proposal has chosen to describe IPD as the commercial terms under which a true lean/IPD project operates. From the research reviewed it is clear that the scholarly community uses this term in multiple contexts including to reference the commercial terms, as this author understands its appropriate use, or when naming the delivery process of projects that include lean tactics and/or ideals in the effort to encourage greater collaboration.

Similar to "success", both the AEC industry and scholarly community have not yet agreed upon definitions for various terminology, making it difficult to produce research that can be easily compared. This author recognizes that she is biased in her feelings regarding how certain terms should be used, likely due to her

training. All that aside, despite differences in terminology usage and perhaps the lens within which research was conducted, the following research was reviewed in search for current findings regarding maximizing success during the delivery of construction projects with a focus on collaboration.

In their article "Transitioning to Integrated Project Delivery: Potential barriers and lessons learned," Ghassemi and Becerik-Gerber (2011) recounted their research findings after inquiring how AEC professionals have overcome the most prevalent barriers of implementing IPD. Ghassemi and Becerik-Gerber are a research team, as noted above, that define IPD as the actual project delivery process rather than using the term solely to reference commercial terms. They define IPD as "a highly collaborative process that integrates the expertise of project teams during the early project stages." In their journal article they went on to describe the process as one that engages experts from all disciplines involved at the project's inception in order to ensure that overall design decisions meet the needs of all parties involved.

Focused upon overcoming barriers to IPD as a collaborative delivery process, Ghassemi and Becerik-Gerber (2011) listed the following as barriers impeding industry-wide adoption of IPD:

- Lack of Appropriate Legal Structure: Including allocation of risks and insurance products, Ghassemi and Becerik-Gerber (2011) charged that the transactional contract structure used and supported by the United States legal system as a cause for disputes and inefficiencies because inherently, it seeks to silo roles and responsibility for risk to parties. It does not consider the need for flexibility to handle ever-changing project conditions. To avoid risk, it discourages parties to a project team to reach across the aisle for the betterment of the project.
- Cultural Barriers within the Industry: Ghassemi and Becerik-Gerber (2011) stated that "mutual respect and trust is the single most important principle of IPD." They used the findings of Briscoe

and Dainty as an example, whose study of supply chain integration in construction found that lack of trust among different parties inhibited project teams from achieving the collaboration necessary to an integrated project.

- Allocation of Financial Incentives: Ghassemi and Becerik-Gerber (2011) made a case for the use of a compensation structure that involves project participants sharing the financial risks while also reaping the rewards of an efficiently and effectively managed project.

And lastly, Ghassemi and Becerik-Gerber (2011) included technology limitations among the four barriers to IPD as a collaborative delivery process.

In order to complete their research, Ghassemi and Becerik-Gerber (2011) employed a qualitative investigation strategy that included conducting interviews with participants of nine projects selected for study. They noted that because only a limited number of IPD projects had been completed and/or were underway at the time of their research, only qualitative investigation was possible. Interviewees were selected from a list of 415 participants from the 2009 IPD Survey or by referrals from the AEC industry. Ghassemi and Becerik-Gerber (2011) deemed a participant eligible if they reported experience with IPD and were a member of the executive management team at their firm. The pool of individuals interviewed included AEC professionals employed by construction firms, architecture firms, owners representatives, and integrated suppliers providing both design and construction services. Formally structured interviews were conducted via telephone after initial contact was made by email. The interviews were recorded and later analyzed using a coding system that identified key terms drawn from a literature review process in order to identify common themes.

In conclusion to their research, Ghassemi and Becerik-Gerber (2011) reported on strategies employed by those projects studied, categorizing them into the types of barriers described above. With regards to cultural barriers, they reported that the benefits of IPD were only realized when subcontractors were brought into the design and construction process as early as possible. Benefits cited included savings with regards to steel in one project studied as well as greater collaboration/sharing of information from the onset of the design phase that was influential in deciding upon the final design. Training was carried out by all nine projects surveyed with regards to protocol and expectations at the project level. Four of nine cases also held training at the organizational level. Lastly, project teams were able to overcome cultural barriers by building confidence toward one another by partaking in trust-building activities and tools. Ghassemi and Becerik-Gerber (2011) reported that the following assisted with building mutual respect and trust:

- Collaboration at the onset of the project;
- Open communication between team members;
- Confidence in the capabilities of individual team members; and
- Sincere, transparent conduct between all members of the team.

They also made the claim that trust within the team came about in one of two ways: pre-existing and forced. Pre-existing trust was observed by the researchers where participants belonging to a project team had long and successful past working relationships. Where pre-existing trust did not exist, tools and activities were employed to assist with facilitating collaboration with the goal of initiating trust among team members intentionally. Among the tactics used to encourage collaboration and foster trust was meeting face-to-face rather than communicating remotely. Four of the projects took this concept a step further by employing the use of a Big Room, or co-locating key team members. These tactics fall in line with research on communication and findings on which methods are the “richest”. Hitt et al (2011) rates

face-to-face communication as the richest, where the level of "richness" is dependent on the availability of feedback; the "use of multiple cues"; the "use of effective language"; and the degree to which the communication has a personal focus. Other strategies used by the various projects profiled included use of "strong" communication and the use of target value design and/or the Last Planner System as methods for facilitating meetings with the goal of reaching mutually agreeable solutions to project costs, design, and methodology (Ghassemi and Becerik-Gerber 2011).

Ghassemi and Becerik-Gerber (2011) found that of the IPD cases they looked into, most established a Guaranteed Maximum Price (GMP) or an Estimated Maximum Price (EMP). With regards to overcoming financial barriers inhibiting integration, Ghassemi and Becerik-Gerber (2011) described incentive schemes employed by cases 2, 3, and 9 that involved sharing cost savings and overruns. Case 2, which employed a design-build contract, agreed upon a GMP after a thorough validation period. As part of the incentive scheme, the contingency funds were held by the core project team. After the project was completed, any savings in addition to the contingency funds were distributed among members of the project team based on the risk each party had taken on. In Case 3, who used a multiparty agreement (Integrated Form of Agreement), the main project team in addition to a few key subcontractors worked together to establish a target value design (TVD), or determine the best possible design for the desired target cost. An EMP was established at the end of the validation period that called for 50% of total savings to be given back to the owner with the other 50% of savings to be distributed to project team members in accordance with the amount of risk each party held for the project. Case 9, which also utilized the IFOA multiparty contract, utilized a similar financial incentive structure to Case 2. Lastly, with regards to financial barriers, Ghassemi and Becerik-Gerber (2011) mentioned that project team members in two of the case study projects elected to place a percentage of their fee into a pool, withdrawing it at the conclusion of the project and sharing in the savings should the project come in at or under budget.

With regards to legal barriers, Ghassemi and Becerik-Gerber (2011) reported that all multiparty agreement projects were able to overcome issues with regards to risk and insurance by choosing contracts that fit within traditional insurance products or choose an insurance product that fit the needs of the project. In one case study project, parties to the project agreed to waive the ability to file claims against one another.

Ghassemi and Becerik-Gerber (2011) reported that technological barriers, or the legal challenges of ownership, liability, and interoperability when seeking to use technology for collaboration purposes, were not an issue on any of the projects they studied. They did mention that there was concern over the availability of Building Information Modeling software to subcontractors and whether or not they would be savvy enough to use it in the case of two of the projects studied. However, if any challenges did arise, the work in finding solutions did not outweigh the overall efficiencies found by using it.

In conclusion to their research, Ghassemi and Becerik-Gerber (2011) reported that none of the nine projects involved in their cross-case comparison suffered from issues commonly observed in the AEC industry. They listed the following as best practices to be followed in order to overcome major barriers and achieve successful IPD projects:

- Select the right project team early and based on quality: Ghassemi and Becerik-Gerber (2011) claimed that IPD projects demand a greater amount of diligence by the owner when selecting members of the project team. Rather than choosing members based on who offers the lowest cost, IPD involves placing an importance on value – who can provide the best design for the target budget. Characteristics that were sought out in the IPD project team candidates included:
    - The ability to participate in planning and design;

- Subcontractors who had both an engineering and trade team in-house;
- The ability to use information technology;
- Those companies who demonstrated they had an open mind, were familiar with IPD, and were able to work collaboratively with other teams;
- An openness to transparent book keeping; and
- Previous experience on IPD projects or with other candidates for the overall team.

- Reconcile project goals: Ghassemi and Becerik-Gerber (2011) said that based on their analysis, it is necessary for the owner to provide the IPD team with a set of project goals. These goals must include desired scope, quality expectations, budget, schedule, and program. They reported that two trends were observed with regards to establishing and reconciling project goals. The owners in four of the cases observed selected their project teams first, charging them with setting project goals prior to a "goal-setting" session. During this session a final budget was set in addition to an agreement on expectations and project member roles. In three of the cases, the owner selected for the team after they had set the project goals on their own. These projects reportedly had more change orders.

- Set procedures for problem solving and resolution: Reportedly all the integrated projects studied placed a dispute resolution procedure within their contracts that called for establishing a core team of individuals who at minimum, represented the owner, architect, and contractor. Of the projects studied, Ghassemi and Becerik-Gerber (2011) mentioned that none of the four that saw completion nor the remaining five active during the study saw a legal dispute handled in court. All potential disputes were negotiated by the core team. While it was recounted that these discussions could be heated, all in all it was mentioned by Ghassemi and Becerik-Gerber (2011)

that the use of an IPD core team for dispute resolution created an environment that promoted open and honest discussion among stakeholders.

- Provide continuous organizational and project-level support: Ghassemi and Becerik-Gerber (2011) charged that IPD projects involve a paradigmatic shift with regards to culture, demanding more collaboration among project participants. When asked how they were able to overcome the changes that come with an IPD project, participants answered support from their respective organization and strong support from their organization's leadership. By staying committed to employing IPD, it was reported that all cases were able to overcome issues that arose. In addition to prior experience with IPD, participants mentioned that an organization's ability to function within the IPD project setting was integral to overcoming communication issues between members of the project team. As a result, Ghassemi and Becerik-Gerber (2011) recommended training at the organizational level should a company decide to get involved in an IPD project.

- Provide collaborative and fully integrated project environments: Ghassemi and Becerik-Gerber (2011) claimed that their analysis indicates that the early collaboration of the major parties to the project team, including the owner, architect, contractor, engineers, and subcontractors, allowed for both extra savings to be found and the early completion of those projects that finished before they had completed their research. They also mentioned that most case participants agreed that "true integration" is only achieved when key organizations to the project are able to marry their respective BIM models into a single model and participate in the project from the early design stage through construction. Of interest to this research project, Ghassemi and Becerik-Gerber (2011) made the claim that despite the AIA distinguishing IPD as a delivery method that uses a multiparty contract, "full integration" was still achieved by project teams studied that chose to

utilize other contract forms available. Ghassemi and Becerik-Gerber (2011) pointed to the three cases that utilized the design-build delivery method.

All in all, Ghassemi and Becerik-Gerber (2011) concluded their study by stating that the degree to which a project is able to achieve integration is proportional to "organizational anticipation", training of individuals, and the establishment of a collaborative framework within IPD teams.

2.2 Why Did the "Tools" Work? Looking Beyond the Project Delivery Methods

The following literature reviewed detailed what the author of the journal article referred to a as a "case study based, practitioner led inquiry" that was carried out in Europe. The case study project involved the construction of a local council swimming pool whose design process began in June 2002 when the Local Council (the Client) hired an architect-led multidisciplinary team that included the architect, structural engineer, and building services engineers. Entitled "Insights into collaboration at the project level: Complexity, social interaction and individual skills", the construction delivery method used by the case study project was called "two-stage tender" (Cicmil 2007). Two-stage tender appears to be similar to construction management at risk delivery in the United States, involving procurement of a contractor before all information related to the design has been completed. In the first stage, the contractor submits a response to a request for proposals. The client may be interested in using this form of delivery because they want the contractor to be part of the desired preconstruction program, which may include design services, or to begin work on scope packages that have been broken out of the preliminary design. In the second stage a fixed price is negotiated for the remainder or the entirety of the construction costs (Rawlinson & Langdon 2006).

The research findings presented thus far in the literature review have been derived primarily from case study projects that were actively attempting to achieve "integration" by using the various strategies associated with Lean Construction, and perhaps were adopting the philosophy that drives it. Similar to these cases, the Local Council chose to utilize two-stage tender as a delivery method in order to integrate the contractor into the design team and incite a collaborative design effort where the expertise of both professions could be leveraged for the best, most cost-effective design. While the case reviewed by Kim and Dossick (2011) utilized the Integrated Form of Agreement, of the nine cases reviewed by Ghassemi and Becerik-Gerber (2011), only three of them chose to use a multiparty contract. The remaining five cases entered into bilateral agreements with the understanding that delivery was to be "integrated". All in all, the majority of the cases were not carried out recognizing all three domains of lean/IPD. While Cicmil (2007) did not mention the concept of "integration" in her research question, it can be argued that her research interests were comparable to both Kim and Dossick (2011) and Ghassemi and Becerik-Gerber (2011) in that she sought to understand the relationship between project delivery and project team collaboration. Of significant value to this research proposal, Cicmil (2007) asked this question in an effort to better understand the social process that takes place in what she called "the multi-organisational setting defined as 'construction projects.'" However, without quantitative data with which to compare each case study project to one another in terms of what constitutes "success," from a qualitative standpoint one might note that the projects that sought an integrated approach as reviewed by Kim and Dossick (2011) and Ghassemi and Becerik-Gerber (2011) seem to return findings and testimony hinting at far greater success and satisfaction compared with the case reviewed by Cicmil (2007).

Cicmil (2007) introduced her research with the argument that construction projects are a complex social setting that require both alternative routes to realize collaborative action and "qualitatively different managerial virtues that correspond to the nature of such arrangements."

In contrast to research previously reviewed, instead of focusing on how the delivery methods assist with integrating a team and fostering collaboration, Cicmil (2007) argued that the claim that project integration can be enhanced through innovative contractual arrangements should be revisited. That instead, scholars and practitioners should be engaging in studies that look at the intricacies of construction projects as social settings with a focus placed on the experiences of members that make up the project organization at both the micro level (social interaction) and macro level (project governance). Cicmil (2007) claimed that in order to make sense of how various project participants respond to and cope with project settings, one must first understand the nature of interaction among those parties to a project or group. Furthermore, she acknowledged that while considering the management of construction projects through the framework of complexity theory has not been widely embraced, that this paradigmatic shift has continued to be addressed by scholars concerned with the field of project management in a broader sense.

Sven Bertelsen noted in his paper "Construction as a Complex System" that while there is no comprehensive definition for what constitutes a complex system, it can be agreed that at its core, acknowledging a system as being complex involves reconsidering the reductionist approach that has prevailed in Western science since the Renaissance that any system can be and should be understood from an ordered viewpoint. Studying a system through the window of complexity studies challenges one to consider the system as a whole without simplification. It involves observing the interaction between elements of a system with just as much focus as observing the elements themselves.

Noting the existence of eighteen characteristics of complexity highlighted by Lucas in his paper "The Philosophy of Complexity", Bertelsen proposed dividing these into three groups – autonomous agents,

undefined values, and non-linearity. He used this condensed set of three characteristics to aide in putting forth an argument as to why construction can be considered a social system through the lens of complexity theory. Bertelsen first charged that construction can be described as a "temporary undertaking for which a new organization is established for every project." He noted that while the organization and its composition is clarified down to a certain level, there are several layers of social relations supplementing the formal management that may not be recognized by project management but are of great importance to getting the work done. Next, Bertelsen described the construction site itself as a "working place for humans" and therefore a setting for "cooperation and social interaction" despite the transiency of its many participants. He mentioned that because the staff at the "production facility" or construction site are not hired and reimbursed by the actual place where they work, the "project", their loyalties are divided between their own firm and the job. Loyalty to the firm likely holds priority over the success of the project from the standpoint of overall time, cost, and quality because their own career success is dependent upon the reputation they build with their employer. Finally, Bertelsen put forth an argument for considering construction as a social system by describing it in terms of the three defining elements of a complex system:

- Autonomous Agents: Although the groups and individuals brought together to complete a construction project may not be completely autonomous, those parties involved in a construction project can often be considered individually as their formal membership with other organizations (i.e. their employer) trump their informal membership to the group established for the sake of designing and constructing the project. While project management may establish what they feel to be the correct "formal organization" of project parties and their roles, an informal project organization will emerge regardless in response to work conditions, individual member behaviors/attitudes, and traditions (Bertelsen).

- Undefined Values: The temporary hiring of firms and crewmembers and subsequent act of bringing these entities together establishes a system at the outset with undefined common values. Both good and bad social values emerge from the groups brought together, establishing a setting unique to the project where the optimal approach to completing the work must be found each time. The organizational and social systems on a construction site can be seen as non-standard arrangements in time and space where an increasing order is emerging (Bertelsen). It can be argued that this dynamic is present during the design phase as well.
- Non-Linearity: The group brought together to complete a project is always more or less the sum of its participants. If one is to embrace this idea one has also conceded that the whole is different than the sum of its parts, or non-linear (Bertelsen).

Bertelsen mentioned that when considering the concept of "groups" or "teams", it is generally accepted that the whole is always greater than the sum of its parts. However, he suggested that team spirit and cooperation are emergent phenomena – they are not guaranteed.

In hopes of ensuring her readers understood where she was coming from, Cicmil (2007) first endeavored to create a lens from which she wanted the reader to view both the description of the research project and findings of her research. She advocated that when considering the management of construction projects, one should contrast the conventional notion of control with what she calls "the inevitable and ongoing interpretation of purpose and goals among the parties accomplishing a cooperative activity within a social arrangement where ambiguity is created by multiple and conflicting interests, roles, identities, and asymmetries of power." She suggested that with regards to construction projects, three aspects capture the overarching concerns of those in academia and industry. Cicmil (2007) endeavored to develop he own concept of project complexity that considers these concerns in lieu of using the term

"complexity" to consider what she called "normative" concerns, using the number of project participants and diversity as examples, among others. The aspects presented by Cicmil (2007) included the following:

- Communicative and power relationships among project participants;
- Ambiguity and equivocality in establishing performance criteria over time; and
- The consequences of unpredictability and continuous change across time and space.

In the effort to convince her readers of the importance of considering the complexity of construction projects from the above aspects, Cicmil (2007) called upon "ontology of becoming", process theory, and the concept of complex responsive processes of relating in organizations. According to the ontology of becoming, organizations are understood as heterogeneous rather than stable – that they are in a state of continuously "becoming" rather than "being." As a result, the parties that make up an organization are constantly in flux as they institutionalize social habits and patterns of behavior necessary for communicating among each other and establishing norms. She noted that under the creation of an organization is the result of a group of human beings interacting together through the "complex responsive processes of relating" where language is used for both having conversation and negotiating social status and power relationships. She noted that central to the concept of complex responsive processes of relating to organizations is recognizing that communication is a complex process of relating. Cicmil (2007) described it as a "chain of patterned responses" that provide context for individual action. She said that these responsive processes of relating are how human beings go about accomplishing joint actions of any kind. Cicmil (2007) described joint actions as being the key feature of all groups, organizations, institutions, and/or societies formed by humans.

Expanding upon the concept of communicative and power relationships among participants and their role in achieving joint action, Cicmil (2007) mentioned that it has been observed that the communicative

interaction between the members of organizations emerges as the result of the context of the situation. In their conversations, members express their 'situational rationality', a term cited by Cicmil (2007). This situational rationality is formed by the "formal structures, procedures, plans, contract document, etc." Said differently, members of a group choose how they interact with one another, influenced by how they see the context of the project situation in real time and where they, and other members, fit within that context with regards to power. Cicmil (2007) said in this way, construction projects are 'persuasive performances' where routines and power relationships are established through informal communication taking place in real time. As mentioned previously, this process of relating through communicative interaction is what allows for joint interaction, as well as "institutionalized rationality" to be achieved. It was mentioned that the potential for change in order to achieve subsequent joint action is always present. However, in order to engage in the collaborative learning process the institutional rationality must be able to be broken down so that a new "reality" can emerge with its own communicative and power structure and routines. It is stated that the results of relational patterns are:

> "…unpredictable over longer periods as they influence and are influenced by the micro-diversity of an organizational setting: human intentions, choices, and actions are seen as essential to, and operating within, the dynamic daily interactions between people where collaborative learning happens and new knowledge emerges over time."

Cicmil (2007) noted that because the conventional practice is to attempt to "regulate patterns of behavior through structural intervention" when seeking to successfully complete a project and realize its goals, planning in advance for how the work will likely unfold, the ideas of long term unpredictability and consideration of organizational micro-diversity challenge one to consider project management differently that one is used to.

In her search to understand the relationship between procurement mechanisms and project team collaboration, Cicmil (2007) employed data methods that included open-ended interviewing of member representatives of parties involved in the project that directly participated in the project's execution along with the personal accounts collected, documentary analysis, and direct observations of the practitioner-researcher. The direct observations of the team members and their actions as witnessed by the practitioner-researcher were analyzed in conjunction with the respective interview accounts. The research team next interpreted the interview accounts and observations of daily interactions between team members through the theoretical lens crafted earlier that considered the three proposed aspects of complexity in construction projects. Using this lens, Cicmil (2007) claimed that it was possible to identify "persisting tensions" arising from the relationship between project governance at the macro level and the resulting informal activity taking place at the micro level that otherwise may not have been as apparent.

Concluding that benefits of using the two-stage tender delivery method were not realized to their full extent, Cicmil (2007) said that these shortcomings found themselves within one of two categories of benefits – "relational" and "performative." Relational benefits included those that led to enhanced collaboration while performative benefits were those linked to successfully achieving project objectives.

Within the journal article, Cicmil (2007) analyzed the findings of her research through the theoretical lens presented earlier, using the first and second of the three proposed aspects of complexity with regards to construction projects – communicative and power relationships among project participants and ambiguity and equivocality in establishing performance criteria over time. The aspect involving unpredictability and continuous change over time and space was addressed in conjunction with the first and second aspects. Cicmil (2007) first considered communicative and power relationships, stating that her research findings

included numerous instances where members of the cross-organizational project team either complained about or communicated frustration with regards to relationships between members of the project team. Cicmil (2007) described the intent of considering the data through the theoretical lens, claiming that if one chooses to understand the nature of the documented complications one becomes aware of "emergence and development" of the Client's project team of consultants. She said that the "complex responsive processes of relating" among project members over time was formed by power relations and fluctuating identities. Cicmil (2007) concluded that the situation described by project participants was the result of each member selectively choosing what dialogue and actions to reference – in essence, creating their "preferred picture of reality." Cicmil (2007) said that as "preferred representations of the 'two-stage tender' procedures [were] put forward (or [were] completely ignored) by different groups of actors, different patterns of behaviour emerge[d]."

Through her observations and interviews, Cicmil (2007) found that the informal rules governing the joint action of the group were in a constant state of renegotiation, with members choosing to reinterpret or abandon them altogether due to what Cicmil (2007) described as "historical differences and on-going renegotiation of identities", which in turn influenced the "process of communicative relating" within the situational context at a given time. Overall, Cicmil (2007) found that the actions of one of the parties to the project team – the quantity surveyor (third party estimator) – as perceived by both the main contractor and architect, created adversarial sentiments and a feeling of distrust. The representatives of the main contractor disclosed in their interview that they felt the design process was handcuffed because the quantity surveyor was unwilling to consider different points of view. The members from the architecture firm on the project noted that while they understood that the quantity surveyor was hired as a watchdog for the Client, their conduct caused the other members of the team to feel as though dialogue should be censored in case the quantity surveyor should recapitulate a discussion back to the

Client in an unfavorable light. Cicmil (2007) concluded that overall, the data indicated that parties to the project team felt that the team never reached a shared understanding of the philosophy and values that the two-stage tender delivery method was meant to thrive under. Instead, there was a feeling that the process was not achieving the intended benefits because it had been broken as a result of pervading negative norms.

Cicmil (2007) next addressed the aspect of ambiguity and equivocality in determining performance criteria, and concluded that the tensions related to performance that arose from the data could be attributed to the constant renegotiation, reconstruction, and reinterpretation of project objectives throughout the project. She claimed that the pattern of communicative processes that ensued and the power relationships formed prior to engaging in the two-stage tender process yielded a lack of open dialog regarding project expectations and performance objectives as well as the amount of available funding for the project. This in turn led to what Cicmil (2007) described as ambiguity and tensions being built into the project delivery procedure from the onset. Again, the alliance between the quantity surveyor and the Client put them at odds with the other project team members – the architect and main contractor. First, the quantity surveyor withheld providing the project team with a target budget for the project. This was done under the belief that it would motivate the main contractor to agree to a leaner project budget. Second, it appeared that the main contractor and architect understood the two-stage tendering process to be one where program and cost certainty were semi-fluid until initial bid results came in, with time being built into the process at the second stage to revise the design should the market not support the budget for the initial design. The quantity surveyor was described to have been more concerned with firmly setting a program with cost certainty in the least amount of time.

In conclusion, Cicmil (2007) suggested one can disregard two assumptions typically made about the role structural interventions have in setting the stage for improved collaboration and integration of project team members. Those assumptions include the following:

- Allocating time for parties to get to know one another and collaborate on the design/program will result in setting realistic project goals/objectives and cost savings/efficiencies: Cicmil (2007) said these assumptions are typically made as a consequence of scholars and practitioners assuming that human action will take place in a linear, ordered fashion thanks to the project delivery method and/or tools in place to offer structure. She mentioned that by viewing the research data through the lens supporting complexity, it was discovered that two-stage tendering, the proposed structure, was not enacted in a linear manner. Instead, as the project situation unfolded, Cicmil (2007) said that influence spontaneously arose in "webs of power relationships" as members of the project interacted in an effort to "create meaningful forms of activity to move things on." The routines and behavior prescribed by the two-stage tendering delivery method did not develop over time as planned and that the results of communicative interaction may be unpredictable.

- A contract can address communicative and power relationships crafted by the complex interactions among project participants and/or hold project teams to ambiguous performance criteria: Cicmil (2007) said that contract documents assume a degree of certainty with regards to how project activity will be coordinated and the degree to which project team members will be integrated that is rarely realized in practice. She reminded the reader that all along, the proposition that structural mediums, including delivery methods, are the silver bullet for realizing team integration and project success was dismissed. That instead, this research was been conducted in order to better understand the process undergone by members of a project team for reconciling differing opinions of what the problem is and what the solutions are to reach joint

action. Cicmil (2007) referenced the emotions, anxieties, and what she called the "identity crises" documented that were the result and a source of influence for the continuously changing communicating and power relating processes. Regardless of the contract, these processes were what created contexts for joint action to ensue, resulting in the execution and completion of the local council swimming pool project.

In wrapping up the journal article, Cicmil (2007) discussed implications for practice. Worth considering in light of this research proposal is Cicmil's answer to the question "what would be an 'adequate social and managerial intervention' in construction projects as social settings to overcome the limitations of structural interventions?" She answered that since the consequences of an action cannot fully be anticipated in advance, the act of managing should focus on ensuring quality interaction between members of the team wither regards to establishing power dynamics and relating to one another, understanding that these processes are on-going in order to achieve the series of joint actions necessary to complete the project. Cicmil (2007) also pointed out that the person managing must be self-aware, understanding where he/she fits in with regard to the processes with a knack for re-routing the course should it need to be in the sake of progressing forward.

2.3 Combining Theory with Science: A View on Team Development and Management as Understood through the Findings of Organizational Behavior Psychologists

Cicmil (2007) created a theoretical lens to explore construction projects through a complex framework using philosophy literature related to social organization. It may be debated that the arguments provided by both Bertelsen and Cicmil (2007) are convincing with regards to viewing construction projects as complex social systems. Which is why this author wonders if perhaps both the scholarly community and AEC practitioners would benefit greater if the theoretical discussion was combined with the scientific

discussion on team development and management being had by organizational behavior psychologists and human resource management professionals.

The terms “project team” and “virtual team” as defined by Hitt et al (2011) touch upon the very characteristics that might be used to describe a construction project team. Hitt et al (2011) describes a project team as a functional team consisting of a group of associates who assemble as a team in order to complete a specific project. These associates typically come from a variety of functional areas. While this description fits with regards to function, the term virtual team in particular touches upon the characteristic that arguably makes construction project teams both delicate and unique. Virtual teams are made up of associates who work together as a team. However, they happen to be separated by time, distance, and/or organizational structure. Construction project teams, an assemblage of members representing the owner, architect/engineer, construction manager/general contractor, subcontractors, design consultants, etc., carry out the tasks necessary to complete a construction project often from different locations and potentially different time zones. In addition, they take the concept of “organizational structure” differences to another level in that representatives don’t just represent different functional units within the same company but represent entire separate organizations that each feature their own company culture.

In describing both the cost and benefit of virtual teams, Hitt et al (2011) notes that the obvious benefit is that virtual teams allow for people in different physical locations to accomplish tasks as a team. However, they mention that virtual teams have shown to be less effective than teams that operate face-to-face. They provide four reasons for this outcome, including:

- Fewer opportunities for informal discussions to take place, leading to slower development of trust between members;

- Reliance on communication mediums that are less rich than interaction face-to-face;
- It is more difficult for virtual teams to establish behavioral norms; and
- Social loafing, or not contributing one's share of the work, is easier to get away with.

Hitt et al (2011) note that a positive correlation exists between increased occurrences of face-to-face meetings and effectiveness with regards to virtual teams. In addition, virtual teams thrive most when members are empowered with the authority to make decisions and when they are led by transformational leaders. Transformational leadership, as defined by Hitt et al (2011), is an approach that involves inspiring followers to carry out more than what is expected, aspire to continuously develop and grow, build self-confidence, and to consider the interests of the team and/or organization before one's own. Transformational leaders are charismatic, stimulate their followers intellectually, and give consideration to members of the team individually. Hitt et al (2011) mentions that transformational leadership enables the development of trust, the establishment of positive team norms, and inspires members to show a commitment to the team. They note that the presence of transformational leadership is more important than face-to-face communication.

Even if one is reluctant to buy into the idea of considering construction project teams as virtual in nature, one cannot argue that indeed, the agglomeration of members to a construction project must function as a team to accomplish tasks if the construction project is ever to be finished. Comparable to the descriptions offered by Bertelsen and Cicmil (2007), scholars interested in organizational behavior psychology describe teams in general as "complex, multilevel systems that function over time, tasks, and contexts (Ilgen et al 2005)."

2.4 Collaborating to Realize Value-Generating Possibilities: Disciplined Collaboration

There are key similarities between the research project conducted for this Master's thesis and past research covered in the above literature review. However, there are also key differences which gave reason for this Master's research project to be conducted. In their search to determine what made a project integrated, Kim and Dossick (2011) ultimately contribute to the body of knowledge that seeks to answer how the AEC industry can go about building effective cross-organizational teams. If one recalls, their focus was purely on what fosters collaboration – not the use of any one method born from Lean Construction.

Ghassemi and Becerik-Gerber (2011) sought to find best practices for overcoming typical barriers identified in literature that impede the success of integrated project delivery (used here to call out the project delivery system). These practices identified can also be used to inform how to build and maintain effective cross-organizational teams.

