TRUST-BUILDING IN THE CONSTRUCTION PROJECT DELIVERY PROCESS: A

RELATIONAL LOOKAHEAD TOOL FOR MANAGING TRUST

A Dissertation

by

JAMES PACKER SMITH

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Zofia K. Rybkowski
Co-Chair of Committee,	Mardelle M. Shepley
Committee Members,	James C. Smith
	Mindy Bergman
Head of Department,	Joseph Horlen

August 2013

Major Subject: Architecture

ABSTRACT

Low levels of productivity and recent evolutions in technology and practices are pushing

the construction industry to collaborate on a higher level. A key component of effective

collaboration is trust. Research also suggests that increased trust levels can lead to

improved productivity in team performance. Trust appears to be valued by industry

practitioners at the executive level but it also appears that active management of trust is

minimal.

With Design Science Research methodology as a framework, this project uses a mixed

methods approach to develop and test a tool designed to assist in the management of

trust levels between construction project participants. This project lays the groundwork

for additional research into trust-building in construction by testing whether or not trust

can be actively built and managed by rigorous analysis of current and upcoming

relationships. In addition to supporting data from case studies, this was accomplished by

introducing specific trust-building techniques into student group interactions and

comparing changes in interpersonal trust levels to a control group of students.

Results from the case studies and student experiment show some support for the idea

that interpersonal trust levels, as perceived by the person making the attempts to build

trust within the group, can be increased through use of a tool such as the one developed.

Further testing and development is needed prior to wider industry application.

DEDICATION

This dissertation is dedicated to my wife

KIMBERLY RANDALL SMITH

for defining by her example what a "help meet" is

and for helping me understand the true value of

continuous improvement in life.

You are the best.

ACKNOWLEDGEMENTS

A dissertation does not come together without the assistance of a veritable army of willing (some more than others) and capable minds. Feeble as it may be, this is my attempt to acknowledge those individuals and groups whose input, ideas and examples created the framework for this work. With a four page limit, I could never hope to include everyone who should be here, but this is my best effort.

In particular, I would like to acknowledge my dissertation committee members. They have not only worked wonderfully on my behalf to make this a quality project, but worked seamlessly with each other and I am extremely grateful for their help and collaborative "tendencies". Specifically, I would like to thank my adviser, co-chair, mentor, friend and children's adopted godmother, Dr. Zofia K. Rybkowski for her tireless efforts on my behalf, for her interest in my family and in my success, for her unfailing belief in me and my potential and for her thirst for knowledge and truth in all aspects of life. I would like to thank Dr. James C. Smith for allowing me to take advantage of our shared name as needed and for exemplifying what it means to be an Aggie. Also I would like to thank Dr. Mardelle M. Shepley and Dr. Mindy Bergman for generously sharing their experience and knowledge and for lending me their support and time in pursuit of this goal.

NOMENCLATURE

AGC   Associated General Contractors of America

AIA   American Institute of Architects

BIM   Building Information Modeling

CIAC   Construction Industry Advisory Council

CM   Construction Management

CMAR   Construction Management At Risk

CSP   Competitive Sealed Proposal

DB   Design-Build

DBB   Design-Bid-Build

DF   Degrees of Freedom

DMAIC   Define-Measure-Analyze-Improve-Control

DMADV   Define-Measure-Analyze-Design-Verify

DSR   Design Science Research

GC   General Contractor

GMP   Guaranteed Maximum Price

IAT   Implicit Association Test

IFOA   Integrated Form of Agreement

IPD   Integrated Project Delivery

IRB   Internal Review Board

LCI   Lean Construction Institute

LPS	Last Planner System®
NASFA	National Association of State Facilities Administrators
OAEC	Owner, Architecture, Engineering, and Contracting
PDCA	Plan-Do-Check-Act (Deming Cycle)
PPC	Percent Planned Complete
SD	Standard Deviation
SE	Standard Error
TQM	Total Quality Management

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Background of the Problem

Researchers have identified a variety of problems faced by Owner, Architect, Engineer, and Contractor (OAEC) industry participants. These problems range from skilled labor shortages and material defects to poor communication and systemic inefficiencies (Hinze 1993; Latham 1994; Lichtig 2006; Mitropoulos and Tatum 2000; Schwegler et al. 2001). This plethora of problems has contributed to an industry experiencing a comparatively low level of productivity across the board (Sabol 2007). Each of these problems contribute - in one way or another - to waste that inevitably finds its way into the final deliverable: the built environment.

Among the most prominent of these problems to the average owner or industry observer might be the lack of trust existing in, and between, the various project participants. Are OAEC participants inherently less trustworthy than members of other industries? Is trust a luxury that cannot be afforded in the high risk/high reward climate of the construction industry? Or do our current practices simply negate the need for trust?

In a review of the mission statements and core value statements of the 86 companies that make up the Construction Industry Advisory Committee (CIAC) for the Construction Science Department at Texas A&M University, I found that one of the most prominent themes was trust. Nearly 80% of the companies claimed to value trust or integrity as a

core value in their overall philosophies. This is evidence that at least at the executive level, a high level of trust between both internal and external customers is perceived to be an important part of construction companies' goals and objectives.