Cicmil (2007) asked the reader to consider construction projects through a theoretical lens that viewed such projects as complex social settings, paying attention in her research to the interactions happening at the micro level between members of a cross-organizational virtual team consisting of the owner, general contractor, designer, and a third party consultant. Her research contributed to dispelling the belief that collaborative delivery approaches enacted by contract can guarantee the governance structure and level of integration achieved between parties to the project. In addition her findings contributed to the body of knowledge acknowledging that methods for encouraging collaboration do not guarantee success in fulfilling that endeavor. This research helped with answering what brings about successful collaboration and why it occurs.

However, what makes the research project featured in this Master's thesis unique and a contribution to current research related to construction project delivery with a concentration on collaboration is its emphasis in exploring when and where collaboration generates value. It considers collaboration, or greater "integration", between cross-organizational team members to be a "means to an end (Hansen 2009)" rather than the goal in and of itself. Which is where the concept of "disciplined collaboration" comes into play.

Since the 1990s Morten T. Hansen has been conducting research in the pursuit of answering how entities, both businesses in the private sector and organizations within the public sector alike, "cultivate collaboration in the right way so that we achieve the great things that are not possible when we are divided." In his book *Collaboration*, an amalgamation of the research conducted in the effort to answer his question, Hansen (2009) makes the claim that while "good collaboration" can result in a return on investment, bad collaboration is worse than no collaboration – wasting resources that could otherwise be used elsewhere. He describes both the traps that entities tend to fall into with regards to collaboration as well as steps one should follow in their pursuit to add value through collaboration, an overarching concept he refers to as "disciplined collaboration."

As a point of reference, Hansen (2009) focuses upon collaboration in a "companywide" sense within his studies. He defines collaboration as the act of people from different units of a company working together in "cross-unit" teams on a common task or to provide significant help to one another. The units may be working toward an objective together or this act may be a one-way transaction with one unit providing assistance or advice to another. Hansen (2009) notes that this differs from what he calls "team work" where the focus is reaching synergy through the management of a local group of 5 – 10 people within the same business unit.

In their effort to collaborate, Hansen (2009) listed six traps that businesses often find themselves in. These traps include attempting to collaborate in an environment unfit for collaboration (e.g. decentralized environments that reward competition and independence – perhaps to their detriment); over collaborating (e.g. sharing ideas/best practices with little ROI to show); overestimating the potential value derived from collaborating; underestimating the costs associated with collaborating; misdiagnosing the reason why people are not collaborating; and lastly, implementing the wrong solution to encourage collaboration – which typically follows a misdiagnosis (e.g. implementing a technology or system to foster collaboration only to realize lack of collaboration was due to an unwillingness to collaborate).

Hansen (2009) notes that leaders of entities do not fall into the above mentioned "collaboration traps" because they are not intelligent. Rather, he says that "smart leaders fall into them because they don't have a framework that helps them clearly see the difference between good and bad collaboration." Which is where the idea of disciplined collaboration comes into play. Hansen (2009) defines disciplined collaboration as the "leadership practice of properly assessing when to collaborate (and when not to) and instilling in people both the willingness and the ability to collaborate when required."

He goes on to state that disciplined collaboration can be achieved by carrying out three steps, including:

1. The Evaluation of Opportunities: Firstly, decision makers must pose the question as to whether or not value is to be found by collaborating, keeping in mind that "the goal of collaboration is not collaboration, but better results." Hansen notes that often it may be better not to collaborate simply because there is not a reason compelling enough to justify it.
2. Identify Barriers to Collaboration: If upon evaluation during the first step one finds that collaboration will provide a value-generating opportunity, the next step is to determine where

barriers exist that block people from collaborating, and in particular, from collaborating well. Hansen (2009) notes that the disciplined collaboration framework works on targeting four common barriers, of which will be provided in more detail to follow.

3. Tailor Solutions for Tearing Down Barriers: Perhaps the key word in the third step within Hansen's (2009) framework for disciplined collaboration is the verb to "tailor." This step acknowledges that there is no "one-size-fits-all" to achieving the potential gains that good collaboration may realize. One might apply this to the world of construction, where perhaps our "one-size-fits-all" mentality has led to inefficiencies in the delivery of our projects. Under his framework for disciplined collaboration, rather than suggesting concrete methods for overcoming barriers to collaboration, he provides instead three lenses referred to as "levers" for viewing common solutions through, including what he refers to as the "unification lever," "people lever," and "network lever."

In carrying out step one to achieving disciplined collaboration, or the evaluation of opportunities, Hansen (2009) states there are three domains in which to assess the potential for generating value. These include the potential for better innovation, better sales, and/or better operations. Again, while Hansen (2009) makes his case for disciplined collaboration in the interest of cross-unit collaboration within a single entity, one can see where one might apply these domains for evaluation across the construction project design/planning/execution landscape. Hansen (2009) notes that better innovation may occur through cross-unit collaboration because when people from a variety of areas come together new ideas have the potential for being created (e.g. "business units, country operations, sales offices, marketing, [and] labs"). Better operations can involve either cutting out waste – and therefore cost – or the transfer of advice that leads to more efficient and effective decision making. Lean methods and otherwise that have gained traction arguably have done so because early adopters found value in carrying them out. As an example,

one might make the case that building information modeling as a tool for facilitating collaboration has the potential for realizing value-generating collaboration in terms of better operations on a project by coordinating trades leading to smoother installation and less mistakes in the field.

Hansen (2009) warns that the potential for gains in the three aforementioned areas varies by company, and furthermore to enforce discipline on collaborative projects to realize the potential gains, each project must have a "collaborative premium." The value of collaborating should be greater than both the opportunity cost of foregoing other projects/opportunities and the cost of collaborating. The cost of collaborating includes the consequential expenses associated with collaborating such as travel time/expenses, time spent negotiating between parties, conflict resolution, and the results of complications (delays, budget overruns, quality, etc.). It is here that this author questions the case for using any method of a delivery system for the sake of using it. For instance, if a poor working culture exists between members of a project that engages in the Big Room concept for the sake of using lean methods, does a project realize gains or losses? The previous literature reviewed hints at the need for a strong team-oriented culture in order for projects to overcome barriers and find success. One might question if members of a team will work in a coordinated fashion simply because they are in a room together. Additionally, one might ask if there is a value-generating purpose to the meeting - is value-generating work being carried out or is this a meeting for the sake of having a meeting.

If the evaluation in Step One yields there is a potential for gains, then those looking to implement value-generating collaboration must work to identify and tear down barriers that might halt or lessen its realization.

First and foremost, Hansen (2009) notes that modern management, although unintentionally, may be the culprit that is blocking collaboration from occurring naturally. This is because modern management consciously and unconsciously celebrates extreme decentralization because it is a system that yields a variety of benefits by encouraging entrepreneurship, individual freedom, and accountability. Hansen (2009) notes that a myth exists that collaboration must occur at the expense of decentralization. However, he argues that not only is this not true, it is not the goal – collaboration, again, is a means to a better end. Instead, the goal of disciplined collaboration is to find balance. This includes leveraging the benefits of decentralization while complementing it with an overlay of collaborative behaviors. With regards to leadership, this means leaders shouldn't be providing orders on where and how to collaborate but rather communicating the opportunities seen after evaluation on when and when not to.

Noting that highly decentralized organizations will have more barriers to collaboration, Hansen (2009) provides four categories of barriers identified under the disciplined collaboration framework, including the following:

- "Not-Invented-Here" Barrier (Figure 1): This barrier is in place in organizations where people may be able to, but are not willing, to work with others outside their unit (Hansen 2009). With regards to project delivery, one may argue this barrier exists in cases between the departments within a firm but in particular, across parties that form the cross-organizational team (owner, architect/engineer, GC/CM, subcontractors). This is problematic in the industry's current state of fragmentation into specialties in that each party holds an expertise otherwise unavailable to the other.

Figure 1: Hansen's "Not-Invented-Here" Barrier

"Not-Invented-Here" Barrier			
Unwilling/uninterested in communicating outside of unit	Unwilling/uninterested in communicating across "status lines"	Belief one should fix one's own problems	Worried collaboration will reveal problems

- "Hoarding" Barrier (Figure 2): The "hoarding" barrier involves an unwillingness of people to provide information or help when asked (Hansen 2009). Members of the AEC industry blame the presence of a barrier such as this on the contractual set up that pits interests against each other. In an industry that requires repeat business for success over the long term, perhaps this could be remedied by applying solutions at the human interaction level, as suggested by Cicmil (2007).

Figure 2: Hansen's "Hoarding" Barrier

"Hoarding" Barrier			
Competition between units	Rewards based upon individual achievement	Feeling there is a lack of time to help others	Worried status will be lost if knowledge is shared

- "Search Problems" Barrier (Figure 3): This barrier is one of two that exists not because people are unwilling to collaborate, but unable. In this case, people are unable to find information easily (Hansen 2009). Any amount of dispersion increases the difficulty/work in transferring information (Hitt et al 2011). In the case of virtual cross-organizational teams, this barrier is always present. In addition, those completing value-added work may not have all contacts that hold the necessary information in their network (Hansen 2009).

Figure 3: Hansen's "Search Problems" Barrier

"Search Problems" Barrier			
Challenges stemming from size of company	Distance between team members (e.g. physical location)	Too much information to process	Lack of relationships necessary for finding sought after information

- "Transfer Problems" Barrier (Figure 4): This last barrier is the second of two that exist because people may be willing but unable to collaborate well. It involves the inability to transfer complicated knowledge across parties. Citing the difficulty of the transfer, lack of knowledge on how to work together, and a lack of strong relationships that would ease in transfer as the reasons for this barrier (Hansen 2009), co-location, BIM, and increased interoperability have been created as methods for breaking down such barriers, when necessary.

Figure 4: Hansen's "Transfer Problems" Barrier

"Transfer Problems" Barrier		
Difficulties transferring tacit knowledge	Haven't learned how to work together	Relationships between members are weak

Lastly, Step Three to achieving disciplined collaboration involves tailoring solutions for tearing down the barriers to value-generating collaboration. As noted previously, under his framework for disciplined collaboration, rather than suggesting concrete methods for overcoming barriers to collaboration, Hansen (2009) provides instead three lenses referred to as "levers" for viewing common solutions through, including what he refers to as the "unification lever," "people lever," and "network lever." Hansen's (2009) levers and what they involve are documented in the below matrix (Table 1).

Table 1: Hansen's Levers for Successful Disciplined Collaboration Explained

Lever	Method	Explanation
Unification Lever Goal: Unify people.	Establish a Unifying Goal	Involves crafting a unifying goal that is compelling and inspires others to commit to a cause "greater than their own". This goal must succeed in four areas: creating a common fate; be both simple and concrete; invoke passion; and remove competition to the outside.
	Establish a Value of Teamwork	Involves leadership placing a value on teamwork and demonstrating it by practicing it at the executive level.
	Establish a Language of Collaboration	Hansen notes that a leader's language sets the stage. If one talks competition, they will receive competition and vice versa if they speak of collaboration. The goal is to speak of collaboration for results.
People Lever aka Cultivating "T-Shaped Management" Goal: Cultivating leaders/general personnel that: 1. Deliver results individually (vertical part of the "T") 2. Deliver results by collaborating w/in teams and across units (horizontal part of the "T")	Lack of Tolerance for "Lone Stars" or those that deliver outstanding performance individually but are unwilling to assist those outside of their units.	Cultivating T-Shaped Management and Personnel involves: • Selecting for T-Shaped Behaviors (hiring/firing) • Changing Behaviors (pay for collaborative results, two-sided performance evaluation, promotion, coaching)
	Discourage "Butterflies" or those that are great team players at the institutional level but do not deliver results in their own role.	
Network Lever Goal: Build nimble networks by recognizing that networking is not always a good thing; the size of the network is not as important as the value found in the type of contacts; networking is not just for the socially gifted nor is it an art.	Rules for Identifying Opportunities	• Build outward, not inward • Build diversity, not size • Build weak ties • Use bridges, not familiar faces
	Rules for Capturing Value	• Swarm the target rather than going it alone • Build strong ties for easier transfer of complicated knowledge
	Build Entity-Wide Networks	• Map the network • Evaluate the network

In the search to better understand how the AEC industry can refine and/or change its delivery process to add greater value to construction projects through the philosophical lens of Lean Construction (eliminate waste and add value), Hansen's theory was used during the research project in three primary capacities. These included 1) encouraging discovery by challenging one to think critically about where, when, how, and why collaborative efforts are and/or should be carried out in construction during the design/preconstruction phase; 2) providing a framework for organizing and subsequently digesting data; 3) in hindsight, the concept of disciplined collaboration provided a way to more clearly explain the goals of the project and communicate results – in this way it provided a shared language.

One may argue that Hansen's (2009) findings are based off of sample businesses concerned with value-generating collaboration across units within their business, not between parties that belong to a cross-organizational team that in addition experiences the pains of being virtual. However, Hansen's (2009) research samples included large companies whose people work out of locations spanning the globe, in effect making many of them virtual cross-unit teams. While there was and continues to be room to discover as one overlays the idea of disciplined collaboration upon the cross-organizational team responsible for designing and planning for a construction project (owner, architect/engineer, general contractor/construction manager, etc.), a case can be made for the validity in using the concept of disciplined collaboration and what it entails to provide lens through which to analyze collaboration in construction project design and delivery.

2.5 Best Practices of Effective Virtual Teams

In the effort to thoroughly answer the research question posed in this Master's thesis – which asks where, when, how, and why does collaboration generate value to construction projects during design/preconstruction – and to further suggest that the AEC can learn from research focused on

collaborative practices and fostering team synergy on projects across all industries, an additional literature review was conducted that surveyed research related to value-generating collaboration across any/all industries.

Waiting until after the case study had been conducted to begin, the author tailored her search to focus on literature concerned with virtual teams and that which might promote a better understanding of and solutions to barriers highlighted by the converged responses compiled and action learning sessions conducted during the case study.

Earlier the author put forth the idea in the initial literature review conducted that the terms “project team” and “virtual team” as defined by Hitt et al (2011) touch upon the very characteristics that might be used to describe a construction project team. Hitt et al (2011) describe a project team as a functional team consisting of a group of associates who assemble as a team in order to complete a specific project. These associates typically come from a variety of functional areas.

While this description fits with regards to function, the term virtual team in particular touches upon the characteristic that arguably makes construction project teams both delicate and unique. Virtual teams are made up of associates who work together as a team. However, they happen to be separated by time, distance, and/or organizational structure. Construction project teams, an assemblage of members representing the owner, architect/engineer, construction manager/general contractor, subcontractors, design consultants, etc., carry out the tasks necessary to complete a construction project often from different locations and potentially different time zones. In addition, they take the concept of “organizational structure” differences to another level in that representatives don’t just represent

different functional units within the same company but represent entire separate organizations that each feature their own company culture.

With the above in mind, the author surveyed literature covering research related to best practices for establishing and managing effective virtual teams.

In their article "An empirical study of best practices in virtual teams," Jeremy S. Lurey and Mahesh S. Raisinghani (2000) sought to explore the issue of effectiveness within virtual teams, and specifically, to add to the body of research concerned with determining the factors that contribute to and/or inhibit the success of virtual teams.

In the introduction to their study Lurey and Raisinghani (2000) stated that there has been a realization by corporate leaders that much of the work that people are being asked to complete requires communication and cooperation with others to some degree. As a result, they claimed that a "well-designed team-based organization" will be more likely to realize better problem solving, increased productivity, a more effective use of company resources, better quality in their products/services, increased innovation, and/or better decision-making capabilities compared with those that are not. Lurey and Raisinghani (2000) were quick to note that access to critical resources – and in particular, information – is imperative to team success, regardless of how well-designed an organizational team may be. They claimed this has helped lead to the formation of virtual teams. Lurey and Raisinghani (2000) noted that like teams, virtual teams are "groups of people who share a common purpose or goal and interact interdependently within a larger organizational setting." Yet they reaffirmed the description provided by Hitt et al (2011) by adding that virtual teams differ from conventionally understood teams because their members are dispersed across "organizational, space, and/or time boundaries and are often cross-functional in nature," because

members may come from a variety of departments and/or business units within an organization. Lurey and Raisinghani (2000) claimed these variables add complexity to effectively maintaining virtual teams, sometimes to the detriment of realizing the greatest potential value found from establishing them in the first place.

With this in mind, Lurey and Raisinghani (2000) conducted an exploratory study using a survey whose variables to be measured were chosen based upon findings rendered through a literature review. The virtual teams survey was distributed to twelve separate virtual teams from eight different sponsor companies. These companies were involved in industries including the high technology, agriculture, and/or professional services industries. Sixty seven individuals, who came from research, product development, sales, marketing, legal support, and management consulting, participated in the study. These individuals were all members of virtual teams with members spanning the United States in addition to several countries in Europe and Asia; represented different companies; performed work from different company locations; and were all self-selected by their sponsor organizations due to their experience working as part of a virtual team.

Lurey and Raisinghani (2000) established two separate measures for evaluating virtual team effectiveness in their survey. These measures included a scale related to the ability of a team to perform its work assignment and a scale that concentrated on the level of satisfaction felt by a team member while working as a member of a virtual team. The survey also included several predictor variables that were identified as potentially impacting team effectiveness. These predictor variables spanned three categories including design, group dynamics, and organizational support systems. The category related to design spoke to the actual designing of the team process itself. Predictor variables related to group dynamics included job characteristics and procedures for selection; relationships among team members; and team processes

including internal team leadership. With regards to the category for organizational support systems, predictor variables included established systems for education and rewards; senior leadership styles within the organization; tools and technologies available to the team; and team communication patterns.

The virtual teams survey consisted primarily of questions that asked participants to indicate on a scale how much they agreed or disagreed with a given statement. The level of agreement or disagreement corresponded with a value which was used to determine a mean score for each question and subsequently, main criteria and predictor variable scales. Scores ranged from 1 (strongly disagree) to 4 (strongly agree) (Lurey and Raisinghani 2000). Next, Lurey and Raisinghani (2000) performed Pearsons' product-moment correlations between the scale measurements of the predictor variables and both measures of team effectiveness (performance and satisfaction) to determine the level of, if any, association between them.

Based upon the findings of their survey, Lurey and Raisinghani (2000) made the following conclusions and recommendations with regards to enhancing the effectiveness of virtual teams:

- First and foremost, virtual teams are teams and as such, they must have a shared purpose in order for members to feel inclined to work together.
- If a shared purpose has been identified, team members must be willing to rely upon one another to perform the work.
- The predictor variables that exhibited the strongest associations to team effectiveness included those with regards to establishing positive, dependable team processes; the development of strong interpersonal relationships among team members; creation of team-based reward systems; and building teams out of individuals who are qualified to do the work.

- A number of the narrative responses noted that virtual teams require more structure compared with co-located teams to carry out their work effectively. In addition, they suggested the importance of explicitly defining both the role of individual team members and the primary objectives of a team, rather than assuming these are understood.
- Despite being recognized as critical to improving the success of virtual teams, many participants noted there was a need for more personal contact in order to establish supportive relationships between team members.
- Based upon their findings, Lurey and Raisinghani (2000) suggested that during the initial phase of designing the team process, virtual teams should take the time necessary for truly considering and defining the team's future goals/objectives and developing a work environment(s) that will be successful in supporting the team in order to realize the greatest potential.

One might argue that the above findings of Lurey's and Raisinghani's (2000) study indicate that the success of virtual teams is dependent upon the capabilities of those charged with establishing and managing them. This claim may arguably be made based upon the above because only those building the team have control over rating the qualifications of potential members – both in their subject matter expertise, and perhaps just as important, their ability to work with others – and determining final team composition. Only those managing a virtual team have control over, in addition to the responsibility for, establishing and communicating shared goals in a way that speaks to and inspires all members. Lastly, only those responsible for managing virtual teams may determine what team processes will be established, how they will be established, and by whom (e.g. will management dictate process or will they allow members to assist with their definition).

With this in mind, literature that spoke to practices of effective leaders of successful virtual teams was reviewed. In their article "Leading Virtual Teams," Arvind Malhotra, Ann Majchrzak, and Benson Rosen (2007) presented six leadership practices of effective leaders of virtual teams that were identified through a two part study that included both conducting a case study and surveying 54 virtual teams identified as "successful."

Malhotra et al (2007) defined virtual teams as teams made up of members that are distributed geographically, which in turn requires them to complete their work together through electronic mediums with minimal interaction face-to-face. They go on to mention that virtual teams often "consist of cross-functional members working on highly interdependent tasks and sharing responsibility for team outcomes." In their research, Malhotra et al (2007) chose to focus on virtual teams who endeavor to innovate without the option of collocation, arguing that these types of virtual teams present the greatest challenge to leaders because they become responsible for both ensuring innovative problem solving and mitigating the challenges that arise from geographic dispersion.

In the effort to address the special skills needed for leading geographically dispersed teams that are responsible for addressing innovative problem solving challenges – an area of research they believe has received limited attention – Malhotra et al (2007) conducted a two-phase study. The first phase involved conducting a case study where the authors followed one virtual team at Boeing-Rocketdyne through its life cycle and attended the virtual meetings held by the virtual teams in order to observe the leadership practices as they were being employed. The second phase involved vetting several hundred virtual teams in the effort to identify those that fit the authors' criteria for being a virtual team. Next, the authors identified teams that were considered "successful" according to the executive familiar with the team. This resulted in a sample consisting of 54 virtual teams representing 33 different companies from 14 different

industries. The virtual teams included in the study were responsible for producing a range of deliverables, including new product development, "pure research and development," identification of best practices, knowledge management, development of new technology, employee training development, and benchmarking analysis. With regards to team make up, team sizes ranged from two members to 50, with the average of 12 members; half of the teams included more than one company; 50% included more than one function; and 75% of the teams included members from more than one national culture. Data collection involved conducting interviews with the team leader of each of the 54 virtual teams and asking the team members of those teams to complete a web-based survey. With regards to the web-based survey, 269 individuals from the 54 teams completed the survey.

As a result of conducting this research, Malhotra et al (2007) identified six best practices used by virtual team leaders in their effort to manage geographically dispersed teams tasked with innovative problem solving. These practices included the following:

- Establish and Maintain Trust with the Assistance of Communication Technology: Because goodwill is difficult to observe over the virtual meeting space, trust between team members of virtual teams must be built through actions. Consequently, the actions carried out by team members need to be done so explicitly in order to ensure members of the team are aware (Malhotra et al 2007).

  Malhotra et al (2007) claimed the first task to ensure actions can be observed and trust built is to establish team norms for communicating information over the course of the virtual work. They expanded by noting that of the teams they studied, several struggled with establishing trust within the team because communication norms had not been established. As a result, the members of those teams resorted to communicating in way that was first nature to them in their local setting,

often leading to the inadequate sharing of information with the rest of the teams. This ultimately resulted in a lack of cohesion between members and difficulty integrating the work.

In the effort to establish communication norms, Malhotra et al (2007) suggested the following should be considered and/or determined/defined:

- A Plan for How Communication Technology will be Used:
  - Frequency for checking the "team's knowledge repository" or where work is stored/platform that supports team communication.
  - Methods for how the team will ensure the "knowledge repository" is/remains a "'living' team room," with regards to keeping electronic discussions active and ensuring that "the latest versions of evolving documents are maintained."
  - Guidelines for posting to the knowledge repository, that answers:
    - What, when, and how to post with the end goal of supporting the coordination of work.
    - Who owns the documents with regards to revisions in order to support version control.
    - How to communicate the location of comments/documents with other team members.
    - Etiquette for electronic communication and video conferencing.
  - External Communications: Norms should be established that speak to what is appropriate to share outside of the team to prevent actual or perceived breaches of confidentiality. Malhotra et al (2007) provided examples of what other teams have done, including establishing a norm that negative information not be shared

with anyone outside the team and limiting access to a virtual workspace to team members in a way that actually "locked" managers out.

- Revisit and Adjust Communication Norms as Team Evolves: It was suggested that teams hold "virtual-get-togethers" where the time is spent evaluating currently established communication protocol and making changes where the team saw fit. It was noted that the most effective virtual teams were led by individuals that had "developed a 'virtual' sense" regarding when their team was in need of reenergizing and would benefit from holding a get-together (Malhotra et al 2007).
- Ensure "Equal 'Suffering'": Malhotra et al (2007) claimed that trust was also created on virtual teams when leaders ensured everyone "'suffered' equally" with regards to working from different geographical locations. For example, they said virtual team leaders would rotate the times that weekly conference calls were held so that every team at some point during the project would experience an early morning or late night obligation.
- Make Team Progress Explicit: Virtual team leaders enforced policies that required team members to post their completed work products regularly to the knowledge repository, linking it to active action item lists and/or project timelines. This was done so that other team members could actively observe that contributions were being made and agreed-upon timelines were being met, establishing trust (Malhotra et al 2007).

- Ensure Diversity within the Team is "Understood, Appreciated, and Leveraged:" Malhotra et al (2007) noted that the ability of a virtual team to innovate successfully is often based on how well the diversity on the team with regards to stakeholder position, experience, functional, organizational, style of decision-making, and interests is "understood, appreciated, and

leveraged." They provided the following examples for how leaders of virtual teams ensure diversity is leveraged to its full potential:

- Explicitly Identify Team Members on the Virtual Meeting Space: With regards to getting to know one another, virtual team members are unable to reap the benefits of informal communication/small talk that occurs naturally in an office setting or over dinner/drinks. Consequently, leaders of successful virtual teams do their best to explicitly identify the training, experience, past assignments, etc. for the rest of the team over the virtual meeting space (Malhotra et al 2007). Two examples included setting up a directory at the onset of the team complete with a photo and details regarding expertise and putting a "skills matrix" on the virtual meeting space.
- "Virtual Sub-Teaming:" Members of the virtual teams studied by Malhotra et al (2007) had rarely worked together in the past. As a result, most members were not familiar with the strengths of those members on their team nor were they aware of preferred working styles. In the effort to encourage team bonding and prevent "ingroup-outgroup fault lines" that can form based upon cultural stereotypes and/or communication barriers, team leaders assigned pairs of individuals that could benefit from learning from one another to complete a task at the onset of a project.
- Providing "Asynchronous" Spaces for Dialogue Exchange: Malhotra et al (2007) stated that successful virtual team leaders provide both synchronous (e.g. face-to-face meetings, conference calls, etc.) and asynchronous (e.g. discussion threads, annotation tools, etc.) routes for collaborating. The authors noted that asynchronous collaboration allows team members to continue generating and evaluating ideas in between meetings; supports the diversity of team members by catering to differing paces/rhythms with regards to idea generation and digestion of those by others; and provides those with different language

capabilities more time to share their thoughts if meetings prove to be too fast-paced (Malhotra et al 2007).

- Virtual Meeting Preparation and Management: Malhotra et al (2007) said that the majority of the team leaders in their studies indicated that regular conference calls with mandatory attendance by all team members were imperative to the success of the team, even if tasks had already been distributed amongst the team members. They added that these regular meetings, which met as frequent as every week, were structured for discussion in addition to reporting and coordination. Virtual team leaders used these meetings as a method for keeping members engaged and excited about the work and for ensuring the team members remained aligned with one another. In their research, Malhotra et al (2007) noticed there was a formula to maximizing the value gained from these meetings and ensuring goals were met. These best practices included the following:
    - Pre-Meeting Preparation: In preparation for the meeting, the following activities were carried out:
        - Discussion threads were utilized, often after draft documents had been posted, for commentary/feedback in order to locate areas of disagreement. Those areas of disagreement were then addressed during the conference call.
        - Agendas with time allocations were circulated in advance to indicate to members when they should call in.
        - Work products by members (e.g. “draft documents, memos, drawings, spreadsheets, analysis results, PowerPoint slides, etc”.) were posted to the knowledge repository and linked to action item lists, project timelines, etc., prior to the meeting.

- Meeting Kick-Off Procedures: The beginning of every meeting was used as an opportunity for team members to reconnect. In order to do so, each member:
  - Shared a personal story.
  - Shared a hobby they had recently engaged in.
  - Touched upon any major life events that may have taken place in one of the members' lives.
- Meeting Facilitation Practices: Malhotra et al (2007) emphasized the importance of keeping team members engaged throughout the meeting. They said their research found that team leaders maintained attention by employing tools/asking the members to "check-in" such as voting tools and/or instant messaging.
- Meeting Closure Practices: Malhotra et al (2007) characterized these large team meetings as "the primary mechanism for creating commitment toward forward movement." They said a key practice of virtual teams included posting in the knowledge repository an action item list that included assignments, responsible parties, and due dates after the meeting. Team leaders also employed an idea referred by Malhotra et al (2007) as "minutes-on-the-go," where meeting minutes were taken in real time and posted in the knowledge repository immediately following the meeting. The task of taking meeting minutes was rotated between members.
- Practices Engaged Between Meetings: Malhotra et al (2007) said that according to virtual team leaders, when outside a virtual meeting session, it may be easy for members of virtual teams to remember they are part of team. This requires effective team leaders to engage in practices that engage members as at team between meetings. These practices include use of discussion threads, instant messaging, using the team website to

spontaneously make announcements, and automating notifications that let team members know when new postings are made to the team knowledge repository.

- Use Technology to Monitor Team Progress: According to Malhotra et al (2007), the most successful virtual team leaders leverage the internet to monitor team progress. This was done by scrutinizing the communication patterns being carried out over both asynchronous and synchronous collaboration mediums. In addition, team progress was made explicit for the team to see using "balanced scorecard measurements."

- Make Virtual Team Participation Beneficial to Each Team Member: In order to maximize the effort put forth by virtual team members, Malhotra et al (2007) claim they must believe that they will benefit personally by participating. In order to ensure team member felt/saw benefits, team leaders were said to have carried out virtual reward ceremonies; recognized individuals at the start of conference calls; and ensuring the managers of team members in their geographic location were aware of the team member's stellar performance.

Perhaps worth noting is a comment to the effect that leaders of successful virtual teams recognize and highlight for the group that the members of their team are often in high demand by others. By valuing their time and recognizing while leveraging their skill sets, leaders of successful teams create an atmosphere that keeps the attention of their team members from gravitating to perceivably better opportunities (Malhotra et al 2007).

One might argue that the findings of Lurey and Raisinghani (2000) and Malhotra et al (2007) are valuable in that they outline a framework for establishing and managing successful virtual teams (i.e. teams that

efficiently and effectively find innovative solutions to problems). However, it could be suggested that both leaders and members of teams and virtual teams alike can benefit from gaining a better understanding of the nuances that can affect the level of success/failure experienced by a team, and that should arguably, be considered when one endeavors to establish/manage a team bound to realize its greatest potential value.

While not suggesting that every project team would generate the same findings, this expanded literature review was inspired by the barriers that posed the greatest challenge to value-generating collaboration as found during the case study, which involved those barring the efficient and effective search and transfer of information. In response, and additionally inspired by Morten T. Hansen and his claim that barriers to value-generating collaboration and their solutions fit broadly within several categories, literature was surveyed that spoke to solutions to these barriers that were referenced most during the interviews and action learning sessions. These suggestions arguably could be described as finding a common language between the group and having previously established relationships with those on the team.

2.6 Understanding Nuances that May Impact Effective Implementation of Team Best Practices

According to Satu Parjanen, Vesa Harmaakorpi, and Tapani Frantsi (2010), the term "creativity" is often incorrectly used as a synonym for "innovation." Rather than being one and the same, creativity refers to the production of new ideas, different than those that have been generated before, that are appropriate to the problem/opportunity being presented for any activity (e.g. the sciences, the arts, education, business, etc.). Creativity, or pure ideas, can lead to innovation, defined as the "successful translation of ideas into tangible products or intangible services." Often, the generation of creative ideas is achieved through the interaction of individuals working together in order to solve a problem and/or pursue an

opportunity they cannot address alone. With creativity being "born out of conscious, semiconscious, and subconscious mental sorting, grouping, and matching," interaction with individuals that can "stimulate and enhance" these actions is essential to generating ideas that can lead to successful innovation (Parjanen et al 2010).

In their article "Collective Creativity and Brokerage Functions in Heavily Cross-Disciplined Innovation Processes," Parjanen et al (2010) argued that "collective creativity" – or the phenomenon where an individual generates a creative idea thanks to being subjected to different types of knowledge – takes place when that individual finds him/herself at an intersection where they can make ties to other individuals possessing these different types of knowledge. They referred to these intersections as "structural holes," or the "social gap" between one or more groups of people.

Structural holes, or the intersection between those possessing different types of knowledge, arguably present the best opportunities for generating creative ideas for innovation. However, the process of bridging a structural hole so that different types of knowledge are accessible to those who may not necessarily have the foundation for fully understanding the knowledge creates a challenging obstacle in the way of innovation (Parjanen et al 2010). Parjanen et al (2010) used the example of cross-discipline groups, noting that while such groups can offer fresh perspectives and the opportunity to integrate different types of knowledge, because these individuals are communicating using a language that is perhaps only understood by members of their cohort, success in generating creative ideas that lead to innovation is dependent upon the ability of the individuals to interact with those outside their discipline or organization. While reading this article, this brought to the researcher's mind construction project teams, whose members come from a variety of disciplines that communicate using different jargon. In addition, it brought to mind the search and transfer barriers described by Morton T. Hansen's concept of

disciplined collaboration, both of which were described by the participant-researchers while conducting the case study.

Parjanen et al (2010) claimed that challenges with bridging structural holes has to do with the "diversity" or "distance" between "innovating partners." In their article they described seven types of "distances" that can both ignite the generation of creative ideas as well as pose challenges to bridging the structural hole. These "distances" included the following:

- Cognitive: Referring to differences in types of knowledge, cognitive distance occurs when members of a group/team possess knowledge related to different topics or have different levels of knowledge with regards to the same topic. While this type of distance increases the probability that creative ideas will be generated, too much cognitive distance leads to communication problems (Parjanen et al 2010).
- Communicative: Individuals that hold "membership" within different groups (e.g. construction professionals, architects, engineers, craftsmen, etc.) have a shared understanding of what various terms and other "symbols" mean to that group (Parjanen et al 2010). Parjanen et al (2010) noted that people often speak to problems using their default "language," incorrectly assuming that everyone in the group understands what they are saying. They stated that this can be described as a "communicative distance." In order to overcome this distance, members of a group/team must develop a shared common language or employ a translator for communicating in order to gain access to people with different knowledge sets.
- Organizational: Organizational distance can be described as struggling to efficiently and effectively coordinate transactions and/or exchange information within and/or between organizations (Parjanen et al 2010).

- Social: Parjanen et al (2010) described social distance with regards to relationships between individuals in a group. Distance in this case is correlated with level of trust and/or impetus to compete, which influences the level of comfort found between members with regards to volunteering information and asking questions.
- Cultural: The way in which organizations/groups view the sharing of knowledge and/or process for creating was stated as being dependent on what is supported by the team culture within the organization and/or subunit of an organization (Parjanen et al 2010).
- Functional: Parjanen et al (2010) described functional distance as that with regards to areas of expertise. They noted that members belonging to different "functional communities" may not understand each other because they may not interpret knowledge the same way, or within the same context. This may call to mind the various disciplines involved in designing a project to be constructed and planning for its subsequent construction. Parjanen et al (2010) claimed that greater functional distance between members of a group/team provide for greater opportunities to learn from one another and generate creative ideas that can lead to innovation. However, increased functional distance also leads to greater challenges to bridging the distance so that learning is possible.
- Geographical: Geographical distance refers to the physical proximity of members of a group, which can pose challenges if members of the group are unaware of what the other members are doing (Parjanen et al 2010). This was noted a challenge of virtual teams with regards to members of the team feeling confident that work was being completed/progress was being made toward shared goals by other members of the team.

With the above in mind, Parjanen et al (2010) conducted a case study in the effort to answer "how it is possible to span the structural holes in cross-disciplined multi-actor innovation." In order to contribute toward answering the above, they asked two questions:

- "What are the forms of distance in structural holes in cross-disciplined multi-actor innovation; and"
- "How can the spanning of structural holes be facilitated by brokerage functions?"

Parjanen et al (2010) claimed that the distance between innovating partners can be large enough that it necessitates a "special interpretation function." Referred to as "information brokerage," such a function involves "making people on both sides of a structural hole aware of the interests and difficulties of the other groups," "transferring best practices," "drawing analogies between groups ostensibly irrelevant to one another," and lastly, "making syntheses of knowledge interests." Said differently, brokers play a role in supporting innovation by "connecting, recombining, and transferring to new contexts otherwise disconnected pools of ideas."

Endeavoring to be an area recognized for "practice-based innovation," Finland's Lahti Region is known for supporting policy that leads to ideas for new businesses, concepts for new types of services, product development and enhancement, rethinking operations, and other strategies for finding innovation. The region has achieved this by carrying out what is referred to as the "innovation session method," which is described as a process that is designed based upon the individual needs/goals of an organization/company that seeks to realize the potential for innovation, but that almost always involves intermediate organizations that employ "innovation experts" approaching local companies to see if they are willing/interested in having an innovation expert study the company and their business in the effort to identify potential opportunities for growth/diversification. The potential for innovation opportunities is

usually recognized when the innovation expert(s) identifies through his/her analysis a structural hole to be spanned. Upon identifying one or more structural holes, the intermediate organization takes steps in preparing for a one-day long innovation session. With the purpose of enhancing the company's innovation potential, experts from the company, scientists, and members of the intermediate organization meet in order to provide a variety of knowledge types, or points of view. After opening the session with introductory speeches made by various experts, the session participants break out into groups based upon a participant's expertise and interest in the issues with the goal of identifying two to four potential ideas for achieving innovation within the company. These group discussions are facilitated with the assistance of a broker, whose role includes proactively encouraging exchange/connection of ideas and to play devil's advocate (Parjanen et al 2010).

The case study conducted by Parjanen et al (2010) focused upon the planning and facilitation of an innovation session involving a medium-sized manufacturing company locating within Finland's Lahti Region that produced stainless steel sink units and sink bowls for domestic kitchens in addition to waste sorting systems. Hoping to brainstorm creative ideas that might lead to innovation with regards to opportunities in e-business, the company had utilized the innovation session method twice before. Data collection for this case study involved gathering documentation related to the innovation session, distributing a questionnaire, and directly observing both the planning process and resulting innovation session that took place.

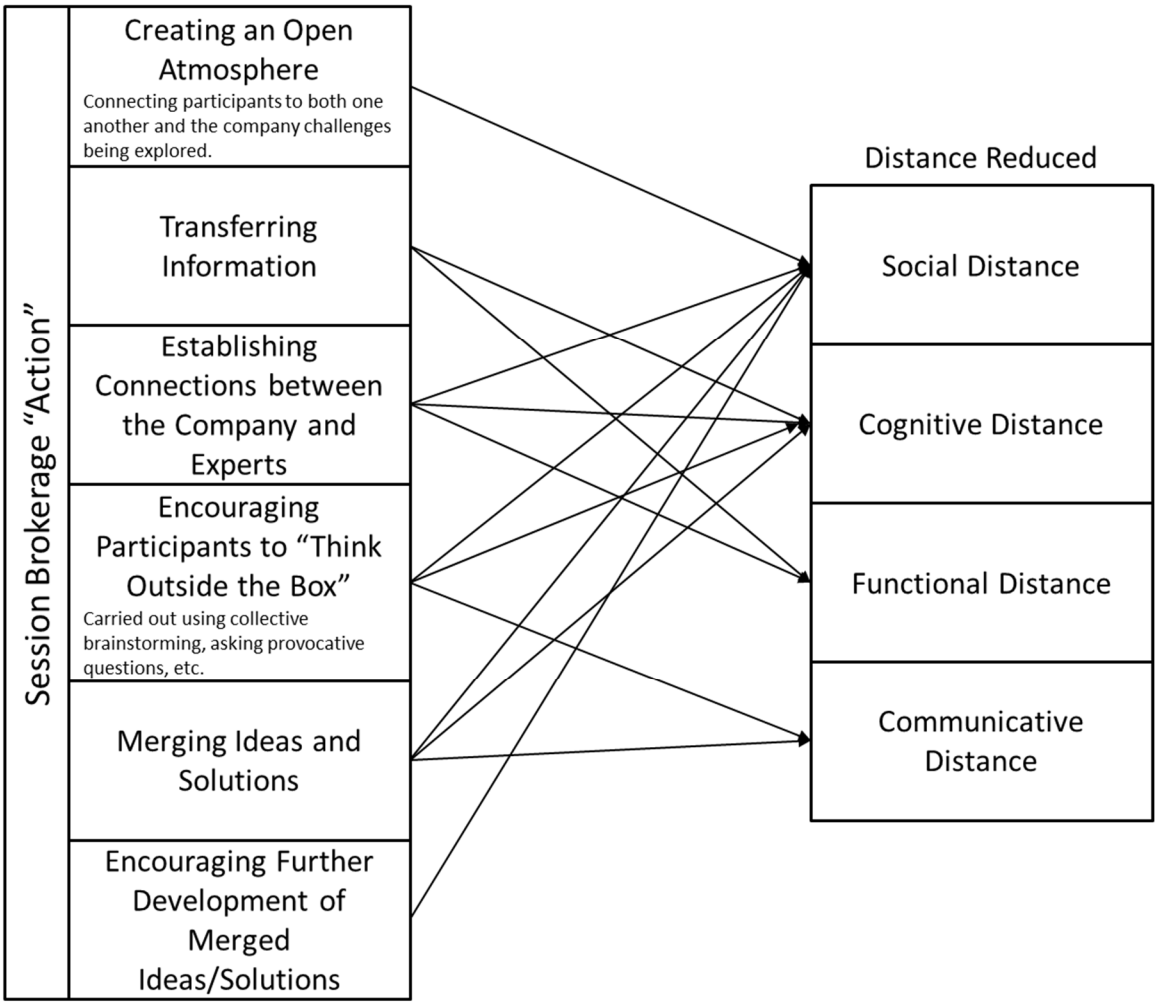
As a result of conducting the case study, Parjanen et al (2010) found the following in answer to the two questions posed. First, they listed the types of distances encountered during the innovation session. These included cognitive, social, functional, and communicative distances.

Second, they stated that the innovation session method should be considered as a process that culminates into the one-day innovation session. This process can for finding innovation "can end before it has started" as a result of large distances of various types being present between potential innovation partners. In the effort to bridge these distances, Parjanen et al (2010) noted that the utilization of two types of brokerage functions were observed during the case study. The first was referred to as "process brokerage," which involved managing the entire innovation session method process.

Claiming that previous evidence has indicated that holding impromptu innovation sessions are inadequate when seeking to bridge structural holes, Parjanen et al (2010) said an intensive preparatory phase that involved finding and preparing appropriate participants was an integral step to ensuring a productive innovation session. As part of this preparatory work, process brokerage involved reducing organizational and cultural distances prior to the innovation session.

The second type of brokerage observed was referred to as "session brokerage." This type of brokerage was used while facilitating the innovation session with the goal of shortening the various types of distances between participants (Parjanen et al 2010). Figure 5 below describes the types of distances that were encountered during the innovation session and how session brokerage was used to reduce that distance, as interpreted by the observer.

Figure 5: Types of Distances Present at Innovation Session and the Role of Session Brokerage in their Reduction



In conclusion, Parjanen et al (2010) reiterated that various types of distances between individuals that result in the creation of structural holes are both the source and barrier to innovation. Brokerage functions are integral to aiding cross-disciplined multi-actor teams with achieving collective creativity in their pursuit to innovate, and Parjanen et al (2010) claim this function can be summarized as follows:

- The brokerage function seeks to bridge the various types of distances between innovating partners.
- Brokerage takes place as process and cannot be described as individual actions.
- Typically, brokers are not experts in any one of the disciplines of which they seek to bridge across structural holes.
- Brokerage enhances methods used for generating ideas through careful intervention during the process.
- Not only can brokerage assist with spanning distances between innovation partners. It can also assist with lessening the resistance to innovation within an organization.
- Brokerage can enable flexibility while using creative methods versatile in nature.
- Brokerage is "asking questions rather than giving answers."

In the effort to break down barriers related to the search and transfer of information, the findings of the case study conducted by Parjanen et al (2010) may assist those responsible for assembling and managing cross-disciplined teams, whether they involve members responsible for designing/planning for construction projects or those tasked with coming up with solutions to innovation challenges in other industries. First, it might be argued that the various types of distances that can indicate both opportunities for innovation and barriers to understanding (i.e. an impediment to the search and/or transfer of ideas/information) are often present between the many parties involved during construction projects, creating a challenge to finding a common language. They were found to be present between the organizations involved in the case study featured in this Master's thesis, in particular communicative and functional distances.

Second, the study arguably speaks to how teams can overcome search and transfer barriers that are founded in members of teams lacking in the ability to effectively communicate with one another by use of a brokerage function, and including what carrying out that function effectively entails (e.g. possess the functional knowledge necessary for asking the "right" question and/or share a common language). The brokerage function described by Parjanen et al (2010) arguably assists teams with finding a common language, which fits under Hansen's "unification lever" with regards to disciplined collaboration.

Lastly as part of this extended literature review, literature was surveyed that spoke to the effective search and transfer of knowledge by way of established networks. Morten T. Hansen's (2002) article "Knowledge Networks: Explaining Effective Knowledge Sharing in Multiunit Companies" was included in this literature review because it spoke to findings connecting effective knowledge transfer and the role of relationships.

As noted in his article, Morten T. Hansen (2002) sought to contribute toward answering the overarching question as to why some business units within a company are able to benefit from knowledge residing in other units, while others are not. He noted in his introduction that previous research has argued that when business units within a firm possess related knowledge useful to the work of multiple units, the firm performs better. In addition, previous research has demonstrated the importance of pre-existing positive relationships between members of different units in the effective search and transfer of related knowledge. However, Hansen argued that these two dimensions had not been considered together.

In his effort to contribute toward answering the overarching question, he introduced the concept of "knowledge-networks," whose core premise is that in order to properly understand how units across a company can effectively share knowledge, one must jointly consider the relatedness in knowledge content among business units (i.e. the expertise housed in various business units of a firm that can be

useful for performing work within a different business unit of the organization) and the network of both direct and indirect lateral relationships between units that enable members to access that related knowledge. In this work, Hansen (2002) referred to these lateral linkages or relationships between business units as "interunit relations" and defined these interunit relations as "regularly occurring informal contacts between groups of people from different business units in a firm," making the assumption that these relationships can be leveraged by business units in order to search for and access knowledge living within other business units.

By testing his knowledge network model, Hansen (2002) endeavored to advance the understanding of knowledge sharing in multiunit companies in the following ways:

- Addressing the relationship between the existence of related knowledge useful to multiple task units in a firm and the lateral relations that enable the search/transfer of related knowledge.
- Considering the role of both direct lateral relationships (where a member of a task unit has an established relationship with a member of another task unit that houses related knowledge) and indirect relationships (where information is sought out and transferred with the help of intermediaries).
- Considering maintenance costs of networks.

As part of his study, Hansen (2002) derived a variety of hypotheses for testing based upon two main arguments. These arguments centered on indirect relations and direct relations and are described below:

- Indirect Relations: Hansen (2002) argued that when indirect relations are leveraged as a conduit for searching/transferring information in a knowledge network, task units obtain more knowledge and perform better when the path length between the task unit in search of knowledge and that possessing the related knowledge is shorter versus longer. He argued further that longer path

lengths led to information distortion within the knowledge network, much like the game "telephone," making a fruitful search more difficult.

- Direct Relations: Hansen (2002) next argued that when direct relations are leveraged in the search for related knowledge, they are beneficial in that they provide immediate access to the business unit possessing related knowledge. In particular, these type of connections are valuable when task units are searching for and subsequently transferring noncodified knowledge. However, Hansen argues direct relationships require more effort to maintain, and therefore are more costly.

In his pursuit to test the validity of the above arguments, Hansen (2002) tested his knowledge network model within a large, multidivisional and multinational electronics company composed of 41 "fairly autonomous" divisions. In order to set up this study, Hansen (2002) carried out the following:

- Understanding Company Context: Hansen (2002) first conducted open-ended interviews with 50 project engineers and managers operating out of 15 of the company's 41 divisions in order to better understand the company's processes for carrying out business and the workplace dynamics. Hansen (2002) noted this understanding was necessary in order to develop survey instruments used later in the study.
- Product Development Project Selection: Next, Hansen (2002) developed and conducted two surveys with the purpose of identifying and then selecting the sample of projects to be included in this study. One of surveys was administered to the research and development managers of the 41 divisions and the second was administered to the project managers of the product development projects available for the study.
- Constructing Knowledge Networks: Hansen (2002) was next tasked with constructing the knowledge networks that existed within the firm upon which he would test his knowledge

network model. In order to do so, and with the help of three corporate R&D managers, he developed a list of 22 technical competencies that constituted the areas of related knowledge housed within the company. Hansen (2002) then had the R&D managers within the 41 divisions indicate up to four competencies housed within their division in addition to asking the project managers of the 120 projects sampled to identify which competencies were required in order to successfully carryout their project. This was carried out in the effort to identify related subunits.

Next, Hansen (2002) administered a questionnaire in order to identify interunit relations existing between divisions, cross-validating the responses to ensure divisions agreed there was an existing relationship between them.

The dependent variables of the study included project completion time – which was used to assess project task performance – and the amount of acquired knowledge. Acquired knowledge in this study came in the form of software code and hardware components that had already been developed and could be described as follows: 1)"standard input" or components that were used in all products, and 2) knowledge used to solve "ad hoc problems" unique to a given project. This study concerned itself with knowledge transferred used to solve ad hoc problems and was measured by computing the fraction of "ware" (ranging from zero to one) in a product that came from other divisions (Hansen 2002).

Independent variables included path lengths in the knowledge network, direct relationships between divisions, degree to which knowledge was noncodified, and variables to test for whether path length or related knowledge contributed to project performance but not both. Control variables were also included that sought to make projects comparable and to control for the probability that divisions with substantial brokering power would control the flow of knowledge (Hansen 2002).

As a result of conducting this study, Hansen (2002) found the following:

- It was found that neither the extent of related knowledge available in a company nor a "beneficial network position" yielding short path lengths to other divisions throughout the entire knowledge network were factors sufficient enough to explain product development time and/or the degree to which knowledge was shared across task units. Project teams located within divisions with short path lengths to other divisions – not necessarily those housing related knowledge – within the entire knowledge network did not acquire more knowledge or complete their projects in less time. The number of divisions housing related knowledge that could have been beneficial to a project did not have a substantial correlation with the percentage of ware incorporated in the final product leveraged from other divisions.
- Shorter path lengths between a project team and task units within a knowledge network yielded more knowledge obtained from other units and shorter project completion times.
- Results indicated partial support for the hypothesis that project teams with a greater number of direct relations in the knowledge network would result in shorter project completion times when transferring noncodified knowledge. The results also partially supported the hypothesis that project teams with a greater number of direct relations in the knowledge network would result in longer project completion times when transferring codified knowledge.
- Longer project completion time within a division was positively correlated with higher numbers of related divisions coming to that division for advice.
- Project teams that acquired high levels of knowledge from other divisions completed their projects faster when compared with those that did not.

2.7 Literature Review Lessons Learned: A Summary

After surveying the literature related to best practices of successful virtual teams, one might read between the lines and ascertain that first and foremost, the success of these types of teams very much hinge upon the time and thought put into preparing for them and subsequently monitoring the disposition held by those on the team, taking proactive steps to establish high team morale and maintain it. Perhaps it is no surprise then that although Malhotra et al (2007) focused upon leadership practices – highlighting six best practices carried out by effective virtual team leaders – and Lurey and Raisinghani (2000) focused on how the effectiveness of virtual teams may be enhanced in general, the findings by Lurey and Raisinghani (2000) were also spoken to by Malhotra et al (2007). Those tasked with assembling and managing virtual teams are ultimately responsible for taking steps to ensure their success. It makes sense that those who are effective in this capacity understand and address those variables that impact success.

With the above thoughts regarding the role of management in mind, the findings of both Lurey and Raisinghani (2000) and Malhotra et al (2007) with regards to best practices of virtual teams have been summarized below by primarily using Malhotra et al's (2007) six best leadership practices as framework:

- Carryout Adequate Due Diligence: Based upon their findings, Lurey and Raisinghani (2000) suggested that during the initial phase of designing the team process, virtual teams should take the time necessary for truly considering and defining the team's future goals/objectives and developing a work environment(s) that will be successful in supporting the team in order to realize the greatest potential. A number of the narrative responses noted that virtual teams require more structure compared with co-located teams to carry out their work effectively. In addition, they suggested the importance of explicitly defining both the role of individual team members and the primary objectives of a team, rather than assuming these are understood.

- Establish and Maintain Trust with the Assistance of Communication Technology: Lurey and Raisinghani (2000) noted that first and foremost, virtual teams are teams, and as such, they must have a shared purpose in order for members to feel inclined to carry out the work. Once identified, the next step to being effective is establishing trust between members so that they feel incline to rely upon one another to do the work. Because goodwill is difficult to observe over the virtual meeting space, trust between team members of virtual teams must be built through actions. Consequently, the actions carried out by team members need to be done so explicitly in order to ensure members of the team are aware (Malhotra et al 2007).

  Malhotra et al (2007) claimed the first task to ensure actions can be observed and trust built is to establish team norms for communicating information over the course of the virtual work. They expanded by noting that of the teams they studied, several struggled with establishing trust within the team because communication norms had not been established. As a result, the members of those teams resorted to communicating in way that was first nature to them in their local setting, often leading to the inadequate sharing of information with the rest of the teams. This ultimately resulted in a lack of cohesion between members and difficulty integrating the work. These findings fall in line with one of the predictor variables in the study by Lurey and Raisinghani (2000) that exhibited the strongest associations with team effectiveness, establishing positive, dependable team processes.

- Ensure Diversity within the Team is "Understood, Appreciated, and Leveraged:" Malhotra et al (2007) noted that the ability of a virtual team to innovate successfully is often based on how well the diversity on the team with regards to stakeholder position, experience, functional,

organizational, style of decision-making, and interests is "understood, appreciated, and leveraged."

- Virtual Meeting Preparation and Management: Malhotra et al (2007) said that the majority of the team leaders in their studies indicated that regular conference calls with mandatory attendance by all team members were imperative to the success of the team, even if tasks had already been distributed amongst the team members. They added that these regular meetings, which met as frequent as every week, were structured for discussion in addition to reporting and coordination. Virtual team leaders used these meetings as a method for keeping members engaged and excited about the work and for ensuring the team members remained aligned with one another. In their research, Malhotra et al (2007) noticed there was a formula to maximizing the value gained from these meetings and ensuring goals were met. This was done by addressing the following:
    - Pre-Meeting Preparation
    - Meeting Kick-Off Procedures
    - Meeting Facilitation Practices
    - Meeting Closure Practices
    - Practices Engaged Between Meetings

- Use Technology to Monitor Team Progress: According to Malhotra et al (2007), the most successful virtual team leaders leverage the internet to monitor team progress. This was done by scrutinizing the communication patterns being carried out over both asynchronous and synchronous collaboration mediums. In addition, team progress was made explicit for the team to see using "balanced scorecard measurements."

- Make Virtual Team Participation Beneficial to Each Team Member: In order to maximize the effort put forth by virtual team members, Malhotra et al (2007) claim they must believe that they will benefit personally by participating. In order to ensure team member felt/saw benefits, team leaders were said to have carried out virtual reward ceremonies; recognized individuals at the start of conference calls; and ensuring the managers of team members in their geographic location were aware of the team member's stellar performance.

  Perhaps worth noting is a comment to the effect that leaders of successful virtual teams recognize and highlight for the group that the members of their team are often in high demand by others. By valuing their time and recognizing while leveraging their skill sets, leaders of successful teams create an atmosphere that keeps the attention of their team members from gravitating to perceivably better opportunities (Malhotra et al 2007).

In addition to addressing best practices of virtual teams, it was also suggested that both leaders and members of teams and virtual teams alike can benefit from gaining a better understanding of the nuances that can affect the level of success/failure experienced by a team, and that should arguably, be considered when one endeavors to establish/manage a team bound to realize its greatest potential value.

Although it was not suggested that every project team would generate the same findings, the expanded literature review was inspired by the barriers that posed the greatest challenge to value-generating collaboration during the case study, which involved those barring the efficient and effective search and transfer of information. In response, and additionally inspired by Morten T. Hansen and his claim that barriers to value-generating collaboration and their solutions fit broadly within several categories, literature was surveyed that spoke to solutions to these barriers that were referenced most during the

interviews and action learning sessions. These suggestions arguably could be described as finding a common language between the group, which fits within Hansen's (2009) "unification lever," and having previously established relationships with those on the team, which fits within Hansen's (2009) "network lever."

With regards to finding a common language, Parjanen et al (2010) found that employing a broker to plan for and facilitate productive discussions between cross-disciplined, multi-member groups was essential when group make up was diverse cognitively, communicatively, functionally, socially, culturally, organizationally, and geographically. The brokerage function was summarized by Parjanen et al (2010) as follows:

- The brokerage function seeks to bridge the various types of distances between innovating partners.
- Brokerage takes place as process and cannot be described as individual actions.
- Typically, brokers are not experts in any one of the disciplines of which they seek to bridge across structural holes.
- Brokerage enhances methods used for generating ideas through careful intervention during the process.
- Not only can brokerage assist with spanning distances between innovation partners. It can also assist with lessening the resistance to innovation within an organization.
- Brokerage can enable flexibility while using creative methods versatile in nature.
- Brokerage is "asking questions rather than giving answers."

In the effort to speak to the role established relationships play in the search and transfer of knowledge, an article by Morten T. Hansen (2002) was surveyed that detailed a study he conducted that involved

testing his concept of a "knowledge network" model within a large, multidivisional and multinational electronics company composed of 41 "fairly autonomous" divisions. The core premise of his "knowledge network" concept is that in order to properly understand how units across a company can effectively share knowledge, one must jointly consider the relatedness in knowledge content among business units (i.e. the expertise housed in various business units of a firm that can be useful for performing work within a different business unit of the organization) and the network of both direct and indirect lateral relationships between units that enable members to access that related knowledge

Hansen (2002) found that shorter path lengths between a project team and task units within a knowledge network yielded more knowledge obtained from other units and shorter project completion times. Results indicated partial support for the hypothesis that project teams with a greater number of direct relations in the knowledge network would result in shorter project completion times when transferring noncodified knowledge. The results also partially supported the hypothesis that project teams with a greater number of direct relations in the knowledge network would result in longer project completion times when transferring codified knowledge. Longer project completion time within a division was positively correlated with higher numbers of related divisions coming to that division for advice. Project teams that acquired high levels of knowledge from other divisions completed their projects faster when compared with those that did not.

3.0 CHAPTER THREE: METHODS

In the quest to contribute to the improvement of construction project delivery, focusing specifically on understanding the relationship between collaboration and value-generation during design/preconstruction, the primary method engaged in this study involved conducting a case study in the effort to produce a conceptual model for planning for value-generating collaboration during the design/preconstruction phase using Soft Systems Methodology (SSM), a method categorized within the paradigm of action research.

SSM works under the understanding that the existence of a perceived "situation," "issue," and/or "problem" does not exist outside one's self, but is a disposition one holds internally regarding various parts of the "unrolling flux of happenings and thoughts that make up day-to-day life (Checkland 2000)." This method can be described as an "organized learning system" that seeks to assist people in an organization with better understanding perceived "problem situations" in order to improve upon them through purposeful action in a continuously changing situational context (Checkland 2000).

This study used the most recent iteration of SSM as described by Peter Checkland (2000), one of its founders, in "Soft Systems Methodology: A Thirty Year Retrospective" which involves the 1990 "Four Main Activities" version. Under this iteration, an action learning cycle is created by carrying out the following activities:

1. Exploring an identified problem situation, including those that are cultural and/or political.
2. Modelling a purposeful activity relevant to the problem situation.
3. Using the models to incite debate, looking for the following:

a. Changes to the model that would improve upon the problem situation that are desirable as well as feasible for the organization.
b. Necessary accommodations that must be made to resolve conflicting interests in order to enable action for improvement to be carried out.

4. Using what was learned to improve upon the problem situation.

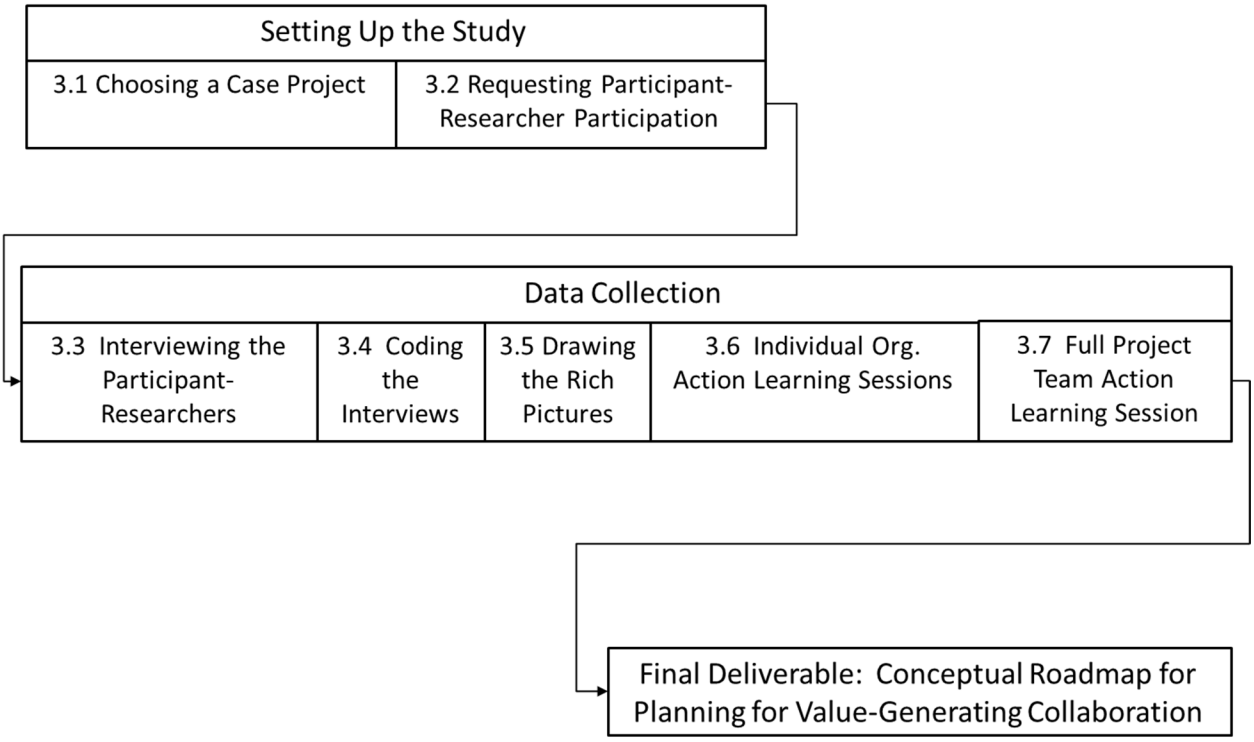
This case study sought to provide what Lawler (1985) called "fine-grained research." While the findings cannot be conclusive for the entire population of project teams, it can contribute a drop in the bucket of research that leads to a better understanding of the relationship between collaboration and value-generation during the design/preconstruction phase, leaving us with a model to test on both similar and dissimilar projects alike for further refinement and/or discovery. Lawler (1985) questioned whether "broad-brush research" collected through questionnaires and secondary data that on the surface looks to be generalizable in fact leads to "antiseptic" descriptions of organizations and simple theories that "ignore many of the factors the practitioner must take into account in managing the work organization." He made the case that the rich information that leads to the comprehensive understanding of an organization can only be collected through direct dialogue exchange and the intensive study of behavior.