Interestingly, literature shows another potential indicator of how the industry views trust. In an earlier research project, I found that the preferred way to handle risk and uncertainty in a construction project is actually to focus on having good relationships with the parties involved (Smith et al. 2011). Specifically, the research project was designed to determine the best practices for dealing with price volatility in the residential construction industry. The results were interesting in that the number one best practice for dealing with the potential for price fluctuation was building and maintaining strong relationships. This "method" for dealing with uncertainty ranked higher than price adjustment (escalation) clauses or other types of contract language, bid time tables, and even timely buyout of materials upon contract procurement. This finding also supports the theory that industry practitioners see strong relationships and high levels of trust as being valuable and critical to their success.

While a scientific study measuring the levels of trust existing in and between OAEC industry participants is yet to be done, some indicators exist.   For example, the American Institute of Architects (AIA) has been creating and publishing contracts for use in the project delivery process for nearly a century and a half. According to their literature, AIA contract documents are the most widely used standard form documents in

the design and construction industry (AIA 2012a). The first contract published by the

AIA was in 1888 (AIA 2012b). It was called the *Uniform Contract*, was four pages long

and made up of 16 articles with no subsections. By 1911, an updated version of the

contract was made available. This time, the contract covered 29 pages and included 63

articles with various subsections. The most current version of the standard AIA contract

is the A201™-2007. The 2007 contract is 38 pages long with 15 articles, each of which

has an average of approximately 17 subsections. Additionally, this contract is now one

contract in what is termed a "family" of contracts produced by the AIA. They have

produced full sets of standard contract documents for the various different delivery

systems, further expanding the overall contract language associated with delivering a

construction project. The AIA website currently shows 11 available contract document

families (AIA 2013). This expansion of contract language is supported by the fact that

organizations such as ConsensusDocs are also getting involved. In a recent count,

ConsensusDocs claims over 100 different contracts available for purchase by

construction industry participants (ConsensusDocs 2013).

One possible explanation for this "contract creep" is that as industry participants have

had problems on projects, language has been added to new versions of the contracts in

an attempt to protect them from falling subject to the same problems again. Each of

these problems is then carried forward and current and future relationships are

effectively treated as the summation of all the unfortunate parts of previous

relationships. The result is expanding contract language and a reliance on contracts as opposed to relationships to protect participants from potential problems.

Additional evidence suggesting a low level of trust can be seen in litigation data. According to some researchers, the construction industry has a reputation for being systemically contentious, leaving participants prone to litigation (Arditi and Pulket 2005). According to Fulbright's 9th Annual Litigation Trends Survey Report, the number of engineering/construction companies spending $1 million or more annually in litigation increased to 71% of their sample of 392 participants. This same number was at 48% in 2011, and 33% in 2010 (Fulbright and Jaworski 2013). This increase is far outpacing inflation and indicates the increasing prevalence of litigation in the construction industry.

Extrapolating the data regarding the "contract creep" with the data regarding increasing litigation spending shows an interesting phenomenon. It would seem that as contracts have expanded, their ability to protect industry participants from litigation has not correspondingly increased. Figure 1 shows a simple curve representing this extrapolation, plotting and extending the data mentioned regarding length of AIA contracts and the increase litigation spending. We recognize that there could be other factors such as inflation or an increasingly litigious human nature at play in these numbers, so this data is only meant to serve as an indicator. Whatever the cause, it

seems apparent that more extensive contracts designed to protect the industry from

potential problems have *not* protected it from increased litigation costs.
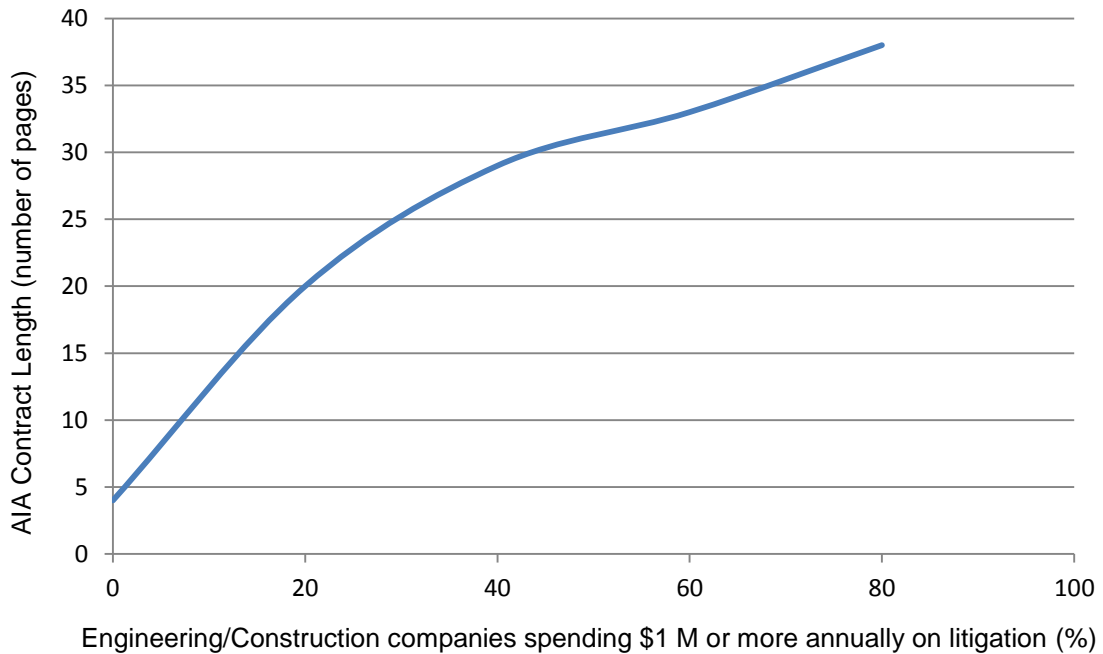
Figure 1: Comparison of Litigation Spending and AIA Contract Length
(Data extrapolated from AIA 2012b and Fulbright and Jaworski 2013)