This methods section is written in an ethnographic style, offering a chronologically detailed account of how the case study was carried out in the effort to achieve the following:

- Ensure this research project is truly replicable for any/all persons looking to use it with a different case study project.
- Describe the lengths that were taken in order to guarantee the validity of the data collected/final deliverables to the greatest extent feasible.

Figure 6 provides a timeline of the research project, whose headings correspond with those below.

Figure 6: Research Project Procedure Breakdown



It should be reiterated that this study has roots in the overarching study of business and project management, which inserts itself within all industries. With this in mind, the researcher borrowed Morten T. Hansen's concept of "disciplined collaboration" for use throughout the research project in three primary capacities. These included 1) encouraging discovery by challenging one to think critically about where, when, how, and why collaborative efforts are and/or should be carried out in construction during the design/preconstruction phase; 2) providing a framework for organizing and subsequently digesting data; 3) in hindsight, the concept of disciplined collaboration provided a way to more clearly explain the goals of the project and communicate results – in this way it provided a shared language.

Lastly, Chapter Three of this Master's thesis provides information related to the method and details the procedure as it was carried out. Information as it relates the specific case study project, the organizations that composed the project team as covered in this study, and details of the case project's design/preconstruction phase can be found in Chapter Four.

3.1 Choosing a Case Project

In order for a project to be an eligible sample case for the proposed study, it had to fulfill three criteria.

1. First, the construction project had to involve a project team that actively sought to carry out the design/preconstruction phase in a "lean" or "integrated" manner. Without a clear, definitive, and/or accepted understanding of what a "lean" or "integrated" project should look like in practice, what was arguably more important for this study was that the project team in the chosen case had to have intended to be integrated or lean. Certainly, if lean/IPD is to truly be a philosophy more so than a set of methods, it would be counterintuitive to base the criteria for choosing a sample case upon the type or number of methods used that were born out of lean/IPD.
2. Secondly, the project had to be finished with the design/preconstruction phase so that the parties to the project were able to reflect on the process in hindsight.
3. Lastly, both the construction manager/general contractor and the architect/engineer had to be willing to participate in the study as participant-researchers. Participation involved being willing to assist the researcher in collecting raw data for telling the story of the process and synthesizing a list of collaborative activities that generated value and/or detracted from value relative to the specific project. They also had to be willing to work as a team with the researcher in mapping out a conceptual model for planning for value-generating collaboration on future projects with at least their organization but preferably with the other party to the project team as well. If acceptable to both the CM/GC and A/E, the Owner would be asked to be involved as well.

While finalizing the Institutional Review Board process, the researcher began the search for potential case study project candidates. However, it must be noted that her search didn't take her far. Her employment with a construction manager/general contractor while completing her graduate studies had allowed her to be privy to a potential project candidate that satisfied two of the required three criteria necessary for a project to be eligible for the study: the project sought to be "lean" and/or "integrated" and it was finished with the design/preconstruction phase to allow for reflection.

In May 2015 the researcher contacted the CM/GC's executive administrative assistant and requested a meeting with the chief executive officer and/or the senior vice president of the company. A brief description of the research project was included in the body of the meeting request and a book summary of Morten T. Hansen's *Collaboration* was attached. At the suggestion of the executive administrative assistant, the researcher chose to bring a copy of the procedure, interview questionnaire, and participant-researcher consent form to the meeting rather than distribute ahead of time in order to prevent information overload. These documents have been included in the Appendix.

Both the CEO and senior vice president were able to join the researcher at a meeting where the purpose of the research project, Morten T. Hansen's concept of disciplined collaboration, and the research project procedure were discussed using a printed visual aide that mapped out the procedure. As noted above, the researcher also provided a copy of the participant-researcher consent form and interview questionnaire for the individuals to take with them and review after they were discussed while walking through the project procedure. As part of the discussion, the researcher noted that in order for the project to be used for the case study, the A/E's willingness to participate would need to be confirmed. It was also

asked whether there were any reservations with regards to involving the Owner, to which the executive team members responded there were none.

At the conclusion of the meeting, the researcher left with verbal permission to involve the CM/GC in the case study. In addition, the CEO and senior vice president suggested contacting the vice president overseeing the project and the project manager in order to obtain assistance with identifying a contact at both the architecture/engineering firm and the owner firm involved.

Having secured permission, the researcher next approached the CM/GC's vice president overseeing the project by visiting his office in order to request a meeting to discuss the research project and obtain assistance in making contact with the appropriate individuals at the A/E's and Owner's firm. The VP agreed to assist and later provided the researcher with contact information for both the principal in charge at the A/E firm and the vice president in charge from the Owner firm with an offer to contact them first in order to make the introduction. Accepting the offer to make this initial connection, the researcher drafted an email for the VP to forward that described the project and requested a follow up meeting to discuss the project further. Included with this email was the *Collaboration* book summary.

The contact at the Owner's office responded to the CM/GC's email, agreeing to a follow up conversation with the researcher. As a result, a phone call was scheduled. In an attempt to stay consistent, the visual aide outlining the procedure and the participant-researcher consent form were not provided to the VP until the day of the phone call. The researcher emailed these documents prior to the phone call. The discussion conducted over the phone was similar to that conducted in person with the executive team at the CM/GC. The researcher explained the purpose of the project, described Morten T. Hansen's concept of disciplined collaboration and how it would be applied to the study, and walked the VP through the

procedure, stopping to explain the accompanying documents. The call concluded with a tentative schedule for receiving confirmation to involve the Owner in the project of approximately one week, and approximately within that time frame the researcher was given permission to involve the Owner in the research project.

A meeting following up the CM/GC's email was scheduled at the A/E's office between the researcher and the principal-in-charge. Held in person, this meeting was conducted in the same fashion as that held with the CM/GC and Owner. The researcher explained the purpose of the project, described Morten T. Hansen's concept of disciplined collaboration and how it would be applied to the study, and walked the VP through the procedure, stopping to explain the accompanying documents. In addition, it was also asked whether there were any reservations with regards to involving the Owner, to which the principal-in-charge responded there were none. The meeting concluded with a tentative schedule for receiving confirmation to involve the A/E in the project within one week.

After receiving confirmation that the A/E was willing to participate, the researcher sent a follow up email to the designated contacts at the CM/GC, A/E, and Owner firms that included the following content:

- A request for their assistance with getting the project underway by carrying out the following:
    - Team Roster: The researcher requested that the executive contact/designee provide her with a roster of all employees that were involved in the design/preconstruction phase of the case study project, including their email addresses and a phone number at which they could be reached.
    - Initial Contact of Team Members: The researcher asked that the executive contact/designee contact all employees on the roster list in order to let them know she would be reaching out to them regarding this Master's thesis project. She attached the

consent form for inclusion with that email that provided an overview of the project and what the potential participant-researcher would be asked to do, should they decide to participate.

In order to get the interview process started, the researcher provided a requested deadline for receiving the roster/having the initial contact made of one week. The researcher also included the day (a Sunday) when she would like to send out her initial email to those on the rosters seeking participation in the research project.

- A request to begin scheduling the action learning sessions (referred to as discussion sessions or focus groups when discussing with the participant-researchers since most were not familiar with the term "action learning" or "Soft Systems Methodology").

- Assistance in putting together a project profile: Out of respect for the executive contact/designees' time, the original procedure indicating that a questionnaire would be issued upfront for use in gathering information on the characteristics of the case project and the organizations involved was revised. After giving it additional thought, the researcher decided to first request any existing write ups on the project and participating firms. It was decided that the researcher would compile a questionnaire after reading through the profiles and learning more about the project through the interview process if she felt she still needed additional information. In addition to acting in the best interest of the executive contact/designees' time, the researcher wanted to ensure that an eventual questionnaire wouldn't exclude a request for information that was later realized to be important through this exploratory study.

The executive contacts/designees were all three incredibly responsive to the aforementioned requests. Approximately within the requested seven day turn around, all provided the researcher with a team roster, complete with an email and direct extension at which the team member might be reached, and sent an initial email to all members on the roster in order to provide some background information on the project and let them know an email from the researcher would follow. It should be noted that after crafting the participant-researcher consent form, including the description of the research project, its goals and objectives, and summary of what each participant-researcher would be asked to do, the researcher sought to use this content as close to verbatim as possible in subsequent correspondence with participant-researchers. This extended to the initial email sent by the executive contact/designee. This was done in order to keep the messaging consistent.

3.2 Requesting Participant-Researcher Participation

The participant-researcher interview process kicked off on July 12, 2015 after an initial email requesting participation was sent by the researcher to all employees included on the team rosters provided by the organizations. Between the three organizations, 26 employees were contacted. Within the email the researcher included the following:

- Project overview/purpose
- What the participant-researcher was being asked to do
- An open invitation to ask questions/request more information
- A list of attachments

The content within the email was taken almost verbatim from the participant-researcher consent form. Aside from seeking to maintain consistent messaging, the researcher was also hoping to provide multiple opportunities to communicate that participation was optional should the potential participant-researcher

choose not to read the consent form. Attachments to the email included the participant-researcher consent form, the *Collaboration* book summary, and a copy of the interview questionnaire to be used during the one-on-one interviews. The interview questionnaire and consent form can be located within the Appendix.

In the procedure proposed, the researcher was to ask in the email that the participant-researcher return a signed waiver to the researcher if he/she was willing/interested in participating. Due to the exempt status of this research project with regards to the IRB review process, a signature was not necessary – simply engaging in the interview was enough to provide consent.

Additionally, in the proposed procedure, the researcher had included a third criteria for eligibility that was discarded during this study. She had initially proposed that a case project achieve ¾ participation rate from each organization involved. To ensure that those potential participant-researchers who declined were never found out, the procedure had outlined steps to protect them. With this in mind, the researcher assumed she would either receive correspondence back that the potential participant-researcher was interested or she would continue to follow the proposed procedure by following up with a phone call within three days to ensure the email was received/answer any questions and/or follow up within another seven days after that to determine final status. Two circumstances arose that rendered the proposed procedure for gauging interest and ensuring the desired ¾ participation rate for each team void. First, the proposed procedure made the assumption that interested participants would be responsive within the ten-day time frame provided for. Second, it did not anticipate potential participant-researchers responding in a proactive fashion.

Instead, within hours of sending the initial email requesting participation, the researcher received responses not only expressing an interest/willingness to participate, but with questions asking how to proceed and comments indicating their excitement to participate – leaving the researcher little choice but to respond with an invitation to schedule the one-on-one interview despite not knowing if ¾ participation from each team would be reached. This initial third criteria for making a project eligible for use in the research project could not be disclosed to the executive contact/designee nor the participant-researchers as a reason for stalling the research project. Should the desired sample have not been reached, it would have been clear to the executive teams that their employees were not interested, possibly inciting a backlash.

Balancing full-time employment and responding to interested participant-researchers did not allow for the follow up phone call to those potential participants who had not responded to the researcher's first email to be made within three days. Instead, this phone call was made prior to the end of the following business week and resulted primarily in leaving voice messages. While some followed up promptly, the researcher failed to anticipate that busy professionals who typically put in more than a forty hour work week might take multiple days to follow up and/or would appreciate more than one request/reminder. In response, for the team from whom she received the lowest initial response rate, the researcher sent a second email in an attempt to follow up.

On a related note, the researcher had not anticipated ahead of time instances where potential participant-researchers might indicate interest and require additional follow up to determine a date/time for interview, leaving the researcher questioning whether or not they could be counted upon to be part of the desired sample, or instances where those scheduled might cancel. Despite achieving an overall participation of rate of 77%, the desired sample of ¾ of each team roster was not achieved for all teams

during this project at the one-on-one interview phase. Achieved for one of the three teams, a scheduling conflict caused a cancellation and in a second scenario, the researcher and a participant-researcher were unable to find one another. Had interviews been conducted with both of these individuals, ¾ participation from all teams would have been satisfied. Instead, these two teams saw a 66% participation rate. The above events should be noted for those looking to replicate this study. The researcher suggests rethinking how the investigator requests participation if there is to be a participation rate requirement.

3.3 Interviewing the Participant-Researchers

The first participant-researcher one-on-one interview took place on July 16, 2015, kicking off the interview phase of the research project. Approximately two weeks into the interview phase, the date of August 21, 2015 was set as the last day by which all interviews had to be conducted. This deadline was set in order to allow the researcher time to carry out the coding process and prepare for the action learning sessions to be held with each organization individually. These sessions were scheduled for the week following the deadline (August 26 - 28, 2015), with the final action learning session to be held with all three parties to the project scheduled for the week following that (August 31, 2015).

Leading up to August 21, 2015, all 26 potential participant-researchers (including 8 members from the CM/GC, 6 members from the A/E, and 12 members from the Owner) were given the opportunity to participate in a one-on-one interview either by phone or in person. Of the 26 potential participant-researchers, 20 interviews were conducted in total. Of these 20 interviews, 17 were conducted in person and three (3) were conducted by phone. It should be noted that the main factors influencing whether an interview was conducted in person or by phone was distance from the researcher's place of business followed by participant-research preference. With limited time to carry out interviews during the work day, those participant-researchers who were in close proximity to one of two regional offices from which

the researcher could work from were more likely to have their one-on-one interview conducted in person. Luckily, all three parties to the project either had an office location nearby or worked out of one of the two regional locations of the researcher's employer.

The researcher began each one-on-one interview with the assumption that the participant-researcher had not read the details regarding the study and/or their option to opt out of the study in the email requesting participation. At the advice of a friend, the researcher chose to make this assumption so that it could still be ensured that each participant-researcher received a brief overview of the project. To assist with keeping messaging and the order in which it was given orderly and consistent, the researcher created a "cheat sheet" of main points to relay to the participant-researcher. Located within the Appendix, these main points covered the following:

- The participant-researcher's option to decline participation
- An overview of how the responses to each questionnaire would be used
- The overall goals of the study and anticipated deliverables, including what the study was <u>not</u> looking to suggest

In addition, the researcher created a one-page summary overview of Morten T. Hansen's concept of disciplined collaboration. Prior to beginning each interview, the researcher went over the concept of disciplined collaboration and explained that this concept was being used as a lens through which to analyze collaboration in construction project delivery during the design/preconstruction phase. This one-page summary was kept on hand throughout the interview should the participant-researcher want to reference it. For those interviews conducted over the phone, the one-page summary was emailed to the participant-researcher approximately fifteen minutes prior to the interview to ensure they also would

have it on hand. After concluding this brief introduction, the researcher moved on to conducting the interview.

During both interviews conducted in person and those conducted over the phone, the researcher used a laptop and a blank interview questionnaire for each participant-researcher into which she typed the responses provided (the interview questionnaire can be found under the Appendix). Tying the populated questionnaire to the participant-researcher was both unnecessary to the study and potentially detrimental to the privacy of the participant-researcher. As a result, questionnaires were saved in a way that identified them to the organization of the participant-researcher - but not the individual - by including the organization name as a suffix to the document title and a number that did not correspond with a name.

The interview procedure involved the researcher asking each question to the participant-researcher in the order it was shown on the questionnaire, aside from one change. Rather than asking what the role of the participant-researcher was during the design/preconstruction phase as the second question, this was asked to kick off the interview followed by the first question in the sequence asking the participant-researcher to describe the process. The response to each question was entered into the questionnaire as close to verbatim as possible. The intent was to capture the full monolog given for each question, keeping the response as free from interviewer interpretation as possible prior to the coding process.

Although this was the plan from the beginning, the importance of taking down responses as close to verbatim as possible in the procedure was reinforced after the first interview when the researcher was surprised by some of the answers to the interview questions. For example, it had been anticipated that participant-researchers would only include the Owner, CM/GC, and A/E as the parties to the project.

During the first interview the researcher found she didn't have enough columns included in her questionnaire template as part of Question #7 to accommodate all parties that the participant-researcher felt were relevant to reference. This trend would continue throughout and led the researcher to change the page layout of her questionnaire from portrait to landscape in order to add more columns to the featured matrix.

Later, it was found that the researcher didn't always understand what participant-researchers from the Owner and/or the A/E were speaking to with regards to their processes/areas of focus and had to ask for them to expand. In the case of those representing the Owner, it was found that they weren't describing the design/preconstruction process using the traditional phases of design – they didn't share this common language with the CM/GC and A/E. As a result, when creating the rich picture of what happened according to the Owner during the design/preconstruction phase, the researcher relied upon the description of events spoken to by multiple people to piece together what happened in the correct sequence. Had shorthand notes been taken during the interviews, the researcher may have missed out on jargon and/or lost texture important to identifying commonly held feedback during the coding process.

Each interview was concluded by asking the participant-researcher to provide any information/feedback that they felt would be important to the study. To identify it for what it was, it was introduced to participant-researchers as the "catch all question" and an opportunity to "answer a question that wasn't asked."

3.3.1 Goals Associated with the Participant-Researcher Interview Process

The participant-researcher interview phase of the study was built in as an imperative step in ensuring the validity of the resulting conceptual model. Although not required for SSM, the following captures the reasoning behind various aspects of this component of the study design:

- Capturing a Holistic View: With regards to the interview process, engaging all members involved in the design/preconstruction phase regardless of where their position lies within the organizational hierarchy was important to capturing a holistic view of the process. Professionals at all levels are necessary for satisfying the goals of a project in various capacities, whether that be providing leadership or carrying out tedious work necessary to the product. It is argued that they will accomplish the requirements of their job, even if they are forced to do so within an environment and/or satisfy parameters where greater efficiencies could be realized. This is why capturing the input of every member is argued as being integral to capturing the full picture of the process.

- Interviewing Participant-Researchers and Asking the Right Question: It was noted that great care must be taken in order to avoid a Type 3 Error and mitigate the insertion of investigator bias while carrying out interviews with participant-researchers. In the attempt to prevent this type of error to the greatest extent feasible, great care was taken in preparing the interview questions to ensure they did not guide a participant-researcher toward a line of thought/answer they otherwise wouldn't have provided (e.g. including questions that assume a process went well or didn't go well); were open-ended to accommodate responses that the interviewer may not have anticipated; and provided an opportunity for the participant-researcher to give feedback that they believe should have been requested.

- Providing the Background Information on the Study: It was noted above that prior to the interview, participant-researchers were to be provided with information on the goal and objectives of the research project, including a truncated description of Hansen's concept of disciplined collaboration. Lawler (1985) asked whether it is safe to assume that despite providing minimal information, subjects will answer questions with rich responses "simply because they were asked to" or provide answers that are of the highest quality relative to the study. The stance was taken that because the product resulting from this research project involved a group of practitioners learning from a past process, giving them a frame of reference for the study would both give reason for why this is a valuable use of their limited time, as well as help keep a rich monologue flowing during the interview. It was the intent of the researcher that after providing a reason for why they should engage, the participant-researcher would seize the interview as an opportunity for being heard by someone who values what they have to say.

- Setting the Stage for Productive Action Learning Sessions: The ultimate goal of carrying out the interviews was to explore the design/preconstruction phase of the case study project through the eyes of those practitioners that were part of it in order to piece together what occurred with the concept of disciplined collaboration in mind. The resulting interview transcripts were coded in order to identify where answers converge so as to develop a list of collaborative activities carried out on the project and the instance when members collectively felt they added value, had zero value, and detracted value. Convergence between answers related to barriers to value-generating collaboration and potential solutions were also to be sought. These findings were to later be presented prior to carrying out an action learning session in lieu of solely brainstorming together as a group in order to satisfy the following:

- Explore the Problem Situation and Identify "What Really Happened": By synthesizing a list of converging responses prior to the action learning session, it was argued that outlier responses would have the opportunity of being initially vetted and focus could be directed toward addressing the commonly-held understanding of the process.

- Avoid Group Think: During the action learning sessions it was argued that it would be disastrous to the validity of the study if group think, defined as a situation in which members of a group "maintain or seek consensus at the expense of identifying and debating honest disagreements (Hitt et al 2011)," were to prevail.

- Protect Against Backlash: It is the duty of a researcher to protect his/her subjects from experiencing harm while carrying out a study. Considering that members along the hierarchical scale of the organization would be working together, it was argued that waiting until the action learning sessions to brainstorm might cause subordinates to hold back information for fear of backlash while those more outspoken might be more forthcoming regardless, leading to potential backlash from management. Alternatively, it was noted that the investigator must also protect members of management from offering information that inspires retaliation against them by subordinates.

3.4 Coding the Participant-Researcher Interviews

For each organization that was included in this research project (CM/GC, A/E, and Owner), the researcher waited until all interviews had been conducted with those willing/interested participant-researchers from an organization before beginning the coding process. For each organization, the process involved the following:

- Populating the Coding Frame with All Interview Questionnaire Responses: Using a Microsoft Excel workbook and designating a worksheet for each question, the researcher transferred the responses taken at each interview conducted. This initial response was placed under a column with the heading "INITIAL TRANSFER" to signal to the researcher that this was the response in its raw form. An example of the coding frame used can be located within the Appendix.

  With regards to responses to interview Question #7, which involved the matrix populated with parties to the project and an indication of who they collaborated with, responses were added as is, regardless of whether or not there was a duplicate. They would be reconciled during the next step in the coding procedure.

  The scores provided in response to interview Question #8, which involved rating parties to the project in search of potential barriers according to the concept of disciplined collaboration, were transferred for each party rated from each interview questionnaire with plans to reconcile during the next step of the coding procedure.

- Initial Extraction of Ideas: Once all responses had been read through, the first step in the actual coding process took place. To begin, the researcher looked for feedback/opinions expressed by the participant-researchers (e.g. praise, criticism, suggestions, etc.). This feedback was extracted from the raw response, including the context from which it was provided (e.g. the collaborative activity it corresponded to, etc.). On the first attempt, the researcher sought to extract feedback regardless of type (e.g. praise v. criticism) and transfer it into the column next to the INITIAL TRANSFER" column in the spreadsheet with the header "FEEDBACK EXTRACTION: ROUND #1."

Instead, this plan was revised shortly after the coding process began. The questionnaire had been designed with clear objectives in mind, including 1) provide an opportunity for the participant-interviewer to provide any and all feedback that he/she felt was pertinent by keeping questions open-ended; 2) avoid the insertion of interviewer bias to the greatest extent feasible (i.e. reason for not including questions that search out where value was added, etc. but instead asking participant-researchers to describe how they "felt."); 3) structure the questionnaire in a way that warms the participant-researcher into giving more detailed answers along the course of the interview. Built with the goal of extracting pertinent information (including that which the researcher could not anticipate), this questionnaire was not the greatest vehicle for communicating ideas in an organized fashion at the action learning sessions where there would be a limited amount of time to make it through SSM.

The researcher found it difficult to extract and converge feedback – even from the outset – without an overall guide that a framework such as Morten T. Hansen's concept of disciplined collaboration would provide. This difficulty was encountered because the raw data was provided by one team where each participant-researcher took on a very different role from the others. Because of this, the context from which they provided various feedback was not duplicated (i.e. a comparison of feedback between estimators on similar case projects v. comparison of an estimator's point of view on a project with that of a project manager). In order to converge responses without exposing participant-researchers or losing texture, the feedback was sorted into three initial categories that would eventually be sorted into the three steps to achieving disciplined collaboration: 1) PRAISE/POSITIVE FEEDBACK (taken as a sign that value was generated – or Step One to achieving disciplined collaboration); 2) CRITISCISM/SUGGESTIONS (taken as a

sign of a barrier encountered – Step Two to achieving disciplined collaboration); and 3) SOLUTIONS (both general and detailed accounts of issues where solutions were found – or "levers" according to Step Three of disciplined collaboration). In addition, a column entitled "OTHER" was added for feedback that didn't seem to fit any category but that might be pertinent for additional exploration.

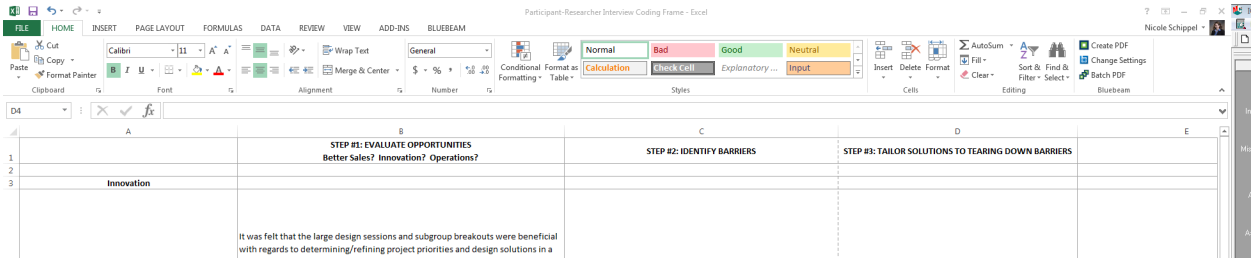
It was also during the first round of idea extraction that the first part of Question #7 (the collaboration matrix) and Question #8 were reconciled into one answer. With regards to Question #8, the scores were summed and then divided by the number of participant-researchers that gave an answer.

- Transfer of Paraphrased/Converging Ideas to Disciplined Collaboration Framework: After all feedback/ideas had been extracted and part one of Question #7 and Question #8 had been converged, the researcher transferred all extracted feedback from each question to a worksheet within the coding template that was broken down into three steps to achieving disciplined collaboration. Feedback that was placed under the "PRAISE/POSITIVE FEEDBACK" column was transferred to a column entitled "STEP #1: EVALUATE OPPORTUNITIES" to indicate where the participant-researchers had found value.

  That which was placed under "CRITICISM/SUGGESTIONS" was transferred to a column entitled "STEP #2: IDENTIFY BARRIERS." For those descriptions of solutions found along the way to various inhibitors of value-generating collaboration during the interview process, these were transferred to a column entitled "STEP #3: TAILOR SOLUTIONS TO TEARING DOWN BARRIERS." Figure 7

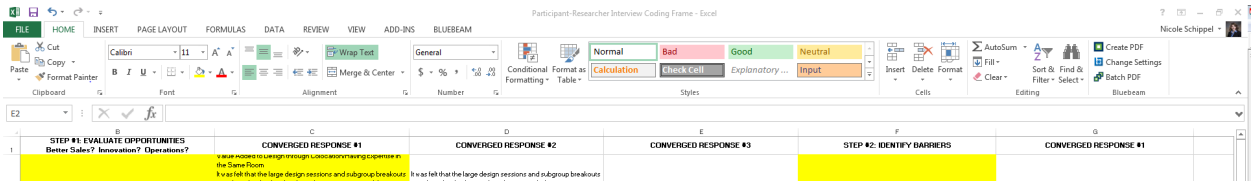
provides a snapshot of the “Disciplined Collaboration Coding Frame” into which all feedback/ideas were transferred for converging.

Figure 7: Disciplined Collaboration Coding Frame



- Converging Responses: After all extracted feedback from each question had been placed under its appropriate column within coding framework worksheet, the researcher began the process of converging responses. First, a column was inserted to the right of that holding the extracted feedback in its raw form. After reading all the feedback within the category being converged, the researcher moved feedback expressing a common idea (e.g. overall positive experience, the process was time-intensive, etc.) and the context to the column to the right, under one cell if possible, and often still in raw form. Ideas that were expressed twice were revisited to ensure they were not the same person reiterating the same idea during multiple questions. If this was the case, they were not carried forward. Ideas that appeared once were also not carried over. Columns were inserted to the right of the most recent converged response column and the above process carried out until all raw feedback had been converged into commonly-held main ideas, with supporting context remaining but not necessarily converging. Figure 8 provides a snapshot of the “Disciplined Collaboration Coding Frame” into which all feedback/ideas were transferred for converging and in addition, demonstrates how the addition of columns were used for converging the feedback.

Figure 8: Disciplined Collaboration Coding Frame with Converged Data Columns



- Organizing Converged Feedback within the Disciplined Collaboration Coding Frame: After all feedback had been converged within the initial three categories (Steps 1, 2, and 3) for a party to the project, the researcher next looked to see if the converged feedback fit within a sublevel of the concept for disciplined collaboration. For example, within the column for Step 1, the researcher looked to see if the positive feedback (or the reason to collaborate) could be identified as one of Morten T. Hansen's three main reasons (better sales, innovation, and/or operations). Most feedback from this column could be placed under either finding innovation and/or better operations. For Step 2, the researcher looked at the feedback to determine if it could be placed under one of the four barriers that Hansen said interferes with value-generating collaboration. This was typically not the case except for one – that speaking to difficulties with transferring information. There was no converging feedback for Step 3: Tailoring Solutions, so this column was left blank.

This final disciplined collaboration frame was printed and distributed during the action learning sessions.

3.5 Drawing the Rich Picture

Once the raw interview data had been converged into commonly held feedback, the raw responses were revisited in order to draw what is known as a "rich picture" in SSM. Checkland (2000) promoted the use of "rich pictures" or providing a visual representation of the problem situation being explored with SSM.

The reasoning behind using visual representations of a past process or situation is that because human affairs involve a complex web of multiple interacting relationships, visual representations are more easily understood that writing out text. In addition, Checkland (2000) claimed that using a visual representation encourages participant-researchers to view the problem situation holistically as well as aides them in identifying where the facilitator may have misunderstood the situation.

Because each participant-researcher carried out a unique role on the project team, rather than looking to converge the responses, the researcher viewed each description of the process and each collaborative activity identified by a participant-researcher as a puzzle piece to the larger picture of the process that occurred. To draw each rich picture, the following steps were taken:

- The raw response to each question was read. Those responses that described activities that took place were highlighted yellow.
- Those highlighted responses were re-read and pieced together in a draft rich picture.
- A final rich picture was drawn on poster paper that had been taped together. Words and shapes were drawn large enough to view from 5-10 feet away, as these would be used as visual aids during the action learning sessions. They were drawn by hand in lieu of drafting using computer software as recommended by Checkland (2000).

Along with the disciplined collaboration frame, the rich picture drafted for each organization was used while carrying out SSM at each action learning session.

3.6 Action Learning through Soft Systems Methodology with Each Organization to the Project Team

Following the interview stage of the data collection phase of this procedure, the researcher separately engaged the Owner, CM/GC, and A/E in an action learning cycle using Soft Systems Methodology (SSM). Scheduled for two hours, each session was held at an office of the participating organization. Except for that held for the CM/GC, the executive contact/designee handled sending invitations to team members and booking a conference room to host the session. Due to the relationship that the researcher had with the CM/GC, she was able to send the invitation and book a conference room for that particular action learning session.

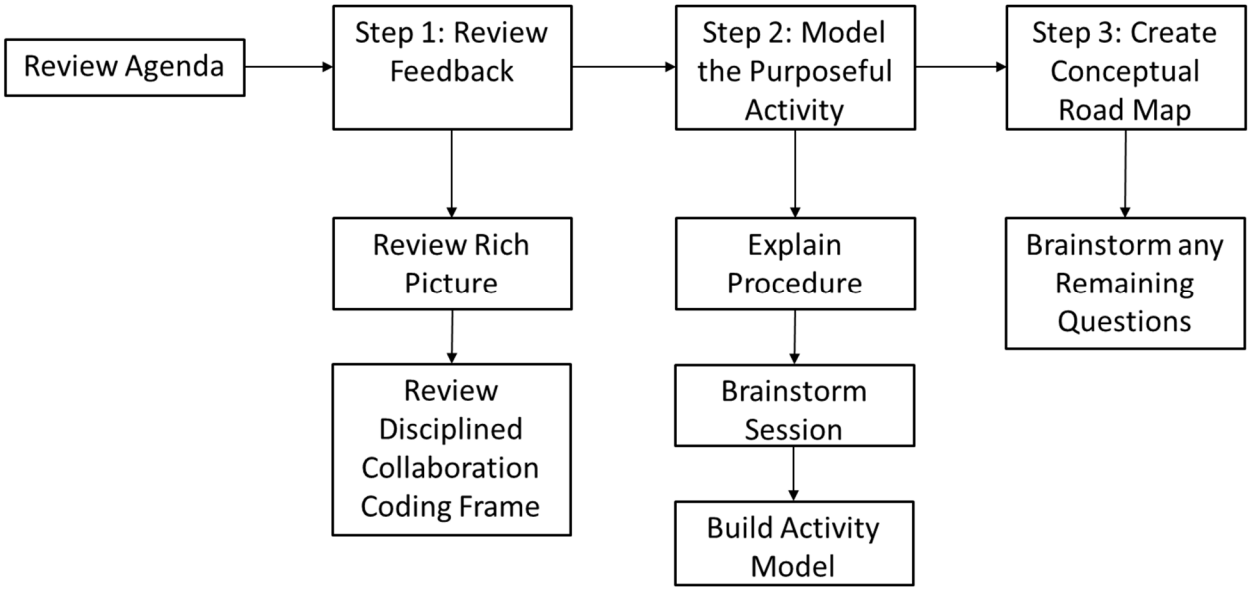
Each organization was instructed by the researcher to invite the entire team roster. This was done to protect team members that were not interested in participating in the interview process and/or the research project in general. It was also done to allow for any and all members of the roster to provide their feedback at the action learning session, even if they had chosen not to provide their input during the interview process.

It must be noted that in the case of the A/E, scheduling conflicts precluded all but two members of the team roster from attending the action learning session. In response, the executive contact/designee recruited two employees to participate in the action learning session. These employees had worked on the case study project as support staff to two of the team members listed on the roster.

All action learning sessions were carried out using the same set up and sequence. The sequence for each action learning session has been detailed in Figure 9 below. Prior to start of the action learning session, the researcher arrived with enough time to hang the rich picture and blank sheets of poster paper. Scrap

paper, post it notes, and pens were also distributed around the table in case a participant-researcher wanted them for taking notes/sketching. For each session, the researcher also brought light refreshments.

Figure 9: Action Learning Session Sequence



3.6.1 Review of the Agenda

At the beginning of the session the researcher distributed an agenda and the disciplined collaboration coding frame populated with that organization's converged feedback to all participant-researchers in attendance. Using the agenda as a guide, the researcher restated the goals/objectives of the research project, where the team was at in the research project with regards to completion, and provided an overview of what would be carried out that day.

It should be noted that because the participant-researchers were not well-rehearsed in the SSM research method, in preparation for the action learning sessions, the researcher considered how the

steps/activities necessary for truly carrying out SSM should be communicated while still ensuring participant-researchers understood the goals of the day and the tasks at hand. Rather than describe the SSM method to the participant-researchers using jargon only meaningful to those well-rehearsed in SSM, the researcher focused on what the goal of each step/activity in SSM was and then sought to organize/describe them in a way that would make the most sense to participant-researchers. It was anticipated that if the researcher used the jargon of SSM, the action learning session would turn into a lesson on the SSM method, taking the focus away from the overarching goal of the session.

With that, the day was organized into three "steps" on the agenda for ease in communicating the major tasks to be completed in order to reach the end product: 1) review of feedback; 2) creation of the activity model; and 3) creation of a checklist for "planning the plan." The same agenda was used at each session for each organization and can be found in the Appendix.

3.6.2 Step #1: Review Feedback

After going over the agenda, the researcher began the first step in the completing the action learning cycle using SSM – considering the problem situation (how one plans for and executes value-generating collaboration while locating and removing that which adds zero or detracts value during the design/preconstruction phase) by first reviewing the interview feedback of the team. This step in the SSM action learning cycle involved the following:

- Review of the Rich Picture: To begin, the researcher addressed what the rich picture was and how it was created, explaining that it was a combination of the feedback she heard as to "what happened" during the design/preconstruction phase.

She next walked the team through the rich picture, describing for the group "what she heard happened." Prior to walking through the diagram the researcher asked the team to correct her if she had "heard"/interpreted something incorrectly. She continued to ask "did I heard this correctly" throughout the time it took to walk through the rich picture, leaving room for discussion amongst the group regarding any corrections that should be made and/or details that should be added.

In the case of the Owner and CM/GC, the researcher made minor revisions to the rich picture, often in the form of additional detail or revision in sequence. With regards to the A/E, she found she needed to create an entirely different diagram. Because they speak the same language with regards to design the design process, the researcher had heard the process from the position of the CM/GC and initially had drawn the rich picture in a way that resembled that of the CM/GC. Notably, the process was drawn as boxes for each design phase connected by arrows when to the A/E, she found it should be drawn in connecting Venn diagrams that get progressively smaller as the details of the design are refined. The boxes connected with arrows did not visually indicate the iterative design process that was taking place between the milestones. The rich pictures with full detail created for the action learning sessions will be featured later in Chapter Four.

- Review of Participant-Researcher Feedback: After reviewing the rich picture and making any edits, the disciplined collaboration coding frame was reviewed with the team. While the researcher walked the team through the data using the paper medium, she had the excel workbook available on a projecting screen. She used this to first walk through how she went about converging the feedback prior to going over the data. Next, for each group, the researcher first went over where the team found value in the collaborative process. Next, she went over

feedback that spoke to criticisms of this particular integrated process/where the process could have been improved. The disciplined collaboration coding frames will be featured later in Chapter Four.

3.6.3 Step #2: Modelling the Purposeful Activity

After using the rich picture and questionnaire as tools for reflecting upon the design/preconstruction process, the second step of the action learning session commenced, which involved modelling an improved process for completing the design/preconstruction phase. This step in the action learning session was accomplished for each organization by carrying out the following:

- Providing an Explanation of the Tasks Necessary for Completing Step #2 and its Purpose: Before beginning the SSM method used for modelling an improved process, the researcher provided an explanation of what the team would be working toward completing as part of Step #2 on the agenda. As noted earlier, because the participant-researchers were not well-rehearsed in the SSM research method, the researcher sought to ensure that the SSM process was being carried out but used a language that would make sense to the participant-researchers. Rather than describing this step by stating the team would be "modelling a purposeful activity" the researcher prepared the team for the task at hand by explaining that they would be brainstorming and drawing out what the design/preconstruction process would look like for the case study project if they could go through this all over again, knowing what they know now.

- Conducting a Brainstorming Session: With the goal of prompting the team to reflect upon the past design/preconstruction phase, including what they thought went well and areas they would improve upon, a brainstorming session was conducted prior to sketching the improved process.

Integral to properly carrying out SSM, the brainstorming session utilized SSM methods for encouraging this reflection, including the following:

- Defining the Purposeful Activity to be Modelled: In addition to being asked what the design/preconstruction process would look like if they could do it all over again, the team was also reminded that the focus of this effort was to evaluate when, where, how, and why collaboration between parties to the team would generate value, looking back in hindsight.

- Carry Out a CATWOE Analysis: In SSM, CATWOE, which is an acronym for "clients," "actors," "transformation," "Weltenschauung" or worldview, "owner," and "environmental constraints," assists the group in remembering the stakeholders of the problem situation and their needs in order to better consider the best transformation. This step involves asking a team to define who the beneficiaries of a process are (the clients), what the improved process looks like with regards to inputs and desired outputs (the transformation), who must be involved to carry out the transformation (the actors), the context that makes the transformation meaningful (worldview), those who could prevent the transformation (owners), and norms that may act as obstacles to the transformation (environmental constraints).

  Because the participant-researchers were not well-rehearsed in the SSM research method, rather than using SSM jargon the researcher chose to carry out the CATWOE analysis by instead posing questions that asked the participant-researcher to consider the above as they brainstormed for an improved process. These questions included the following:

  - "What are we trying to achieve?": This question, which spoke to the "transformation" was partially answered for the team in that the overarching goal

and reason for carrying out the research project and as part of it, modelling the purposeful activity, was in the effort to improve construction delivery while focusing specifically on understanding the relationship between collaboration and value-generation during design/preconstruction. However, this question was explored further at the project level as well. In particular, the teams considered what the reasons/goals/objectives were for carrying out the design/preconstruction process from the various perspectives of the organizations that made up the team.

- "What will define success?": This question sought to encourage the team to think about what the "outputs" of the improved process must be/look like as part of a successful transformation, at both the project level and that of the overarching goal (e.g. value as defined by the team must be generated in order for instances of collaboration to be worthwhile in the improved activity model). This spoke to the "worldview."
- "Who will benefit?": This question asked the team to consider who the beneficiaries of the improved process would be (or the clients).
- "Who must be involved?": This question spoke to the "parties" that must be present in order for the activity model to be possible (the actors). It also prompted reflection on who must not only be present, but willing or ready to participate in the capacity that would bring the most value. If unwilling or unprepared, value generated through collaboration might diminished or null (e.g. a design-assist partner being brought on that is unable or unwilling to participate at more conceptual phases of design). This reflection considered the "owners" and "environmental factors" of SSM's CATWOE.

At the beginning of the brainstorming component of modelling the purposeful activity, the researcher read aloud all the above questions the team was looking answer. These questions were on the agenda as well to keep them in front of the participant-researcher throughout the discussion. The researcher used the questions to loosely guide the brainstorming and keep the conversation flowing when commentary slowed down. During this brainstorming session, she wrote down the thoughts that were being expressed by the participant-researchers on the blank poster paper that had been taped to the walls. Aside from moving the team's focus to the next question when the conversation slowed, the researcher also stopped the team in order to read back the notes she was taking to ensure she was hearing the feedback correctly.

- Building the Activity Model or "Modelling the Purposeful Activity": Once the brainstorming/analysis had been carried out, the team of participant-researchers commenced with modelling the purposeful activity, described to the participant-researchers as "building the activity model." SSM calls for this step in the procedure to be completed by carrying out the following steps:
    1. Write down activities necessary for carrying out the desired transformation
    2. Select all activities that could be completed simultaneously.
    3. Write those independent activities out in a line, listing those activities dependent of the first line on that below, continuing on until all activities for the model have been added.
    4. Redraw the model to avoid overlapping arrows.

Overall, this process was followed, but similar to how the brainstorming session was carried out, the researcher was most concerned with achieving intent (modelling the improved

design/preconstruction process) rather than carrying out a rigid procedure that cut off the natural flow of ideas.

The activity model building component of SSM carried out during action learning sessions for this research project involved having researcher ask the participant-researchers to "name the activities" that would make up the improved design/preconstruction process based upon what they know now and in light of the brainstorming that was carried out (who needs to benefit, what does that look like, etc.). The agenda posed questions to help prompt this segment in the process, including the following:

- What does the design/preconstruction phase look like?
- What does the process of each activity look like?

The researcher found that this segment started off slow for all three organizations, as participant-researchers looked to the researcher to further clarify what was being asked of them. For each organization, the researcher turned to a piece of common feedback that was generated by each organization while brainstorming. In so many words, each organization noted that understanding the priorities of the Owner was imperative to designing the best process and determining where/when/how much collaboration would generate value.

In reflecting upon the procedure that took place and the results with regards to this case study, it is important to note that the Owner overall felt positive about the design/preconstruction process. They felt they were getting a better product thanks to the level of collaboration, in part due to the amount of input they had in the design. In addition, as a financial institution that had been born out of a merger approximately two years prior to commencing the

design/preconstruction process of their headquarters, they felt the design/preconstruction process that had been designed for them assisted them with both defining their culture and then living it.

In hindsight and with the above in mind, the researcher believes it was beneficial to this research project that the first action learning session was conducted with the Owner. This is because although the researcher was already aware that overall, all organizations involved in this project felt positive about the design/preconstruction process that had been carried out, in the end the CM/GC and A/E, regardless of their contractual obligations, noted the ultimate goal is to satisfy the Owner.

To provide greater clarification to the participant-researchers, for each organization the researcher first restated the initial question:

- What does the [improved] design/preconstruction process look like?

Next the researcher rephrased the question:

- Based upon what we know now, would the team want the overall process to be different?

At their action learning session, the Owner team replied that they would keep the overall process and how it flowed the same. With this, the researcher sketched the process described in the rich picture without the detail and then refocused the group on the individual activities and their sequence. Using the critical feedback generated during the brainstorming session, the participant-researchers representing the Owner identified where they would make changes to

the sequence of events and what could have been done to improve the value generated from the collaborative activities that took place.

Because the action learning session with the Owner was conducted first, the researcher knew that the Owner was satisfied with the overall process and would keep it the same for the reasons they found value from it noted above. When the researcher asked the CM/GC and A/E if they would change the overall look of the process, their primary concern was whether this had achieved the Owner's priorities. Knowing that the Owner would have kept the same overall process (level of collaboration, sequence, etc.) assisted the researcher with facilitating the activing modelling component with the CM/GC and A/E (and in particular, the A/E) in that she could assure that priorities had been met. While the CM/GC was ultimately concerned with pleasing the Owner, they had also designed the design/preconstruction process in a way they felt would provide the best value to the Owner and overall, were happy with the product that resulted. The A/E was under contract with the CM/GC and had not had the same opportunity to inform the design of the phase. As a result, they may have designed the process differently. However, moving forward with the understanding that the process had pleased the Owner, they also kept the overall shape from their revised rich picture and tweaked sequence and collaborative activities in a way they felt would have generated more value. Had the researcher not held the action learning session with the Owner to begin, she would not have been able to provide the same input.

After gaining consensus on what the process should look like and the activities that should be added/modified, the researcher drew out a rough draft of the improved process to ensure she was envisioning what the participant-researchers had in mind.

3.6.4 Step #3: Creating an Initial Conceptual Road Map for Planning for Value-Generating Collaboration - Create Checklist for "Planning the Plan"

Upon completing the activity model, the next and final step in carrying out the SSM action learning session for each organization involved using the model to create a map, or checklist, of questions to be asked at the onset of any "lean" or "integrated" project in order to craft a plan for ensuring that the collaborative activities to take place during the design/preconstruction stage presumably would add value. In addition, the map/checklist should assist a team with asking questions in order to identify potential barriers and generate solutions for both enhancing results and for when barriers are encountered.

The last step in this phase of the data collection recognized that while the resulting activity model may have led to a greater return on investment from collaboration had it been followed for the case study project, it would be impossible to replicate the case study project – even if the construction documents and accompanying requests for information were used. The variables that come into play during the design/construction of a project are numerous. In fact, the variables may not necessarily be "problems" but stem from a difference in team make-up, attitude toward the project, market conditions, etc.

While this last step was indeed carried out, it must be noted that Step #3 truly began as soon as the participant-researchers from each organization began brainstorming at Step #2. The discussions generated during the brainstorming session resulted in both the participant-researchers generating questions they would have asked to better design and/or facilitate the process. In addition, the researcher used the participant-researcher feedback written down during the session to prompt the generation of potential questions that should have been asked.

After the activity model of the improved process had been drafted, it was found many of the questions the participant-researchers felt should have been asked for this process to result had been already been suggested. In light of this, the researcher asked the participant-researchers if they could think of any questions that were missing. After any discussion was exhausted, Step #3 was concluded. This signaled the end of the action learning session and participant-researchers were thanked for their time.

3.7 One Final SSM Action Learning Session with the Entire Project Team

After developing a list of questions for planning for value-generating collaboration during design/preconstruction individually as the Owner, CM/GC, and A/E separately, a fourth and final SSM action learning session was held that involved all three parties to the project team working together. This final session was held in order to accomplish the following:

- Provide the opportunity for the Owner, CM/GC, and A/E to see how one another saw the process and provide a forum for sharing/discussing what went well/would be done differently if the process were to be carried out all over again.
- Create a final conceptual road map, or checklist of questions, for planning for value-generating collaboration at the project team level.

The procedure for carrying out the SSM action learning session as detailed above was carried out in its entirety using the same agenda, with a few notable differences which are described below:

- Final Action Learning Session Preparation: In order to prepare for the final SSM action learning session, the researcher revisited the rich pictures prepared for those held individually with each organization to determine if they were in need of being redrawn. Aside from the A/E, this was not the case. Next, the researcher revisited the activity models of the improved process and

redrew these sketches so that they would be more aesthetically pleasing. Last, the researcher read through all notes taken down at the action learning session in order to extract the questions that were brainstormed. These were added to a worksheet within each organization's coding workbook and printed on 11x17 paper in large font for the meeting. An agenda with the same content and the disciplined collaboration coding frame for each organization were printed to be provided as handouts to each participant-researcher.

- Final Action Learning Session Set Up and Location: The final action learning session was held at the Owner's office located approximately halfway between the A/E and CM/GC. Similar to the previous action learning sessions, the researcher distributed scrap paper, post it notes, and pens around the table in case a participant-researcher wanted them for taking notes/sketching, in addition to bringing light refreshments. For each organization, the rich picture was taped to the wall with the improved process activity model taped below it and the questions generated taped to the left. This was done in way so that both the rich picture and activity model for each organization were hung side by side for comparison.

- Step #1: Review Feedback: Rather than walking through the rich picture and converged feedback as a group, the researcher passed out the converged feedback handouts to all participant-researchers at the onset of Step #1 and told the group they had approximately 20 minutes to review the feedback, rich pictures, and activity models on their own. During this time, the participant-researchers read quietly and in some cases, got up from their seats to take a closer look at the diagrams/questions featured for each group on the wall.

This fourth and final SSM action learning session concluded the data collection phase as well as generated the final deliverable to this research project – the conceptual roadmap for planning for value-generating collaboration at the project team level.

4.0 CHAPTER FOUR: RESULTS

As a result of conducting the procedure as written in Chapter Three, the researcher succeeded in carrying out a case study involving a project that sought to be "lean" and/or "integrated" and ultimately, drafted a roadmap of questions that a different project team consisting of the owner, CM/GC, and A/E might use in order to plan for value-generating collaboration during the design/preconstruction phase. This was only made possible thanks to the participant-researchers involved who were very generous in giving both their time and feedback.

Below one will find the results of this case study, which include the following:

- Description of the Case Study Project: Here the researcher has used information provided by the organizations in order to describe the type of construction project that was the focus of this case study. This has been provided in order to assist others interested in replicating the procedure used in this study with comparing their results back to those found with this particular project.
- Profile of All Organizations Involved (Owner, CM/GC, and A/E): With the same intent as above, the researcher has used information provided by the organizations in order to provide a profile for each that others replicating the study can compare back to.
- Overview of Design/Preconstruction Process: Using the rich pictures generated from the feedback of each organization, the researcher has sought to describe for the reader the design/preconstruction process that took place during the case study project.
- Common Feedback: In conjunction with the rich pictures, the disciplined collaboration coding frames with their converging responses have been included to describe for the reader when, where, how, and/or why collaboration generated value during this design/preconstruction process.

- The Improved Process: The researcher has included the activity models of an improved process that were created at the four action learning sessions in order to depict for the reader the changes that the participant-researchers would have made to the design/preconstruction process if they could carry it out all over again.
- Conceptual Roadmap for Planning for Value-Generating Collaboration: As the final deliverable resulting from the described procedure and forthcoming data, the conceptual roadmap for planning for value-generating collaboration concludes the results section of the second component to this Master's thesis.

4.1 The Project: A New Headquarters for an Emerging Organization

Construction Type: New Construction

Site Type: Greenspace

Market: Commercial Office, Headquarters

Size: Approx. 100,000 GSF; 17 acre site

Construction Cost: $26 Million

Completion Date: Fall 2015

The "lean" or "integrated" project used as the focus of this case study is the new headquarters for a Michigan-based credit union that was formed by a merger of two other Michigan-based credit unions in the spring of 2010. Since the merger, the credit union (the Owner) has been operating between three different administrative offices spread between Lansing and Detroit, which has proved to be both challenging and inefficient.

As a result, in 2012 the Owner began an assessment in the effort to determine what their strategy with regards to their headquarters location would be. They began by assessing the buildings that were employed as headquarters by the two credit unions prior to their merger to see if they could accommodate the larger organization. Although they had an adequate property footprint, the size of either building would not suffice. The Owner found it was left with three options: 1) tear down and build a new headquarters in Lansing; 2) find an existing building to purchase that provided a manageable commute for employees; or 3) find new parcel in a location that provided a manageable commute and build new. After determining that an option that minimized the impact of travel on employees based upon where they live would be best, the Owner began its relationship with the CM/GC's development arm, who began assisting the Owner with evaluating potential properties and determining a program to accommodate the proper functions.

Having chosen a parcel located in a Michigan township near highway access, the final design of the headquarters involves a three-story office building that seeks to combine a strong, iconic design with varied exterior finishes in order to engage and inspire both visitors and employees alike. The interior layout includes a 100% open office environment with senior leadership co-located centrally on the main floor working alongside their associates situated in the open office workstations.

The new headquarters will include a ground level floor at grade with the north elevation entrance, a first floor at grade with the main entrance from the parking lot, and a second floor all united by a grand central staircase and atrium. Employing a steel superstructure, the building will be enclosed by a combination of curtainwall, masonry, metal panel, and/or phenolic faux wood paneling with a living wall located at the main entrance. The south elevation of the building will include two outdoor balconies, one located at the first floor and the other at the second floor.

Approximately 99,000 gross square feet, all three floors that make up the new headquarters are similar in design layout. The majority of each floor has been dedicated to employee open office space. The remaining space will include small huddle rooms, conference rooms, restrooms, and IT spaces. In addition to spaces typical to each floor, the ground floor also includes back of house and storage space, as well as a wellness gym and locker rooms. The first floor features the main entrance reception as well as casual employee collaboration space. With regard to the interior construction, the central "stadium" staircase has been included as a showpiece, designed to create an amphitheater effect. In addition to the stadium staircase, the building includes two elevator and two additional egress stairways. The interior finishes include primarily paint, carpeting, and a combination of acoustic tile, wood veneer paneling, and gypsum board ceilings. They have been chosen with the goal of exuding comfort and warmth while simultaneously conveying the Owner's strong brand.

All design solutions were considered from the views of wetlands, woodlands, and grade changes offered by the site, which poses both opportunities and challenges due to the steep changes in grade throughout. Staying true to company goals the Owner has set forth, this 17-acre site will be leveraged to enhance workplace culture by providing recreational space for its employees. The stands of trees natural to the site will be preserved around its perimeter up to the parking lots. They will be combined with over 3,000 lineal feet of mulch trail for employees to enjoy. In order to address drainage as well as create an aesthetically pleasing outdoor environment, the remainder of the site is to include bioswales throughout along with other natural grasses and plantings. In addition to the bioswales, drainage and erosion will be addressed with a series of retaining walls of varying sizes, culverts, and a retention pond to which stormwater runoff is directed.

The design of the new headquarters is centered on the Owner's desire to promote and support a collaborative and innovative culture that the Owner has been taking strides to grow and nurture, ultimately in hopes of better serving its members. By consolidating headquarters operations to one location the Owner also looks forward to decreasing overhead costs and providing a manageable commute for its employees.

Looking forward, the new headquarters is also expected to support future growth. Over time the Owner expects to grow from 240 employees at its corporate offices to 350 employees across all areas of operation. The Owner also anticipates looking into opportunities to provide additional products to its members that are not currently offered, such as insurance, investments and other financial services beyond just deposits and loans. In addition, the Owner will be looking into launching a larger retail growth strategy in order to increase its presence within the 35 counties it serves.

4.2 Organization Profiles

4.2.1 The Owner

Business Focus: Finance, Banking

Assets: $1.5 Billion

Members Served: 163,000

Number of Employees: 240 (at Headquarters)

The Owner featured in this case study is a Michigan-based credit union that serves over 163,000 members. With regards to size, the Owner ranks in the top 1% of credit unions nationwide and is the fourth largest credit union in Michigan in terms of asset size, holding $1.5 billion in assets. Established in the spring of

2010 after a merger took place between two other Michigan-based credit unions, the Owner serves members living in 35 counties across the state of Michigan, spanning from Lake Michigan to Lake Erie and Lake Huron. This merger united the histories of not just two, but six credit unions that had begun merging since the late 1960s. With the first established in 1944, the mergers between these six credit unions that took place over time united over 100 years of serving members.

Aside from statistical data, two other defining characteristics worth noting in the effort to adequately describe the Owner include the style they employ in their effort to best serve their members and their desired workplace culture they designed their headquarters to support.

With regards to serving their members, the Owner endeavors to provide a personalized experience for every member. They have placed offering the highest level of customer service at the forefront of their business strategy, noting on their website that customers can expect "a warm smile and sincere greeting" or a representative being willing to take "extra time to explain a program, answer a question, or solve a problem" when visiting one their 21 branches. As part of this commitment to customer service, they want to establish personal, trusting relationships with members so that they are able to best direct them toward the programs and accounts that are right for them, ensure they receive the best terms and rates, and provide solutions and advice that will help their members build greater financial security.

With regards to organizational culture, the Owner endeavors to be both collaborative and innovative – and they have taken strides to ensure they are living this culture rather just writing it down on paper. These strides have included, among others, designing a headquarters that ensures one is working in an inspiring space with access to aesthetically pleasing views and campus-style amenities regardless of one's level in the workplace "hierarchy." The traditional corner offices for executives have not been included

in the floor plans. In addition, collaboration has been promoted through the organization by instituting regular meetings between the members of the various disciplines housed within headquarters and including employees at various levels hierarchically in design sessions related to the headquarters rather than leaving all decisions to the echelons of management.

4.2.2 The Construction Manager/General Contractor

Annual Revenue: $650 Million

Bonding Capacity: $1.25 Billion

Legal Structure: Fully employee- and management-owned

Number of Employees: 275

Headquartered in Michigan, the Construction Manager/General Contractor (CM/GC) involved in this case study offers construction management, program management, facilities planning and consulting, design/build, general contracting, and real estate development services. With eight offices providing comprehensive preconstruction and construction services spanning the Midwestern through the Southeastern United States, the CM/GC has carried out work in a plethora of construction markets including office, data centers, healthcare, higher education, historic preservation/adaptive reuse, industrial, K-12 education, multi-unit residential, parking, power generation, public, religious/cultural, retail/hospitality, science/technology, sports/recreation, and sustainable/high performance.

Founded in 1894 and incorporated in 1927, the CM/GC is a fully employee- and management-owned company where all projects are overseen by a corporate officer who is also a shareholder of the company. With annual revenues of approximately $650 million, the CM/GC was ranked 111 in the 2015 *Engineering*

News-Record ENR 400 list of top contractors nationally and 79 in the 2014 ENR 100 list of top construction management-at-risk firms.

The CM/GC employs more than 275 full-time employees, including project managers, superintendents, planners, value analysts, LEED accredited professionals, estimators, architects, in-house mechanical/electrical coordinators, information specialists, engineers, and accountants. The CM/GC endeavors to support a workplace culture that values teamwork, mutual respect, the recognition of excellence, a passion for the work, a competitive spirit, and a focus on developing long-term relationships.

4.2.3 The Architect/Engineer

Annual Revenue: $145 Million

Legal Structure: Employee Owned C-Corporation

Number of Employees: 900

Founded in 1853, the Architect/Engineer involved in this study is described as being one of the largest architecture, engineering, and planning firms within the United States. With a staff of over 900 people working out of offices located nationwide and internationally, the A/E is able to offer a palate of disciplines related to serving the built and natural environment, including architecture, engineering (civil, structural, mechanical, electrical and plumbing), landscape architecture, urban design and environmental science.

Specializing in the healthcare, workplace, higher education, and science/technology sectors, the A/E's project teams seek to deliver high performance, environmentally responsible places and buildings that are designed to the highest standards. The A/E takes pride in being recognized for their innovation, close

attention to owner objectives, and sensitivity to project context, working closely with clients to transform their vision and mission into built form.

Described as one of the nation's leading sustainable design firms, the A/E provides expertise in best practices for a variety of sustainable design strategies, including adaptive re-use, energy recovery and green roofs, as well as sustainable site development, ecological restoration, and stormwater management, among others. The A/E incorporates sustainable design solutions into all projects as a standard practice and has adopted the energy targets of the Architecture 2030 Challenge. The A/E has been credited with designing the world's first LEED platinum rated building, the first platinum-rated Federal building, and first triple platinum-rated building.

The A/E is currently ranked #35 overall by *Architect*, the magazine of the American Institute of Architects.

4.3 Overview of the Design/Preconstruction Process as Described by the Owner, CM/GC, and A/E

Below one will find the rich pictures that were created for use during the action learning sessions. A defining step in carrying out SSM, these rich pictures not only provide a visual representation of the design/preconstruction phase that took place but offer an opportunity for one to consider the process as seen through the eyes of the Owner, A/E, and CM/GC. Following the rich pictures, one will find the process that was carried out during the design/preconstruction phase described in words, combining the feedback provided by all three parties to the team involved in this case study.

In the spring of 2010 the Owner, a Michigan-based credit union, was formed by a merger uniting two other Michigan-based credit unions. After the merger the Owner found itself operating out of three

different administrative offices spread between Lansing and Detroit, which proved to be both challenging from an operational standpoint and inefficient.

As a result, in 2012 the Owner began an assessment in the effort to determine what their strategy with regards to their headquarters location would be. They began by assessing the buildings that were employed as headquarters by the two credit unions prior to their merger to see if they could accommodate the larger organization. Although they had an adequate property footprint, the size of either building would not suffice. The Owner found it was left with three options: 1) tear down and build a new headquarters in Lansing; 2) find an existing building to purchase that provided a manageable commute for employees; or 3) find new parcel in a location that provided a manageable commute and build new. After determining that an option that minimized the impact of travel on employees based upon where they live would be best, the Owner began its relationship with the CM/GC's development arm, who began assisting the Owner with evaluating potential properties and determining a program to accommodate desired functions.

While providing its development services to the Owner, the CM/GC noticed that aside from needing an architect/engineer and construction manager in the future, in the present the Owner might be in need of assistance with organizational design. At that time the CM/GC had an organizational behavior psychologist on staff that specialized in assisting clients with identifying who they wanted to be as an organization and how they wanted to run their business in order to ultimately participate in a collaborative design process uniting owner, A/E, and CM/GC that ensured the resulting design would support the desired workplace culture and business strategy. Because the Owner was still in the process of defining who it wanted to be and how it wanted to operate, the CM/GC thought the Owner might find value in its organizational design services. As a result, while still conducting site selection, the CM/GC began

facilitating workplace culture workshops for the Owner. At this time the CM/GC invited the A/E to partner with them in facilitating these workshops, or as the A/E described this period of time in the design process, the initial programming.

4.3.1 Organizational Design/Programming/Brainstorming: Part One

During the initial programming/workplace culture workshops the CM/GC and A/E sought to assist the Owner with defining their culture. In addition, they prompted the Owner to begin considering what they might want out of their new headquarters (e.g. functions that needed to be supported, desired image, presence in the community) and how that building should respond/support those priorities. The CM/GC wanted to give the Owner the ability to come to the table with ideas that influenced the designer when the time came to hire an architecture/engineering firm. Last, a first attempt at quantifying parameters of the building without giving it form was made at these workshops. To assist the Owner with finding answers to these questions regarding who they wanted to be and what they might want out of their building, the CM/GC and A/E had the representatives involved fill out surveys that asked about their preferences, review aerial maps depicting different types of sites and give their opinion, provided education on various types of construction delivery methods to prepare them for their eventual RFP/RFQ process, and took them on a field trip to a furniture dealer out of Chicago.

During this time the Owner prepared for an RFP/RFQ process seeking construction services. It was noted that the RFP/RFQ was left open-ended in a way that encouraged proposers to sell what they thought the Owner would benefit from most during this design/construction endeavor. The Owner interviewed three construction firms that were each proposing an approach different from the other. These approaches included construction management at risk, design-build, and what was described as an integrated approach. The Owner was most interested in the integrated approach that was being sold by the CM/GC

they were already doing business with – perhaps because the integrated approach that was being sold was being designed by the CM/GC for the Owner based upon what they felt the Owner needed in order to satisfy its priorities. After being selected, the CM/GC submitted a request for proposals from the architecture/engineering firms. It was noted by the CM/GC that cost was purposely not reviewed until the design firms had been interviewed and ranked based upon other qualities important to finding the best fit for the project/process. In the end, the A/E that the CM/GC had partnered with during the initial workplace culture workshops/programming was selected.

4.3.2 Organizational Design/Programming/Brainstorming: Part Two

This first set of workplace culture workshops/programming continued on into a second phase of organizational design/programming, continuing to leverage staff from the CM/GC and A/E that specialized in workplace cultural development (the organizational behavior psychologist) and listening to owner criteria and responding with design solutions (the A/E's programmers). After being selected as the A/E for the project, the A/E used this time to validate the findings from previous programming. In addition to further defining the Owner's goals/priorities, during this period in the design/preconstruction phase the A/E began providing shapes/visuals at meetings in order to communicate options and gauge the preferences of the Owner. In addition, they began offering design solution suggestions based upon earlier stated preferences. Strategies for gauging preferences used during this phase as mentioned by the Owner included the use of candy bars to strategize functional spaces, the presentation of building material options, the review of potential floor plans, additional surveys, voting on options with stickers, and pretending to give tours of the new headquarters on its opening day, describing what the representatives of the Owner would want to see. As the program manager, the CM/GC was looking forward, ultimately seeking to design the design/preconstruction process in a way that would allow the Owner to live and further solidify their desired culture through the design/construction delivery process. This was

considered a priority in addition to designing a quality building that would be constructed within budget and on time.

It should be noted that the programming/organizational design process involved 40+ people from the Owner, CM/GC, and A/E in order to ensure, in particular, that input was coming from Owner employees representing all disciplines and levels on the hierarchy. At this time the Owner also hired a new CEO who played an integral role in supporting this project, placing high value on collaboration.

4.3.3 Schematic Design

The organizational design/programming phase of the design/preconstruction phase moved into schematic design with an initial concept for the design. Described as a transition from program/concept to establishing physical form, at schematic design the team consisting of the Owner, CM/GC, and A/E carried out the following:

- Continued to define the vision
- Explored different alternatives for the building using shapes
- Looked at floor plan layouts, designing the building from the inside-out
- Considered mass/orientation of the building
- Considered methods for improving energy efficiency
- Informed which structural system to use (steel, concrete, etc.)
- Looked at bay design options that would support the desired workspace standards
- Selected the mechanical system
- Decided what trades to bring on as design-assist

- Prepared a traditional schematic design estimate which was used to inform and ultimately set the budget

At this phase the CM/GC advertised its RFP/RFQ for design-assist partners (DA partners). Scopes of work that were identified for DA included mechanical, electrical, plumbing, steel, and curtainwall. Firms were identified by the CM/GC, provided with the RFP, a shortlist was created based upon the RFP responses, and interviews were conducted. It should be noted that one firm was selected to handle the entire MEP scope. During the firm selection process the mechanical contractor came to the table with a fully assembled team consisting of the mechanical, sheetmetal, electrical, and plumbing trades and demonstrated they were prepared to carry out an integrated, collaborative design process. The DA firms were selected in time to participate in the one value analysis/engineering workshop that was held prior to setting the target budget to design to and moving into the design development phase.

4.3.4 Design Development

After the target budget was set at the value analysis workshop, the team – now consisting of the Owner, CM/GC, A/E, and DA partners - moved into the design development phase. For this case study project, this phase was defined by the large work sessions/big room sessions that took place at the offices of the A/E and the CM/GC. With the goal of refining the design to achieve a best fit solution with regards to program, cost, and schedule and provide cost certainty as unknowns were eliminated, these large meetings first brought all team members together to begin in order to identify the goals for the day. Afterward, members broke out into subgroups to carry out a working session that lasted between ½ to a full day. Subgroups were created based upon disciplines of expertise/owner requirements (e.g. MEP, structural, exterior façade, data center/security). They provided stakeholders with the opportunity to provide input on design, share expertise, and take ownership. Members of these subgroups were given

decision-making power to avoid bottlenecks in waiting for approval. After spending the majority of the time working, the subgroups came together in order to report back to the entire group, concluding the meeting. There were approximately ten of these meetings, which at first met on a weekly basis.

Offline, subgroups participated in conference calls and/or met together. With regards to interaction between the A/E and the DA partners outside of the large meetings, design work was first completed individually by the organizations. Afterward, the A/E would collaborate to varying extents with the DA partners. The MEP partner and the A/E worked on the model the mechanical trade partner was creating in real time (overhead coordination, duct layout). After these sessions the A/E would then take the input and update their model. The A/E and the steel DA partner drew in parallel. The A/E and the curtainwall DA partner called one another once a week.

At this time the CM/GC was researching the subcontractor market and building relationships in preparation for bid day.

4.3.5 Construction Documents

With the major systems/design determined, the team moved into the construction document phase. At this time, the following took place:

- The A/E took time to complete the CD drawing set.
- The DA partners worked toward completing shop drawings.
- Information systems design-assist partners were procured. Upon being hired these trades, including those responsible for structured cabling, telecommunications, security, and furniture, began holding monthly meetings with the Owner.

After construction documents were completed, GMPs were signed with the DA partners, and bid day took place in order to procure the other trades, construction began. This juncture concludes the area of the construction delivery process that is the focus of this case study.

Figure 10: Owner Rich Picture

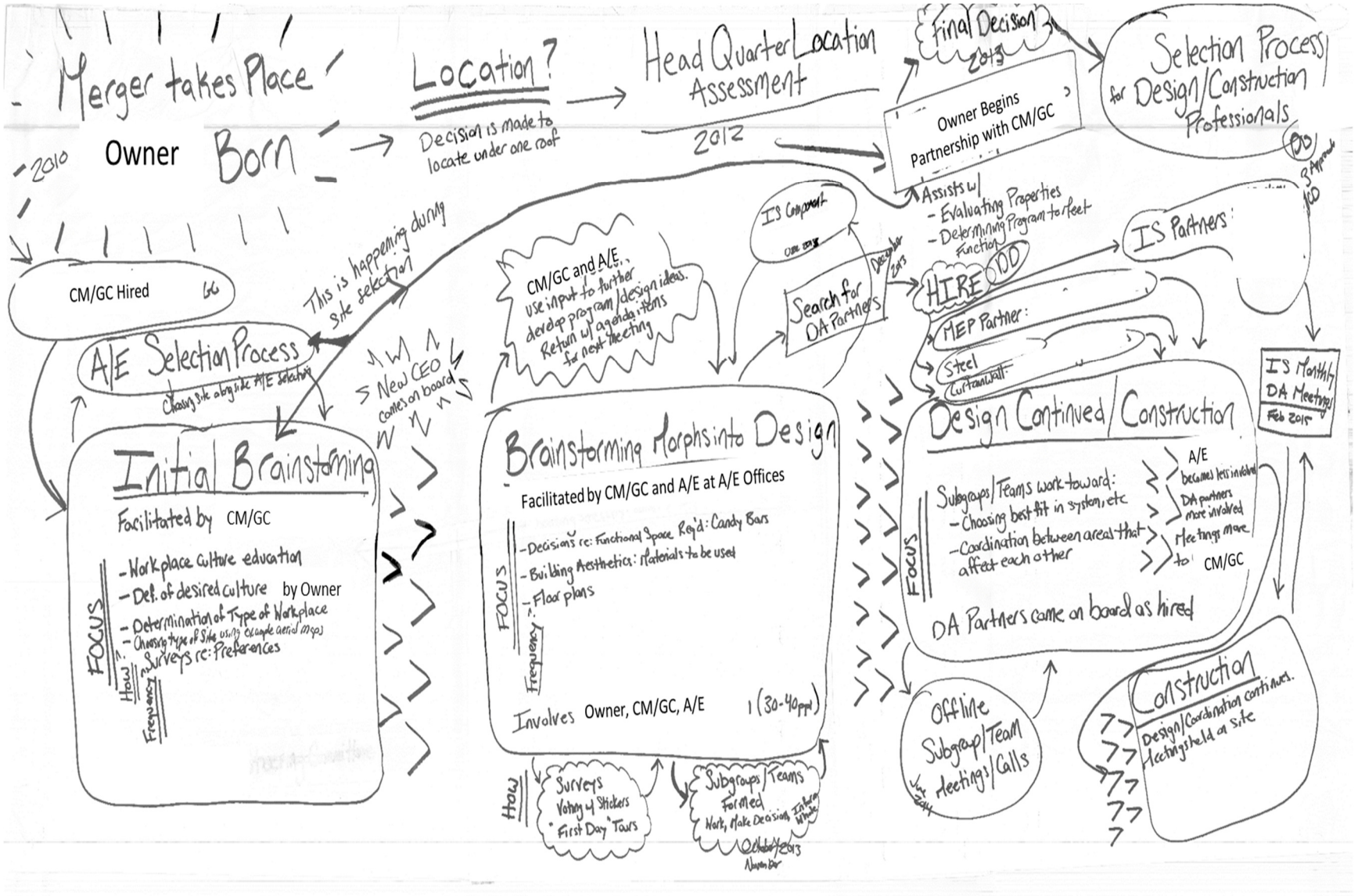
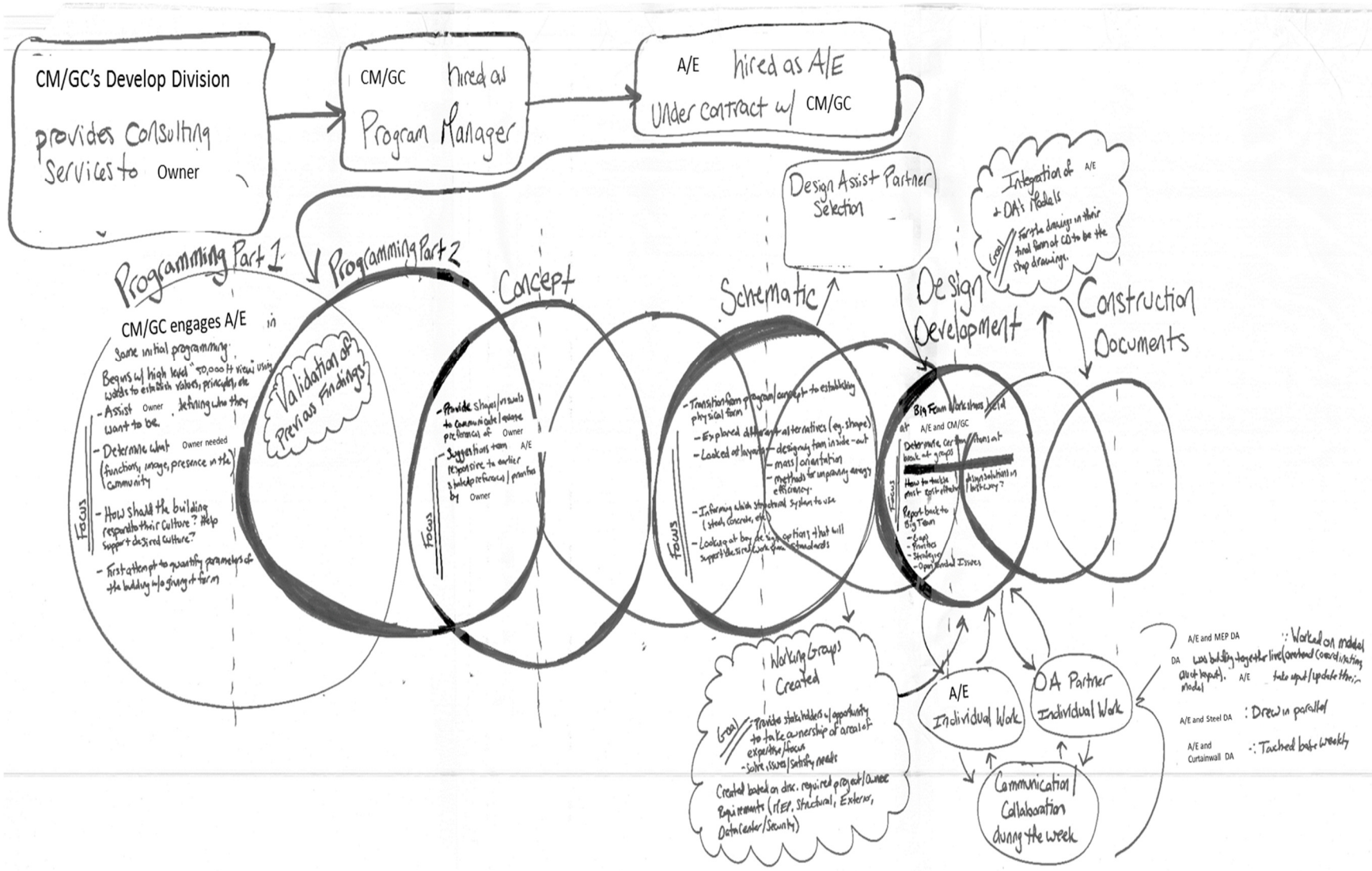


Figure 11: CM/GC Rich Picture

Figure 12: A/E Rich Picture



4.4 Common Feedback: Disciplined Collaboration Coding Frames

In conjunction with the rich pictures, the disciplined collaboration coding frames with their converging responses have been included to describe for the reader when, where, how, and/or why collaboration generated value during this design/preconstruction process. Located below, the coding frames seek to organize the common feedback using Morten T. Hansen's concept of disciplined collaboration. Specifically, they break the feedback into the three steps for planning for disciplined collaboration: 1) identifying whether a team should collaborate; 2) identify barriers to generating the most value from collaborative activities deemed worthwhile; and 3) identifying and tailoring solutions to breaking down barriers.

In the case of this study, the converged responses spoke to where collaboration added value during the design/preconstruction process and spoke to criticisms of this particular integrated process/where the process could have been improved. However, it did not touch upon solutions that were implemented to correct criticisms identified. This being the case, this section of the disciplined collaboration coding frame has not been included below.

Table 2: The Owner's Disciplined Collaboration Coding Frame

	STEP #1: EVALUATE OPPORTUNITIES **Better Sales? Innovation? Operations?**	**STEP #2: IDENTIFY BARRIERS**
Innovation		
	At the time, this process felt like an experiment, a process that was on the cutting edge. First, we held brainstorming sessions to determine what should be in the new headquarters and what type of building would best reflect the Owner culture we were looking to define. Once this had been better defined, the CM/GC began developing scale/scope of project while the A/E brought creative solutions, all the while considering work place psychology. This design/preconstruction process felt more collaborative than a typical design/build, where a firm will come up with a design and then tweak ideas. The Headquarters building design was developed as the process moved along. The use of design-assist was valued in that as the A/E was talking about design concepts, design assist (DA) partners had a chance to respond with various input/alternative solutions. In this process all partners could disagree and share expertise. This reminded us there is a lot of information we could have access to if we are partners with people with different approach. This design/preconstruction phase was much more thoughtful than what has been witnessed on other projects. In particular with regards to the due diligence put into understanding how people work. As a result the product is much more personalized and efficient than had the Owner not been	

Table 2 (cont'd)

	involved. This process allowed the Owner to ensure they received exactly what they wanted in less time.	
	The Headquarters design/preconstruction process didn't feel like a project run by the those at the executive level, nor one dictated to the Owner by the CM/GC and/or A/E. Input from a variety of departments and hierarchical levels was not only solicited by, but felt valued throughout the process. Employees of the Owner were involved in tasks such as the design-assist interview process, were able to ask questions, and given the autonomy to make decisions. This design/preconstruction process provided employees of the Owner with the opportunity to be creative. It also created a sense of excitement after experiencing struggles stemming from the dispersion of teams attempting to work between two different locations. As the culture was defined this process achieved 100% buy in.	
Operations		
	Felt the large meetings were efficient/helpful with regards to how they allowed for the opportunity to bring the subgroups together. Communication was better face to face on the spot and members from other subgroups whose work impacted others could be consulted.	
	The smaller break out teams and their make-up were well thought out, with various functional areas working with the A/E and DA partners. They were able to get a lot of work done and were given the autonomy to make decisions which assisted in avoiding bottlenecks. The preference was to find things to take offline so we wouldn't have to bring all 20+ people together.	

Table 2 (cont'd)

	Forced everyone to work together when at that time in the organization was much siloed. Process promoted more communication, more teamwork.	
	The increased planning and communication had led to fewer change orders. We were also able to be proactive with items that might have challenged us later.	
	Value of the process is paying off in crunch time trying to get finished since used to working with one another. Used to working with one another.	
	This design/preconstruction process has influenced Lake Trust's project management approach to corporate service construction services due to the value added and efficiencies found.	

"Not Invented Here": People are able but not willing.		
"Hoarding": People have the info needed but unwilling to share.		
"Search Problem": People are willing but unable to easily find the info they need.		
"Transfer Problems": Inability to transfer complicated knowledge across parties.		
		The area of the job that received the most criticism was the AV/data systems design/coordination. This criticism seemed to stem primarily from the experience employees of the Owner had

Table 2 (cont'd)

		working with the consultant that was recommended for and then chosen to handle the scope. It was noted that while this consultant was certainly capable of designing a data system, they didn't take the time to ask the Owner what they wanted and instead, told them what they should want when there was able and willing IS expertise on the Owner staff that could have better informed the design. These issues may have been exacerbated with the consultant working out of Chicago and not being able to afford to be on site in addition to the rotating group of project staff that had to be brought up to speed. In the end this was a system that was way out of the price range and more complex than needed. Although the consultant's drawings went to construction, they had to bring in the partners hired to install/work on network in order to redesign. In addition a glitch was found with schedule logistics. To have the network operating the day the building opens, the data system work needs to be finished on the first floor where the fiber optic line comes in before it can be installed on the second floor. Didn't realize and it affected the schedule negatively. This put a huge stress on the IS staff and now the construction staff on site.
Other Criticisms		
		This process was incredibly time intensive on all staff.
		In general the design meetings contributed positively to the effort but some could drag on. There was the feeling that both the larger meetings and the break out groups could have been more productive some days with the help of additional guidance. It would have been helpful to receive information to be discussed at the meeting ahead of time for digestion in addition to having the refined goals set before the meeting.

Table 2 (cont'd)

		There was a feeling that the contract components got in the way of collaboration, in particular with regards to the A/E. It appeared that the A/E had a set number of hours allocated to the job, and at some point those hours had been expended. As the Owner needed additional collaboration with the A/E from a design perspective it wasn't part of what they had allocated in the contract, and so it would have cost the Owner more. This is why the Owner didn't ask much from the A/E during construction. There was the feeling this brought a negative element to the process.

Table 3: The CM/GC's Disciplined Collaboration Coding Frame

	STEP #1: EVALUATE OPPORTUNITIES **Better Sales? Innovation? Operations?**	**STEP #2: IDENTIFY BARRIERS**
Innovation		
	It was felt that the large design sessions and subgroup breakouts were beneficial with regards to determining/refining project priorities and design solutions in a timely fashion and leveraging expertise from the various disciplines in attendance. By bringing representatives of the parties to the project (Owner, CM/GC, A/E, Design Assist) into the same room, they were able to spend time thinking about the project and ways to improve from a cost/performance perspective together. Anytime there was an opportunity to recognize a cost/schedule savings it was possible to go from one group of people sitting at one table to a group of people sitting at another table and run through clashes in design/issues with code. This was felt to be more productive then reacting to/addressing needs/issues in meetings held with stakeholder groups separately. The team as a whole was able to get answers to questions expediently. Co-location allowed for the various disciplines speak to share their expertise as well as	

Table 3 (cont'd)

	concerns/needs together and come up with solutions that worked for everyone. Had the subgroups been meeting separately, the intermingling that took place (in particular the ability for the Owner to weigh in on a variety of groups in one setting) wouldn't been possible.	
	Satisfying the Owner priorities for the building/goals in carrying out the process were ultimately met in part due to the programmatic exploration phase that took place prior to design getting underway. Invented by the A/E and the CM/GC, the initial effort which coupled cultural/organizational expertise with designers who are good at hearing this criteria and coming up with design solutions (compared with a traditional program where the A/E gathers info about what is needed quantitatively/qualitatively) provided a longer window for workplace strategy to evolve. This ultimately led to a better informed design with regards to meeting Owner priorities.	
	It was felt that involving the various design-assist partners, and in particular those members focused on the mechanical system, had a very positive impact on the final building design. It was felt that the DA partners added value by coming up with alternative design options/addressing constructability. With regards to schedule, they were able to explain why a various method takes longer versus others.	

Table 3 (cont'd)

Operations		
	It was also felt that efficiencies were realized by having the DA partners on board. These efficiencies included cutting down the time taken on drawings in that DA partners were completing their shop drawings in tandem with/supplement of the A/E. In addition, shop drawings were completed earlier and there was comfort with having the DA partners, who know the details with regards to constructability better than anyone, inform the drawings. It was noted that on a typical project redesign happens as a function of who you get in the bid market – this was avoided by having the constructor on early.	
	The process itself set the stage for extracting value from the DA partners. Traditionally, the mechanical/electrical contractors do not work as collaboratively as a team and instead try to minimize risk, protect profit, and protect scope. In the past seen specific subcontractors concerned with devaluing their role in the construction process. For example, by giving input on how to do this more efficiently they would give away their control of their work scope.	

Table 3 (cont'd)

	It was noted that overall there was a cost savings and a return on investment compared with what was spent on the design/construction phase. In part these savings were a function of the refinement of the design that took place because the owner, trades, engineer could all comment on what was really needed. When looking at things broadly the project will cost more – when refined we really know what we are working with.	
	The time spent with the various parties to the project allowed for trust to be established/meaningful relationships to be built.	
"Not Invented Here": People are able but not willing.		
"Hoarding": People have the info needed but unwilling to share.		
		There was the feeling that some parties to the project were better inclined from the beginning to participate in the collaborative design/preconstruction process. In some cases this was as simple as having the wrong personnel and replacing them while with others, such as with the trades, it was getting them comfortable with sharing information/asking for help if they did not understand the process.
"Search Problem": People are willing but unable to easily find the info they need.		

Table 3 (cont'd)

		It was noted that asking the right question to get the needed information was a challenge.
"Transfer Problems": Inability to transfer complicated knowledge across parties.		
		It was noted that the transfer of complex information was a challenge.
Other Barriers		
		There was a feeling that some opportunities with regards to design were missed. Some of those mentioned included paying greater attention to the finer details of the design from a building production perspective (e.g. flashing, handrail) and carrying out HVAC system selection before the DA came on board, ultimately taking away the creativity of the submarket. On a related note, it was realized that not all partners added the same value. It was learned early on that the industry for curtainwall is not geared for this type of collaboration. They don't know about anything more than where their product goes – wasn't versed for this. Was no savings on that contract even with open book because of their accuracy. Didn't have any other information other.
		Although the large design meetings were valued, it was noted that it could be difficult to get everyone to set aside time to sit in one room and be focused and productive and establish goals/have positive outcome throughout the day.

Table 3 (cont'd)

		Early on the goals of what was trying to be accomplished by the team through the collaborative process were not always clear. Later it seemed the principles/framework for the collaborative process aimed at achieving those goals seemed to be either undefined or not communicated well to the team, in addition to the roles that members of the team were to play. Members would have liked more direction/explanation of the process.

Table 4: The A/E's Disciplined Collaboration Coding Frame

	STEP #1: EVALUATE OPPORTUNITIES **Better Sales? Innovation? Operations?**	**STEP #2: IDENTIFY BARRIERS**
Innovation		
	This process allowed for a lot more communication/interface between members of the team, in particular between the CM/GC, A/E, and the design-assist partners. Having the design-assist partners involved allowed for a greater number of design ideas/solutions to be considered, questions that would typically result in an RFI to be answered earlier, input/expertise of those constructing the job to be incorporated, and a reconciliation of design and constructability to avoid issues in the field.	
	Although there were issues with transferring information across platforms, the collaboration and integration that took place was valued, likely due to those who formed the groups involved.	
Operations		
	The design/construction of the MEP systems went more smoothly because those building the systems were at the table and had ownership.	
	Although time intensive, there was value found in meeting together, in particular in the break out groups, because it allowed for informal discussion to take place around the same drawing board.	

Table 4 (cont'd)

"Not Invented Here": People are able but not willing.		
"Hoarding": People have the info needed but unwilling to share.		
"Search Problem": People are willing but unable to easily find the info they need.		
"Transfer Problems": Inability to transfer complicated knowledge across parties.		
		Although value was found through the design-assist component, working efficiently and effectively with the contracting side of the team was a learning process that perhaps never realized full success. Among other reasons, the responses from the interview process seemed to point at four: 1) there was a feeling that the contracting side didn't/doesn't understand the design process, 2) some partners didn't understand what their role was/what they should be doing, 3) because this concept is not widely used yet, relationships are still being cultivated/still learning how the subcontractors work/finding a common language, and 4) the design component still took just as long from the AE perspective because, among other reasons, the time spent outside of meetings completing the design and overcoming interoperability issues with incompatible design software platforms.
Other Barriers		
		It was noted that there were difficulties experienced in balancing the time commitment required for the design

Table 4 (cont'd)

		meetings with the work that goes into completing the design.
		Participant-researchers felt that the design meetings would have been more productive had they been more focused. There was a question as to whether there was a diminishing value for those meetings to be so large with regards to the number of participants.

4.5 An Improved Process: Reflection through Building Activity Models

Below one will find the activity models of an improved process that were created during the four action learning sessions in order to depict for the reader the changes that the participant-researchers would have made to the design/preconstruction process if they could carry it out all over again.

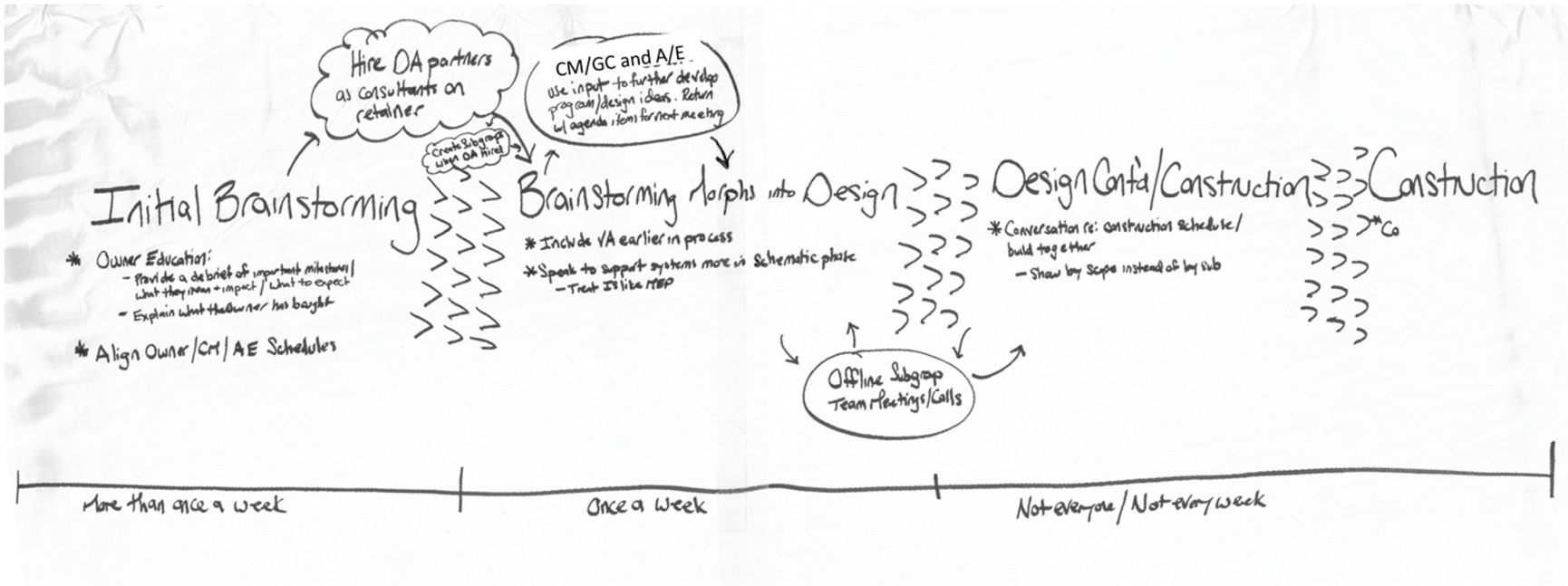
4.5.1 The Owner

After reflecting on the design/preconstruction process that was carried out during the case study project during their action learning session, the participant-researchers representing the Owner suggested the following improvements to the process if they were able to carry it out all over again:

- Additional Owner Education: The Owner noted that looking back, they would have appreciated a debriefing on important milestones in the design and construction schedules, what they meant and their impact, and what to expect during the delivery process. They also would have appreciated an explanation of what they had purchased through the various contracts held by the CM/GC.
- Alignment and subsequent communication of the Owner's, CM/GC's, and A/E's schedules
- Timing for Hiring the DA Partners: The Owner would have hired the DA partners earlier, using a retainer if necessary to pay for the consulting time prior to determining the budget for their scope. At this time, the Owner would have then created the subgroups for various disciplines.
- Value Analysis: The Owner would have liked to go through value analysis earlier in the process.
- Speaking to Owner Priorities: The Owner would have liked to have had the information systems scope treated with the same importance as MEP due to the nature of the business and its importance to it. As such, they would have liked to have begun involvement with DA at schematic design.

- The Construction Schedule: The Owner noted they would have liked to been more involved in planning the construction schedule, primarily so they better understood the sequence of work. The construction schedule was broken down by subcontractor rather than the scope of work, leaving it ineffective in communicating the sequence of work and when it would be finished – which was of importance to the Owner so they could better plan for their role in preparing for the move to headquarters.

Figure 13: Owner Activity Model

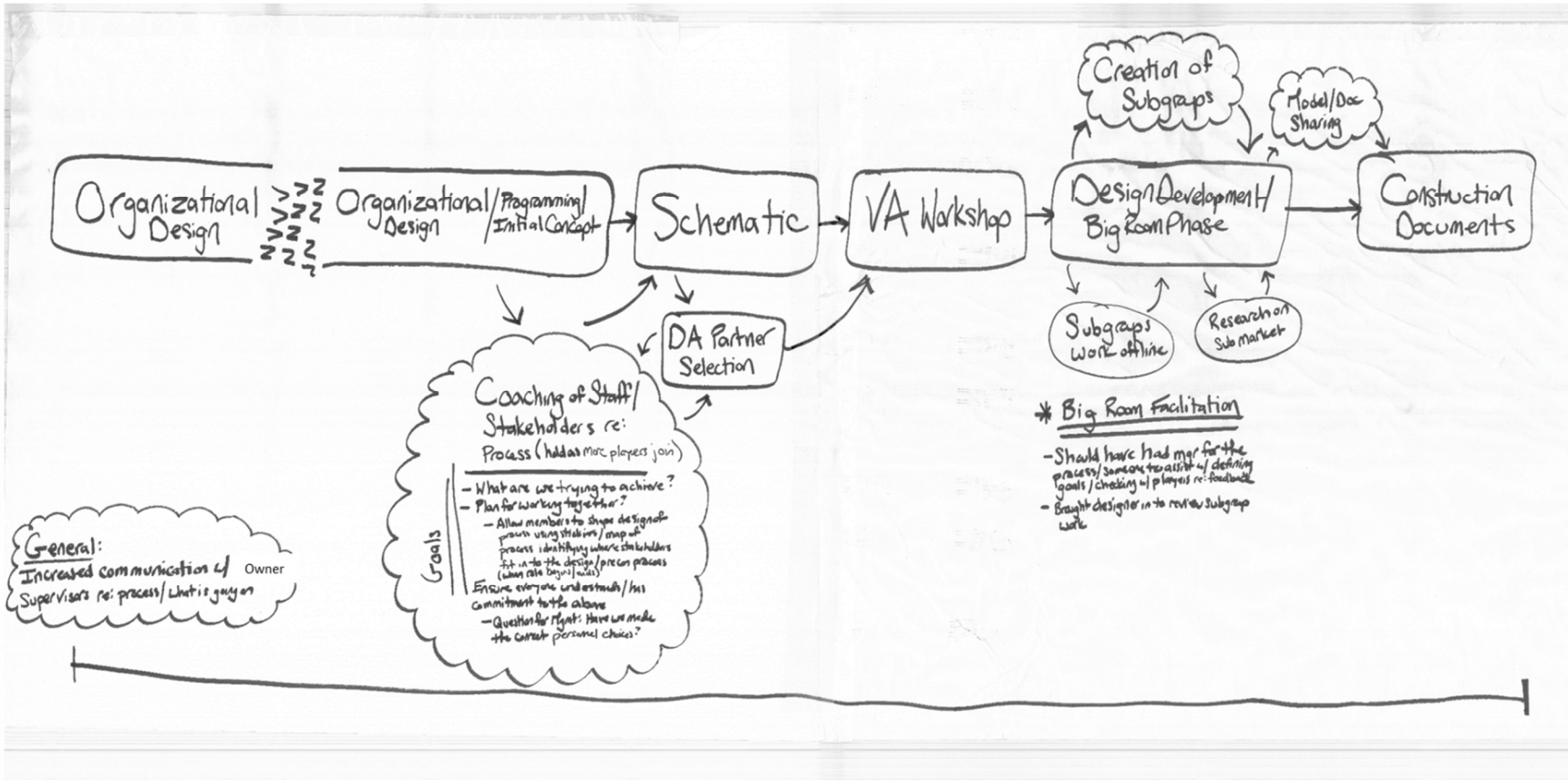


4.5.2 The CM/GC

After reflecting on the design/preconstruction process that was carried out during the case study project during their action learning session, the participant-researchers representing the CM/GC suggested the following improvements to the process if they were able to carry it out all over again:

- Increased Communication with Supervisors: The CM/GC noted that despite the number of employees representing the Owner that took part in the design/preconstruction phase, value would have been found through increased communication to the Owner's middle management regarding the needs/outcomes of the design/preconstruction process.
- Coaching of Staff/Stakeholders with regards to the Design/Preconstruction Process: Participant-researchers representing the CM/GC noted that although they realized the process was kept loosely defined in order to allow for greater creativity, they would have appreciated a more thorough debrief on the process that was being built in order to gain an understanding of what the team was trying to achieve. It was suggested that as part of this debrief/coaching session, the members of the team be provided an opportunity to shape the plan for working together across organizations, mapping out where/when various stakeholders fit in, their role, and when their role ends. Such a debrief/coaching session should result in members of the team understanding the process and committing to it. It was also noted that management should also ensure they are asking if they are making the correct personnel choices.
- Big Room Facilitation: The CM/GC said if they were to carry out this process all over again, they would have included a manager for the process – someone that wasn't attached to the process to assist with defining goals for the meeting and checking in with members of the team. In addition, they said they would have brought the head designer in to review the work of subgroups in the effort to carry out clash protection earlier.

Figure 14: CM/GC Activity Model

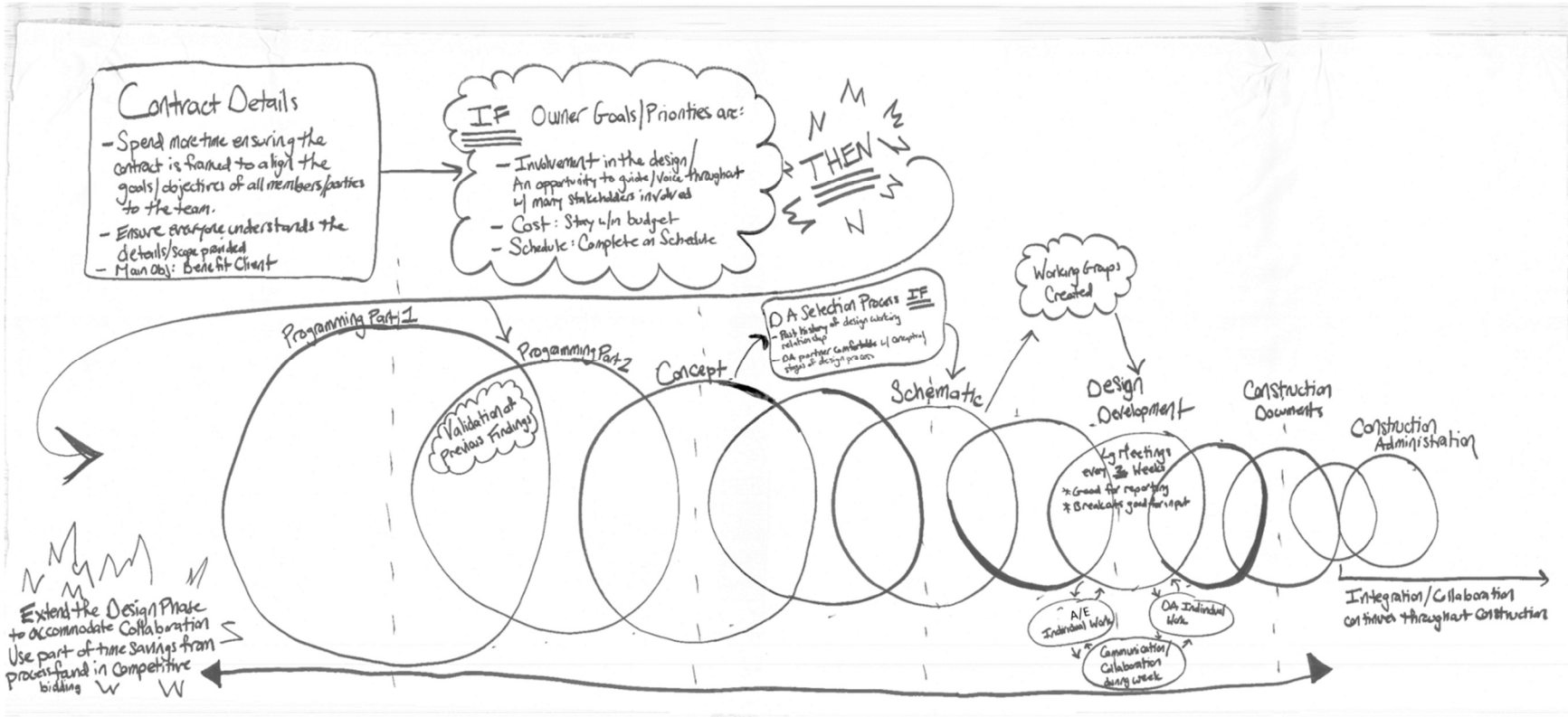


4.5.3 The A/E

After reflecting on the design/preconstruction process that was carried out during the case study project during their action learning session, the participant-researchers representing the A/E suggested the following improvements to the process if they were able to carry it out all over again:

- Contract Details: If they could carry out this process all over again, the A/E noted they would have spent more time ensuring the contract was framed to align the goals/objectives of all member/parties to the team and ensure everyone understood the details/scope provided, all in the interest of better serving the client.
- DA Process: If the DA partners had established relationships due to a past history of working together and the DA partner was comfortable working in the conceptual stages of the design process, the A/E noted that there would have been value found by hiring the DA partners earlier in the design/preconstruction phase (as early as concept).
- Frequency of Large Team Meetings: The A/E suggested that meeting together as a team for the large team meetings every two weeks would have provided the opportunity for reporting out and gaining input while providing more time to get the design work accomplished.
- Integration/Collaboration Continued through Construction: While not part of the scope of this project, the A/E noted that collaboration with regards to their involvement stopped at construction. They believe continued value would have resulted from their involvement.
- Extension of the Design Phase: The A/E noted that collaboration during the design/preconstruction phase is more time consuming compared to traditional delivery. The time savings is seen during the bidding phase of the delivery process because shop drawings are already complete. In addition, there are less RFI's during actual construction. They suggested allocating part of the savings in schedule realized during competitive bidding to the design phase.

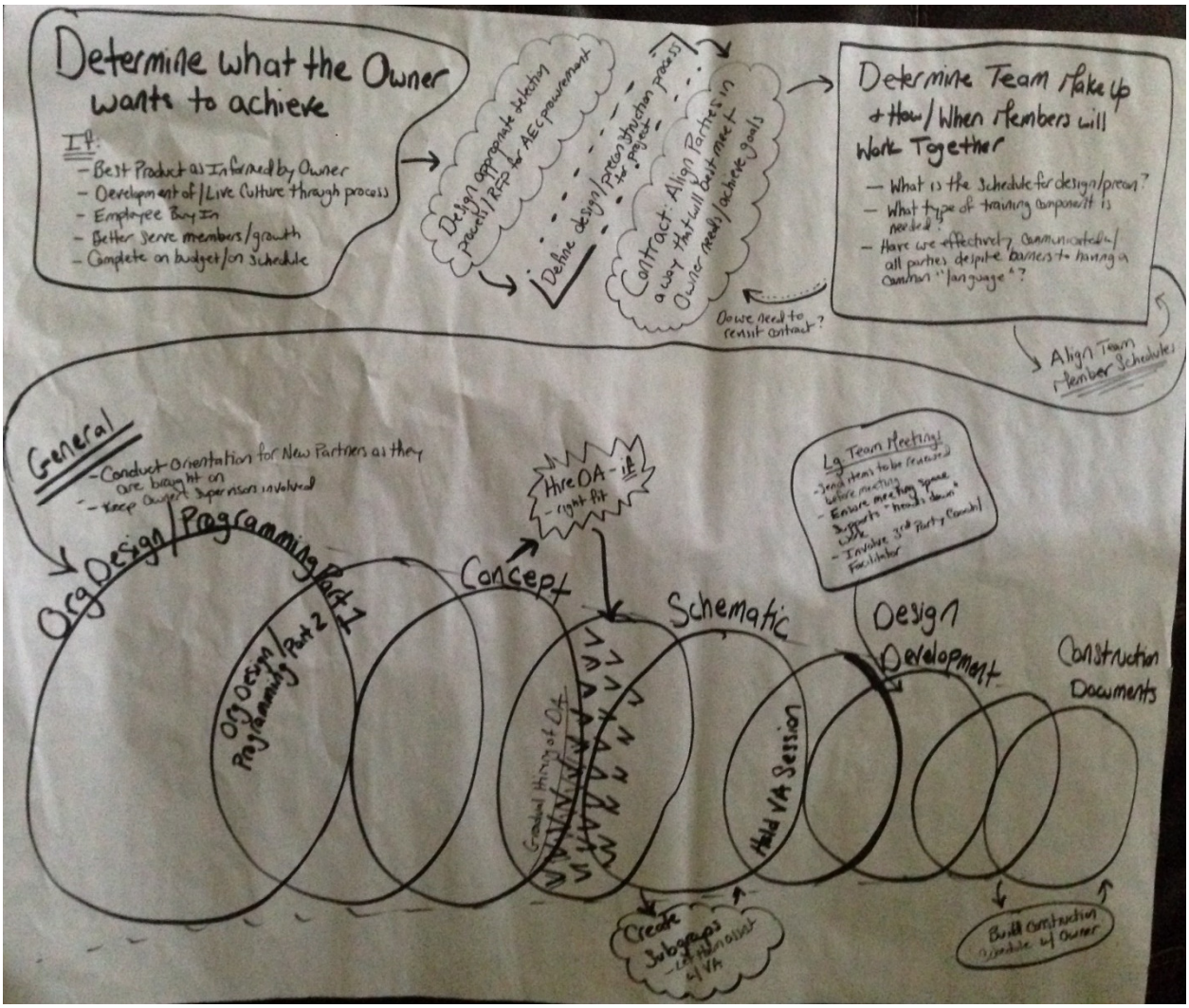
Figure 15: A/E Activity Model



4.5.4 Complete Team

Using the suggestions for an improved process identified during their individual action learning sessions, participant-researchers representing the Owner, CM/GC, and A/E built an activity model for an improved process together as a team during the final action learning session. While brainstorming for and subsequently building the activity model, it seemed there was only minor disagreement expressed over the individual organization's suggestions. One might argue that the suggestions noted above either worked toward benefitting all parties and/or they simply indicated what would have needed to occur to ensure that each party to the project was able to realize its goals/objectives and collaborate in a way that generated the most value. The resulting activity model of an improved process for this particular case study project is featured below.

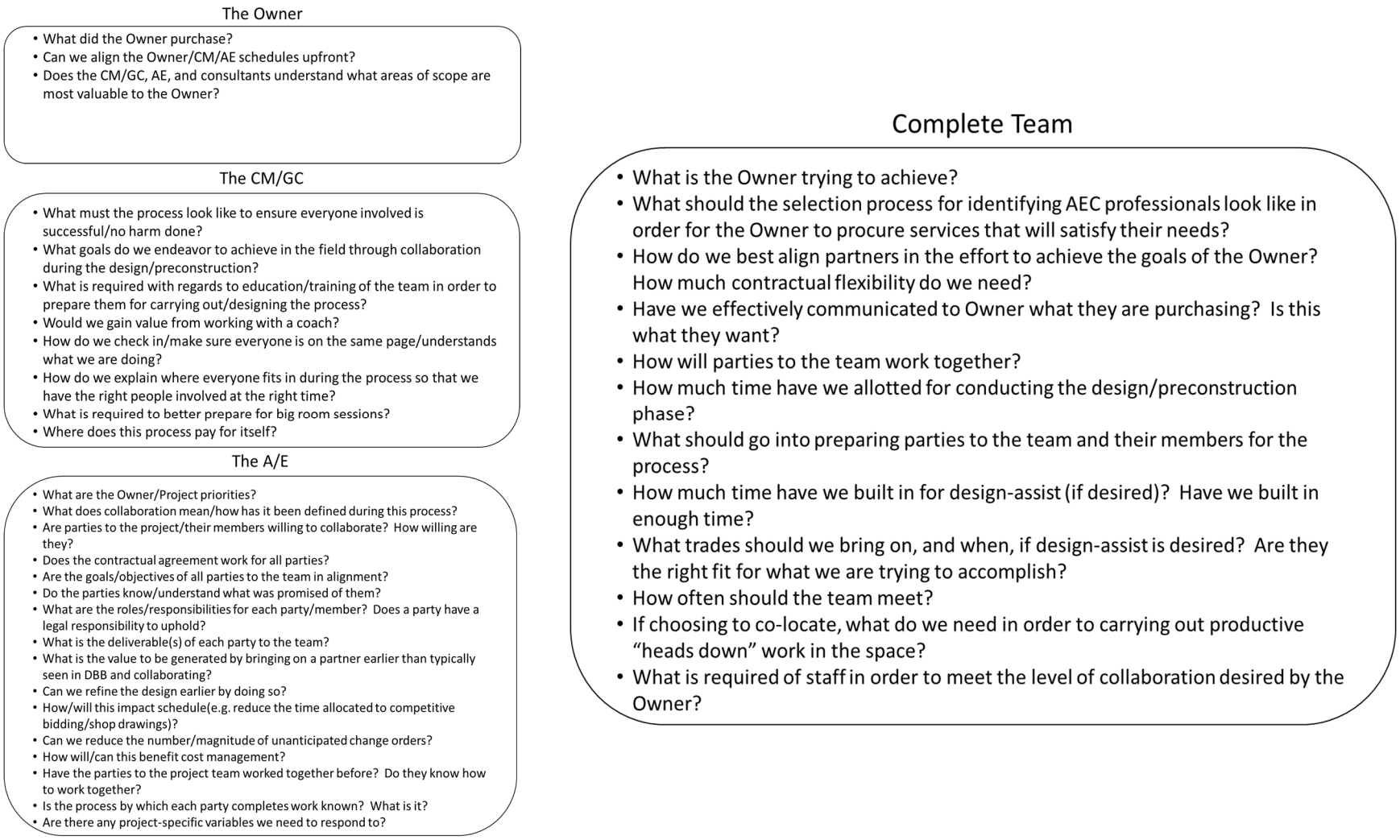
Figure 16: Complete Team Activity Model



4.6 A Conceptual Roadmap for Planning for Value-Generating Collaboration

As the final deliverable resulting from the described procedure and forthcoming data, the conceptual roadmap for planning for value-generating collaboration concludes the results section of the second component to this Master's thesis.

Figure 17: Conceptual Roadmap for Planning for Value-Generating Collaboration



4.7 Implications for Industry

4.7.1 First Step to Planning for Value-Generating Collaboration? Ask the Owner What They Are Trying to Achieve

It was stated earlier that the true primary difference between the traditional and lean paradigms for thinking about construction project delivery seems to be overshadowed, or at least underwhelmed, in both practice and research by our understandable infatuation with exploring the effectiveness and efficiency of the strategies and/or characteristics associated with lean/IPD. The primary difference between traditional delivery and lean/IPD lies in the philosophy that bread the strategies to begin with – the belief that an organization and its people must continuously seek to eliminate waste while simultaneously improve operations with value-added possibilities. This is in contrast to the goal of traditional delivery which is simply to construct a project on time, on budget, in line with the drawings and specifications.

If one is to agree that the objective of Lean Construction is to eliminate waste while adding value as defined by the owner and/or parties to the project team, then one should note that practicing lean/IPD does not mean to engage in all strategies associated with it (although those highlighted time and again are likely done so due to their success in adding a desired value to the project). Instead, the delivery process and the methods/strategies included should be deliberately chosen in order to maximize the success of the project at hand. Said differently, the process chosen for each project should be carefully considered so as to eliminate waste while generating value. And if the findings of the case study hold, the first step in planning for value-generating collaboration is to determine what the owner is trying to achieve.

Only after understanding the goals/objectives of the owner can a project team answer questions related to the design/preconstruction process, included those related to its design; the level of collaboration that is needed and between whom in order to satisfy the owner's objectives; the level of collaboration that will be supported by the owner; how to prepare the team; and the contractual arrangements necessary for aligning the parties to carry out the type/level of collaboration called for. Questions that take a closer look at detail (e.g. those related to design-assist), are only necessary if that type/level of collaboration is identified as necessary to achieving overall goals.

While asking the owner what they are trying to achieve may seem obvious, tailoring the process to meet their needs according to the project at hand rather than accepting those processes that have always been used/are becoming more common perhaps is not. It is this concept that has the largest implications for an industry that, among others arguably, sells buzzwords and types to contractual arrangements to clients, often prior to truly understanding the owner's program.

Last, but perhaps most importantly, the findings of this study has implications for owners. One of the questions generated as part of this study asked that the owner consider the type of RFP/RFQ process necessary for procuring services that will assist with achieving their objectives. The onus is ultimately on them to ensure they do so. Based on the overarching search and transfer barriers encountered in this study, it was concluded that communication with regards to finding a common language could have been improved upon. This doesn't just speak to the language of the AEC industry with regards to design, but those of the industries of clients. Despite due diligence, there is still at the very least, a functional barrier that can lead to misunderstanding. This study has implications for the type of relationships owners may want to form with contractors, architects/engineers, and program managers, in their pursuit to learn what their options are related to construction delivery that will maximize the success of their project and

achieve their objectives. To that end, the onus is also on them to take care in taking all advice at face value, without further exploration.

4.7.2 Where and How Does Collaboration Add Value?

While this cannot be generalized for every project, it still seems worth noting that the value cited from the types and level of collaboration seen during the design/preconstruction phase of this case study in the eyes of participant-researchers could typically be categorized as lending to better innovation and/or better operations using Hansen's concept of disciplined collaboration as a framework.

With regards to innovation, the Owner felt that engaging in a design/preconstruction phase with this level of collaboration resulted in a better product. Rather than the A/E coming to the table with a design for tweaking, this process allowed for a building design to develop over time using the input of the many stakeholders – and in particular, end-users - involved. Involving many stakeholders representing the Owner, CM/GC, A/E, and design-assist partners during the design/preconstruction process, the Owner felt this collaborative process was much more thoughtful than what they had witnessed on past projects. As a result, they felt they were receiving a much more personalized and efficient product. In addition, by involving employees from all departments and hierarchical levels, both the Owner as a firm and their employees bought into the building design, with participant-researchers belonging to the Owner noting that they felt their input was not just solicited but valued. The CM/GC also noted that they felt the exploration component of the design/preconstruction phase of this project provided for a longer window for workplace strategy to evolve. They said this ultimately led to a better informed design with regards to meeting Owner priorities.

Both the CM/GC and A/E said that bringing the entire project team together during the large design sessions and subgroup breakouts was beneficial to determining/refining project priorities and design solutions. By bringing the team together through co-located work sessions, expertise from a variety of disciplines could be leveraged with regards to considering different design solutions, discussing ideas for cost/schedule savings, and speaking to constructability in preparation for the field.

With regards to improving operations, the integrated design/preconstruction phase of this case study project was cited as having lent to better communication between parties to the project, assisted in developing relationships between members of the team, and the refinement of the design earlier leading to greater cost certainty and fewer RFIs.

While these findings require additional research, should others find this to be the case, it may lend toward answering when collaboration should be looked into and to what degree during the design/preconstruction phase.

4.7.3 Overcoming Search/Transfer Barriers: Finding a Common Language and the Role of Relationships

While it shouldn't have come as a surprise, what was most jarring to the researcher while carrying out the case study was the moment she realized that the rich picture for each organization had taken on a different shape compared with one another. This was after she had found it necessary to completely redraw the rich picture initially created for the A/E during their action learning session, realizing for the first time after working as an estimator for 2 ½ years that she did not know what the design process she worked within looked like to the A/E – she was not sure what was taking place during the weeks in between drawing sets upon which she estimated.

While based off of one case study, this visual representation of the differences in which organizations view the same process, in addition to the converging feedback and activity models generated that spoke to the need for more information, or for that information to be communicated in a different way, may have implications for industry. Should additional research on communication barriers between parties to design/preconstruction phases yield results that show parties typically see this same process differently and/or encounter similar types of search/transfer barriers, this may uncover a need for best practices for brokering communication. The case study by Parjanen et al (2010) reviewed as part of this Master's thesis provided a description of what a brokerage function looks like for cross-organizational multi-disciplined teams, like those assembled during the design/preconstruction phase.

One may also wonder if both the architecture/engineering community and construction community are consulting one another in their pursuit to improve construction project design/delivery. If not, this type of reflection process that seeks out the input of both professions in the AEC seems warranted. During this case study, where the CM/GC cited efficiencies, in some cases the A/E noted this wasn't quite the case from their perspective (e.g. design-assist).

A commonly cited reason for issues related to the search and transfer of information had to do with lack of past working relationships between the A/E and the design-assist partners. It was noted that some design-assist partners struggled while working in a more conceptual stage of design. It was also noted that having never worked together so closely before, there was a learning curve with regards to knowing one another's work style. While this is not to suggest these obstacles would be present for any/all cases, they do hint at a larger theme which is the importance of previously established relationships in the transfer of related, noncodified knowledge. Hansen (2002) spoke to this, finding that shorter paths to

contacts with related knowledge (i.e. fewer intermediaries needed) correlated with decreased project completion time and greater amount of input from other experts in a final product. Perhaps for industry, this signals the need for greater networking between A/E's and the trades.

4.7.4 The Importance of Structure and Checking In

The AEC industry, whose professionals find themselves members of cross-organizational, multi-discipline virtual teams often, especially if the contract structure calls for it, could benefit from paying greater attention to literature surrounding the best practices for assembling and managing virtual teams. Aside from search and transfer barriers, the converged feedback, the activity models, and the questions generated for designing a process for value-generating collaboration spoke to how to better plan for and communicate process. Which makes sense if one is to accept the characterization of construction project teams as virtual teams. Lurey and Raisinghani (2000) and Malhotra et al (2007) noted the importance of establishing structure, norms for communication, and checking in with the team.

4.7.5 An Argument for Frames in lieu of Generalizable Facts

In his conference paper addressing the need to bridge theory and practice, Lawler (1985) noted that the production of "facts" is indeed important because they allow researchers to test and validate theory, may assist with constructing theory, and play a role in improving practice. This is not to say that the conceptual road map produced could not be used to generate "facts" after further testing is conducted to identify what subset of projects it perhaps services best and/or it is improved upon with the help of others answering the researcher's question using the same or differing methods.

However, in acknowledging that "one-size-fits-all" does not work for designing/delivering construction projects in a manner that creates the most value (as defined by the owner and/or project team at large), this researcher wonders along with Lawler (1985) if when seeking to improve practice, what is most valuable is the production of "frames." While facts undeniably have their place in improving science and practice, frames help one with thinking about and then organizing the world. The AEC industry will never improve upon project delivery if those running the show cannot make sense of the complex world within which we conduct business.

As noted previously, this case study was conducted in the effort to develop a framework, or list of questions, that a construction project team might employ in the effort to plan for value-generating collaboration between parties during the design/preconstruction phase. In the effort to develop such a framework, the researcher was aided by a framework already in existence. During this study, Morten T. Hansen's concept of disciplined collaboration and the steps to achieving it was used a framework for organizing the converged feedback into broad, yet legible categories so that it could be considered holistically, specifically identifying where/when/why collaboration added value and placing the feedback unique to this case in broader terms (i.e. collaboration was worthwhile in that it led to innovation and better operations in the eyes of the team) and areas where the collaborative process could have been improved/issues arose (i.e. search and transfer barriers, and constructive feedback on organizing the process). In addition to organizing feedback related to the process that took place, the framework also assisted with organizing feedback related to improvements into categories related to solutions (i.e. feedback tended to lean toward Hansen's "unification lever" and "network lever" categories).

Although feedback related to process and its impact on value-generating collaboration did not fit into any of Hansen's barriers, overall his concept of disciplined collaboration might be applied to the AEC industry

based upon its use in this particular study. In addition, it speaks to the value that frames have in assisting with organizing one's world.

4.7.6 Implications for Industry: A Summary

In summary, this research first and foremost suggests that when endeavoring to plan for collaboration within the design/preconstruction phase that results in generating value, first one must understand what the owner is trying to achieve. If one agrees that collaboration is not the end goal but a means to an end, before it can be recognized as valuable, one must first determine if it is needed, and if so, in what form, between who, etc., to best realize the objectives of the owner.

Next, although the goal of this research project was not to provide generalizable facts, the findings may leave the research community with some questions to further explore related to the following:

- Where and how collaboration generates value: Using Morten T. Hansen's (2009) concept of disciplined collaboration, the converged feedback from the participant-researchers related to when, where, how, and why collaboration generates value suggested that collaboration lent to better innovation and better operations during this case study.
- Barriers to collaboration: Using Hansen's (2009) concept of disciplined collaboration, most converged feedback from participant-researchers in the form of lessons learned could be categorized as a search and/or transfer barrier, in this case with regards to finding a common language or the need for previously built working relationships. Feedback related to lessons learned that fell outside of Hansen's (2009) concept largely spoke to planning/executing the process efficiently/effectively and ensuring all parties involved understood what was taking place and their role. This was compared back to the challenges inherent in building and managing virtual teams.

5.0 CHAPTER FIVE: CONCLUSION

5.1 Purpose of Study

It was argued previously that if one is to agree that the objective of Lean Construction is to eliminate waste while generating value as defined by the owner and/or project team, then one should note that practicing lean/IPD does not mean to engage in all strategies associated with it (although those highlighted time and again are likely done so due to their success in adding a desired value to the project). Instead, the delivery process and the methods/strategies included should be deliberately chosen in order to maximize the success of the project at hand. Said differently, the process chosen for each project should be carefully considered so as to eliminate waste while generating value.

It was mentioned that at the surface, the purist version of the lean/IPD approach described in Chapter One contrasts greatly with that of design-bid-build (DBB) and those delivery systems that have spun off of this primary method of accomplishing construction projects. Which may be why the true primary difference between the two paradigms for thinking about construction project delivery seems to be overshadowed, or at least underwhelmed, in both practice and research by our understandable infatuation with exploring the effectiveness and efficiency of the strategies and/or characteristics associated with lean/IPD. The primary difference between traditional delivery and lean/IPD lies in the philosophy that bread the strategies to begin with – the belief that an organization and its people must continuously seek to eliminate waste while simultaneously improving operations with value-generating possibilities. This is in contrast to the goal of traditional delivery which is simply to construct a project on time, on budget, in line with the drawings and specifications.

Embracing the Lean Construction mantra that AEC practitioners can add value to our projects by eliminating waste, the goal of the proposed research project was to add to the body of knowledge concerned with improving construction delivery while focusing specifically on understanding the relationship between collaboration and value generation during design/preconstruction. In the practice of construction, the researcher argued that we tend to focus our attention on managing the tangible aspects of our day-to-day jobs at the expense of understanding how to maximize the most complex, and yet most expensive, resource in our business – people. Although there has been a focus on methods for achieving greater collaboration, or levels of "integration", among parties to a project, perhaps the focus should instead be on when the time and resources spent on collaboration add the most value and just as importantly what cultivates team synergy – where the whole is greater than the sum of its parts. There is a tremendous difference between a group of people working toward the same goal and a "team."

With the above in mind, the following exploratory research question was offered:

Where, when, how, and why does collaboration generate value to construction projects during design/preconstruction?

In posing the above question, the proposed research project endeavored to fulfill the following objectives:

- Synthesize a list of contemporary practices associated with collaborative practices and fostering team synergy on projects across all industries.
- Develop a conceptual model for planning for value-generating collaboration during the design/preconstruction phase of a construction project.

The proposed research question was explored using Morten T. Hansen's concept of "disciplined collaboration" as a framework through which to analyze collaboration in construction project design/preconstruction.

5.2 Summary of Procedure

In order to explore the posed research question and accomplish the desired objectives, the researcher carried out the following:

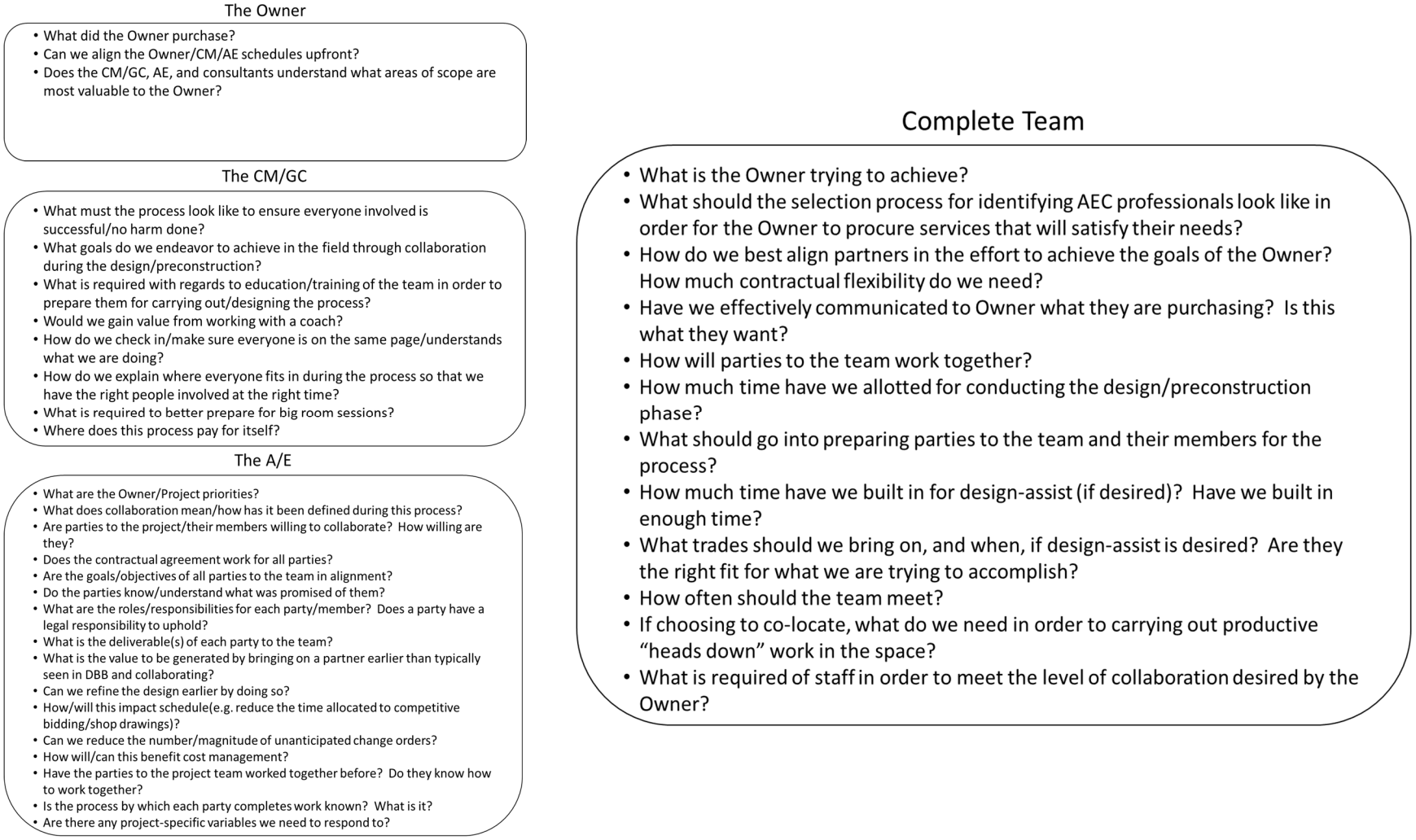
I. Expanded Literature Review: While literature surrounding "lean" and "integration" concerning construction was surveyed with the purpose of identifying where the value of collaboration may have been considered, the researcher argued that the research project conducted had roots in the overarching study of business and project management, which inserts itself within all industries. In the effort to thoroughly answer the research question posed in this Master's thesis – which asks where, when, how, and why does collaboration generate value to construction projects during design/preconstruction – and to further suggest that the AEC can learn from research focused on collaborative practices and fostering team synergy on projects across all industries, an additional literature review was conducted that surveyed research related to value-generating collaboration across any/all industries. Waiting until after the case study had been conducted to begin, the author tailored her search to focus on literature concerned with virtual teams and that which might promote a better understanding of and solutions to barriers highlighted by the converged responses compiled and action learning sessions conducted during the case study.

II. Case Study Grounded within the Paradigm of Action Research: A case study involving a "lean" and/or "integrated" project was carried out within the paradigm of action research, engaging members of the Owner, Construction Manager/General Contractor, and Architect/Engineer that played a role in the design/preconstruction phase as participant-researchers. With their assistance, the research project arguably succeeded in bridging theory and practice, with the end goal of contributing both a case study for others to survey in their own attempts to improve delivery methods and to increase their understanding of the role of collaboration in addition to creating a conceptual road map for planning for value-generating collaborative efforts during the design/preconstruction phase.

5.3 Summary of Findings

As a result of carrying out the research procedure, the researcher succeeded in completing a case study involving a project that sought to be "lean" and/or "integrated" and ultimately, drafted a roadmap of questions that a different project team consisting of the owner, CM/GC, A/E, etc. might use in order to plan for value-generating collaboration during the design/preconstruction phase. This was only made possible thanks to the participant-researchers involved who were very generous in giving both their time and feedback. This list of questions has been included below:

Figure 18: Conceptual Roadmap for Planning for Value-Generating Collaboration



5.4 Conclusions

In summary, this research first and foremost suggested that when endeavoring to plan for collaboration within the design/preconstruction phase that results in generating value, first one must understand what the owner is trying to achieve. If one agrees that collaboration is not the end goal but a means to an end, before it can be recognized as valuable, one must first determine if it is needed, and if so, in what form, between who, etc., to best realize the objectives of the owner.

Next, although the goal of this research project was not to provide generalizable facts, the findings may leave the research community with some questions to further explore related to the following:

- Where and how collaboration generates value: Using Morten T. Hansen's (2009) concept of disciplined collaboration, the converged feedback from the participant-researchers related to when, where, how, and why collaboration generates value suggested that collaboration lent to better innovation and better operations during this case study.
- Barriers to collaboration: Using Hansen's (2009) concept of disciplined collaboration, most converged feedback from participant-researchers in the form of lessons learned could be categorized as a search and/or transfer barrier, in this case with regards to finding a common language or the need for previously built working relationships. Feedback related to lessons learned that fell outside of Hansen's (2009) concept largely spoke to planning/executing the process efficiently/effectively and ensuring all parties involved understood what was taking place and their role. This was compared back to the challenges inherent in building and managing virtual teams.

5.5 Contributions to Knowledge

While the researcher recognizes that arguably, this study contributes to knowledge in a number of ways (e.g. by introducing the use of Hansen's concept of disciplined collaboration as framework for understanding collaboration on construction projects and introducing SSM in a construction environment), rather than make a list, she would prefer to highlight the two contributions she finds most important.

As this researcher reflects back upon this entire research endeavor, she would like to offer that the conceptual model is the most significant contribution. She offers this not because it provides a tool for testing, but because the list of questions generated give us cause to step back and ask what we are really trying to achieve when we set out to design and subsequently construct a project for an owner. We are looking to achieve the objectives of the owner, to satisfy the reasons that the owner is choosing to carry out a construction project.

The questions generated as a result of this study ultimately suggest that when planning for collaboration that generates value to a project during the design/preconstruction phase, a project team consisting of the owner, CM/GC, A/E, etc. should first determine what it is the owner is trying to achieve. Only after understanding the goals/objectives of the owner can a project team answer questions related to the design/preconstruction process; its design; the level of collaboration that is needed and between whom in order to satisfy the owner's objectives; how to prepare the team; and the contractual arrangements necessary for aligning the parties to carry out the type/level of collaboration called for.

While answering this question may seem obvious, and some may argue that it does in fact get answered in practice, this researcher would ask in response if this question is answered first before engaging in any

other services (all of which have a cost) or before determining the delivery system or set of strategies we associate with a particular delivery system to be used when we as AEC professionals assist owners in realizing construction projects. She suspects the answer to this question would be a negative in some, if not many, cases.

If we did, ultimately AEC professionals would be letting owners know that their objectives and what they find "valuable" will ultimately dictate what is required of the construction delivery process. One of the questions generated as part of this study asked that the owner consider the type of RFP/RFQ process necessary for procuring services that will assist with achieving their objectives. The onus is ultimately on them to ensure they do so. Based on the overarching search and transfer barriers encountered in this study, it was concluded that communication with regards to finding a common language could have been improved upon. This doesn't just speak to the language of the AEC industry with regards to design, but those of the industries of clients. Despite due diligence, there is still at the very least, a functional barrier that can lead to misunderstanding. This study has implications for the type of relationships owners may want to form with contractors, architects/engineers, and program managers, in their pursuit to learn what their options are related to construction delivery that will maximize the success of their project and achieve their objectives. To that end, the onus is also on them to take care in taking all advice at face value, without further exploration.

Based upon the findings of this research project, this researcher would ask that both owners and AEC professionals reconsider our tendency to buy and sell pre-packaged ideas and strategies and instead, determine what we are trying to achieve and carry out the due diligence necessary for building a process that realizes the objectives at hand. We must understand what we are trying to achieve before we can decide what it is we need (and who, and when). Collaboration is not the goal, it is the means to an end.

In addition to the above, this researcher dares to suggest that this research project and its findings are a contribution to knowledge in that the data was generated from the perspectives of all three major parties to a construction project – the owner, CM/GC, and A/E. As a result, the final conceptual roadmap of questions for planning for value-generating collaboration asks questions that if answered honestly, should maximize the use of resources across all three parties. It also contributes a case study to the literature that includes the feedback of all three parties with regards to when, where, why, and how collaboration generated value, where barriers were encountered, and suggestions for refinement that might be used in combination with the research of others. It seems pertinent to mention this, especially in light of the very different ways all three parties viewed the same design/preconstruction process. If we are to plan for a design/preconstruction phase that maximizes the project/achieves the objectives of the owner, we must be sure we are considering the perspectives of all parties involved.

5.6 Limitations of Study

Despite the attempt to generate a framework or conceptual model meant to assist project teams with planning for value-generating collaboration on their specific projects in lieu of producing generalizable facts, the conceptual model was still generated with the help of a single project team working together on one specific project. It will take subsequent testing of this model to determine if it is useful in planning for value-generating collaboration. In addition, other limitations to this study include the following:

- It is not proven that projects embodying differences in project team make up, project type, etc., would generate the same questions.
- The researcher was an employee of the CM/GC, potentially influencing the company and the participant-researchers' willingness to participate.

- Despite the measures taken to ensure individuals were not pressured to participate in this study, there is still a possibility that because they were asked to participate by management, that they did so despite reservations.
- The case study project and project team featured had pre-existing contractual relationships and/or a history of past working relationships.
- This case study was conducted and documented from the viewpoint of the CM/GC.
- Information regarding demographics, years of experience, etc., were not collected from participant-researchers.
- Although the researcher asked that all integral members of the team be included in the study, this was left up to the opinion of the executive contact/designee to determine and provide.
- The experience of participant-researchers as it relates to working on other projects seeking to employ an integrated or collaborative approach was not measured.

5.7 Future Research

In light of conducting this research project, this researcher would like to make two suggestions to the research community with regards to future research:

- As an industry that deals heavily in the management of people, this researcher would suggest that others look to the bodies of research related to project management and organizational behavior in the effort to consider best practices for running effective teams and to better understand the nuances that result in both barriers to collaboration, etc., and solutions to those barriers.
- We should be making sure that in our research, we are considering the perspectives of all parties to the project team. Whether we agree with one another or not, if we don't consider construction project delivery from the perspective of all AEC members involved, we run the risk of creating

inefficiencies for one or more of the parties, for which the owner will ultimately pay. After realizing that she did not understand the design/preconstruction process from the A/E point of view, this researcher would also suggest that literature generated to assist AEC professionals better understand what the design/preconstruction phase looks like to all parties to the project would be helpful with increasing understanding/level of respect for what each member brings to the project and designing the process from holistic view.

With this in mind, potential topics of interest for future research include how to ensure owners are able to ask the right questions in order to communicate their objectives effectively to AEC professionals; when and how AEC professionals need to approach owners to ensure owners understand the various construction project delivery philosophies/options; how to effectively communicate recommendations with regards to the level and type of collaboration that might maximize an owner's objectives for a project prior to/during contract negotiations; and how to ensure contractual negotiations protect the interests of all parties involved when designing a process unique to an owner rather than engaging in a well-understood, linear delivery method.

APPENDIX

Figure 19: Research Project Procedure Visual Aid

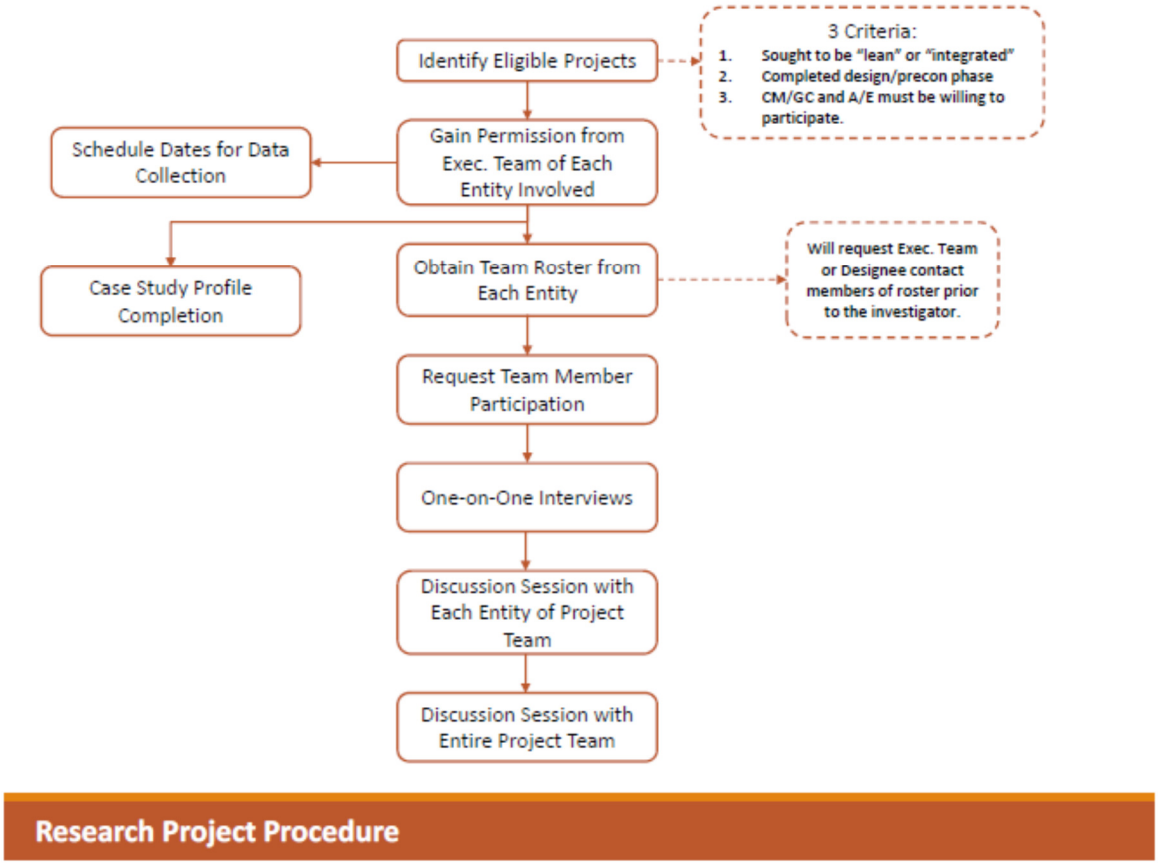


Figure 20: Participant-Researcher Consent Form

Research Participant Information and Consent Form

1. EXPLANATION OF THE RESEARCH and WHAT YOU WILL DO:

- You are being asked to participate in a research study that seeks to explore the role collaboration between the construction manager/general contractor, architect/engineer, and/or client plays in generating value during the design/preconstruction phase of a construction project. In the case of this research study, the term "value" will be defined by participants in the research study, including yourself, should you choose to participate.

  The ultimate goal of this research study is to create a list of questions that can be asked at the beginning of a project that will result in the planning for value-generating collaboration during the design/preconstruction phase. This list of questions will be generated by carrying out the research study process described below.

  You are being asked to participate because you were acknowledged as a member of the team integral to carrying out the design/preconstruction phase of the Lake Trust Headquarters project. This project is being considered for use in this research study.

- *If you decide to participate in this research study, you will be asked to do the following:*
  - *Participate in a One-on-One Interview: You will be asked to participate in a one-on-one interview, either in person or over the phone, with one of the research study investigators. Along with this Consent Form, you have been provided with the list of questions that will be asked at the interview so that you may review ahead of time. You are welcome to contact the investigator at any time prior to the interview if you have any questions about what you are being asked or would like more information about the research study. You are not required to answer any question that you wish not to answer. The identity behind your answers will be kept confidential. Your responses to the interview questions will be paraphrased and compared with the responses of other participants. Common feedback/ideas/etc. will be shared with the team during a later discussion.*
  - *Participate in a Discussion with Team Members from Your Organization: You will be asked to participate in a discussion regarding the design/preconstruction phase of the Lake Trust Headquarters project. During this discussion, team members from your organization will reflect upon the process that took place during the design/preconstruction phase of the project, in particular the collaborative activities, and how it could have been improved upon. The improved upon version will be used to generate questions that might be asked to plan for value-generating collaboration in future projects.*
  - *Participate in a Discussion with Team Members from the Entire Project Team: You will be asked to participate in a discussion regarding the design/preconstruction phase of the Lake Trust Headquarters project. During this discussion, team members from the CM/GC, A/E, and client will together reflect upon the process that took place during the design/preconstruction phase of the project, in particular the collaborative activities, and how it could have been improved upon. The improved upon version will be used to generate questions that might be asked to plan for value-generating collaboration in future projects.*

- You must be at least 18 years old to participate in this research.

2. YOUR RIGHTS TO PARTICIPATE, SAY NO, OR WITHDRAW:

- Participation in this research project is completely voluntary. You have the right to say no. You may change your mind at any time and withdraw. You may choose not to answer specific questions or to stop participating at any time. Whether you choose to participate or not will never be disclosed/discussed with your employer or other members of the project team.

Figure 20 (cont'd)

3. COSTS AND COMPENSATION FOR BEING IN THE STUDY:

- *If you choose to participate in this research study, you will not be reimbursed for any out of pocket expenses (e.g. travel).*

4. CONTACT INFORMATION FOR QUESTIONS AND CONCERNS:

If you have concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher:

Dr. Tariq Sami Abdelhamid
Associate Professor of Lean Construction
School of Planning, Design and Construction
552 West Circle RM 214
Michigan State University
East Lansing, MI 48824
P: 517-884-4557
P: 517-432-6188
e: tariq@rhs.msu.edu

Nicole Schippel
Secondary Investigator
Candidate, Construction Management Master of Science
schippel@msu.edu
248-376-6061

If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at Olds Hall, 408 West Circle Dr Rm 207, East Lansing, MI 48824.

5. DOCUMENTATION OF INFORMED CONSENT.

You indicate your voluntary agreement to participate by beginning this one-on-on interview and by participating in any and/or all of the discussion sessions.

Figure 21: Participant-Researcher One-on-One Interview Questionnaire

Participant-Researcher Interview Questions

1. Please describe the process used during the design/preconstruction phase of the project.
2. What was your role in the project during the design/preconstruction phase?
3. How did this process compare with those processes you have participated in on projects in the past?
4. Overall, how did you feel about the process?
5. How would you describe disciplined collaboration?
6. What are the goals of this study?
7. Collaboration Matrix (Adapted from Morten T. Hansen)

Instructions: Participant-researchers will be asked the following questions:

- Who, to the best of your knowledge, were the parties to the project team?
- Did collaboration take place between any and/or all of those parties named?

If affirmatively answered, the participant-researcher will be asked to expand/reflect upon the collaboration that took place with the help of the "Collaboration Matrix" included below, adapted from Morten Hansen's work.

Party to Project	Ex: Client	Ex: CM/GC	Ex: AE	Ex: Trade
Ex: Client				
Ex: CM/GC				
Ex: AE				
Ex: Trade				

The investigator will ask the following questions for each pairing:

- Did [insert name] and [insert name] collaborate during the process?
- If yes, what collaborative activities took place?

For each activity named, the following questions will be asked:

- Please describe the activity and the role of each party.
- What are your overall feelings with regard to the activity?

Figure 21 (cont'd)

8. Identification of Barriers Present Among the Project Team (Adapted from Morten T. Hansen)

   Instructions: Assess each party/organization that make up the project team (including your own) using the following questions in order to identify whether predominant barriers exist and their prominence.

Survey Question	Enter a Score of 1-100 (1 = not at all, 100 = to a large extent)
Even when they need help, members of this organization are not willing to seek input from outside their organization.	
When faced with problems, members of this organization strive to solve them by themselves without asking for help from outsiders.	
There is a prevailing attitude in this organization that people ought to fix their own problems and not rely on help from outside the organization.	
The members of this organization keep their expertise and information to themselves and do not want to share it across the parties to the project team.	
Members of this organization are often reluctant to help colleagues from other parties to the project team.	
Members of this organization seldom return phone calls and emails when asked for help from people outside their organization.	
Members of this organization often complain about the difficulty they have locating colleagues from other parties to the project team who possess the information and expertise they need.	
Experts in this organization are very difficult to find.	
Members of this organization have great difficulties finding the documents and information they need in the company's databases and knowledge-management systems.	
Members of this organization have not learned to work together effectively across parties to the project team in order to transfer tacit knowledge.	
Members from the other parties to the project team are not used to working together and find it hard to do so.	
Members of the organization find it difficult to work across parties to the project team to transfer complex technologies and best practices.	

9. Please provide any additional information/thoughts regarding this process.

Participant-Researcher Interview Introduction Transcript:

Initial Points:

- First, if you haven't read over the consent form, I want to be sure to cover the following:
    - If you do not wish to participate in this study, you are not obligated to do so. It will never be disclosed to your employer whether you did or did not participate.
    - You may quit the study at any time, or, if you run into a question you do not wish to answer, you may refrain from doing so.
    - By participating in this interview, and later, in the discussion sessions, you are giving your consent.

About this Interview:

- Your answers to these questions will never be seen in their raw form/your name is not attached by anyone but me (the researcher) or the primary investigator (my professor). There is a plan for their safe storage/destruction.
- The answers you give me will never be repeated verbatim. They will be compared with those of the other participants at your organization and converged into common thoughts/ideas/etc. for use in the remainder of the research project.

About this Research Project:

- As we go through this research project, I will be asking you to describe/reflect on the collaborative activities that took place during the design/preconstruction phase. We will be looking to reflect and ultimately consider where, when, and how we would collaborate if we could do this process all over again.

- However, this case study is not being carried out to suggest that the collaborative activities that generated or didn't generate value according to our team would hold on another project.
- The objective of this case study is to use this reflection process to ultimately develop a checklist of questions we could ask at the onset of the design/preconstruction phase in hopes of planning out collaboration that always generates value to the team.

To help us reflect, I have borrowed Morten T. Hansen's concept of disciplined collaboration to provide a framework for us to focus our thoughts.

- Believes that collaboration is a means to an end, not the goal in and of itself.
- A leadership practice of properly assessing when to/not to collaborate and then making it possible to do so.
- Good collaboration: ROI – Bad Collaboration: Wasted Resources

Figure 22: Disciplined Collaboration Cheat Sheet

6 Common Traps to Reaching "Good Collaboration"	1. Environment is unfit for collaborating 2. Over Collaborating 3. Overestimating the Potential Value Derived from Collaborating 4. Underestimating the Costs Associated with Collaborating 5. Misdiagnosing the Reason Why People Are Not Collaborating 6. Implementing the Wrong Solution to Encourage Collaboration ◦ Typically follows a misdiagnosis (e.g. implementing a technology/system to foster collaboration only to realize lack of collaboration was due to unwillingness).

Solution: Disciplined Collaboration		
3 Steps to Planning for "Good Collaboration"	1. Evaluate Opportunities: Better Sales? Innovation? Improved Operations? 2. Identify Barriers 3. Tailor Solutions to Tearing Down Barriers	
4 Categories of Barriers	1. "Not Invented Here": People are able but not willing. 2. "Hoarding": People have the info needed but unwilling to share. 3. "Search Problem": People are willing but unable to easily find the info they need. 4. "Transfer Problems": Inability to transfer complicated knowledge across parties.	
3 Categories of Solutions	1. Unify People	Establish a unifying goal, value for teamwork, common language.
	2. Cultivate T-Shaped Management	Leaders that produce value individually and are great team players.
	3. Build Nimble Networks	Networking with purpose, value over size.

Source: Hansen, M.T 2009

Figure 23: Disciplined Collaboration Coding Frame Example

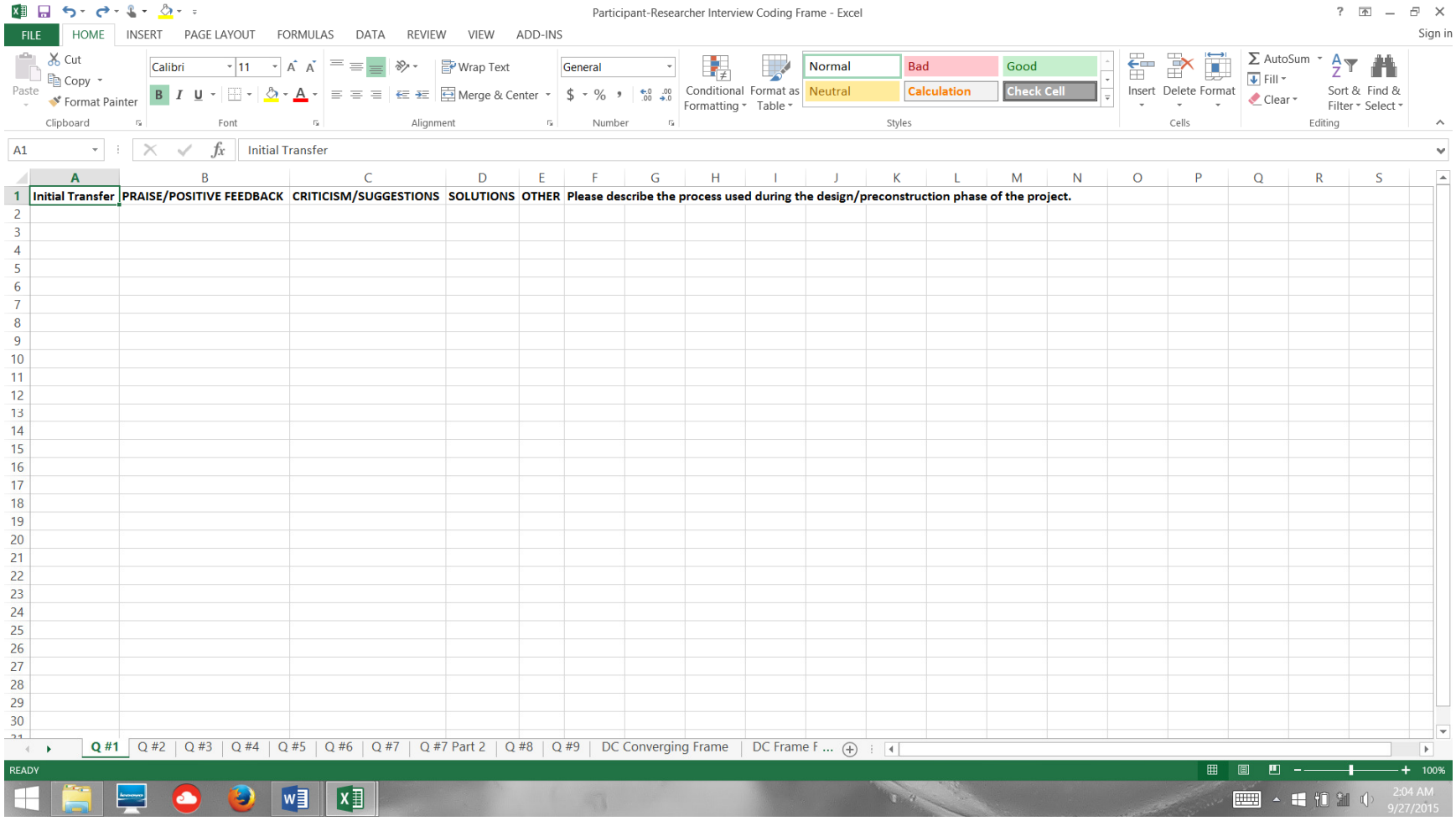


Figure 24: Action Learning Session Example Agenda

Final Discussion Session Agenda

Monday, August 31, 2015
9am – 12pm

Introduction

- Project Goals/Research Project Question (for reference)
  - Overarching Goal: Improving construction delivery while focusing specifically on understanding the relationship between collaboration and value-generation during design/preconstruction.
  - Research Project Question: Where, when, how, and why collaboration generates value to construction projects during the design/preconstruction phase by carrying out a case study involving a "lean" and/or "integrated" project.
  - Objective/Final Project Deliverable: List of questions that can be asked at the beginning of a project that will result in the planning for value-generating collaboration during the design/preconstruction phase.

- Progress Update: How far into this process are we?

- Final Discussion Session Overview

Step #1: Review Feedback

- Rich Picture
- Participant-Researcher Feedback

Step #2: Create an Activity Model: What would the process look like if we could do it all over?

- Initial Brainstorm:
  - What are we trying to achieve?
  - What will define success?
  - Who will benefit?
  - Who must be involved?
- Naming the Activities:
  - What does the design/preconstruction phase look like?
  - What does the process of each activity look like?
- Building/Finalizing the Activity Model

Step #3: Create Checklist for "Planning the Plan"

- What would we have to ask ourselves to come up with the activity model created?

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WORKS CITED

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