There are undoubtedly exceptions to each of these examples. However, they are

symptoms of the problem in question. Anecdotally, perhaps the most powerful example

of the low level of trust in the construction industry can be demonstrated, and has been

demonstrated, by using a simple phrase on a job site. During the interview process for

the early stages of this research, participants needed to be informed about the topic and

objectives of the study. The overwhelmingly common response to the statement, "I am

studying trust in construction," was significant and suggestive. Upon hearing the topic, a majority of industry practitioners being interviewed would quite literally *laugh*.

In spite of apparent low levels of trust in the industry, and Luhmann's famous claim that the alternative to trust is "chaos and paralyzing fear" (Luhmann 1979), trust in construction has received comparatively little academic attention (Bresnen and Marshall 2000; Lazar 2000). In a field where a majority of the work is subcontracted out, and so much of our success depends on the collective efforts of players from different companies and backgrounds, there is a need for research devoted to improving collaboration and trust between construction project participants. This relative lack of deliberate and rigorous attention on the issue helps create the backdrop for the problem that exists.

Despite the previously mentioned existing perceptions of trust and a lack of focused research on the topic, various current industry trends are simultaneously converging on the need for improved collaborative capacities and trust-building techniques. The continuing evolution of the project delivery process towards increasingly collaborative models highlights the need for a better way to manage relationships and do business. In a white paper published in 2007, the AIA claimed that Integrated Project Delivery (IPD) is built on collaboration, which in turn, is built on trust (AIA 2007). Globalized work processes, increased building complexity, and heightened demand for sustainability are also pushing industry participants to find new and better ways to interact and rely on

each other. Additionally, new tools and technology such as Building Information

Modeling (BIM) are increasing the need for improved collaboration and teamwork skills

in order to effectively capitalize on their capabilities. In essence, it appears that the

ability to establish and maintain trust will play in increasingly important role in

industry's ability to effectively take advantage of the benefits offered by these

developing technologies and practices.

1.2 Problem Statement

The overall problem existing in the construction industry on which this research will

focus is ultimately a result of the three items mentioned above: (1) the low-trust

environment, generally speaking, in the construction industry; (2) research on the topic

is minimal; and (3) industry trends are necessitating an ability to create effective teams

built on collaboration and trust in order to capitalize on their efficiencies. Trust is an

aspect of the built environment that regularly makes it into mission statements, company

recruiting materials, and new employee training programs, but rarely makes it beyond to

the point of active management on the job site.

PROBLEM: Research suggests that the ability to establish, build and maintain trust is

necessary for success in the current construction industry (Egan 1998; Latham 1994;

Swan 2002), but we do not have tools to help us manage it, improve it, or make it a

conscious priority.

1.3 Purpose of the Research

The purpose of this research is to develop and test a tool that builds interpersonal trust within the construction industry. The tool is meant to help participants recognize the value of establishing, building, and maintaining high-trust relationships, *and* to help them accomplish this task in a systematic way. Although the scope of this project is limited to the trust between construction project delivery participants, it is expected that the applicability of the tool may expand into other relationships and industries.

1.4 Significance of the Research

Trust management on the construction job site can be accomplished by utilizing a tool specifically designed to encourage and assist in building and maintaining trust on the job. Despite drawing heavily on the literature for the necessary constructs, the tool itself introduces a new, forward thinking, deliberate, and pro-active approach to trust on the job that may be highly significant to interested practitioners.

From a more conceptual point of view, the significance of this research can be analyzed on two social levels. We adopt the view that trust, at its most fundamental level, is an "inherently individual-level phenomenon" (McEvily and Tortoriello 2011, pg. 26), therefore the process of building trust will take place one individual at a time. This approach is categorized as a form of micro social work (Hepworth et al. 2012). An improved understanding of the nature of trust will allow participants to deliberately and proactively establish, build, maintain, or even rebuild trust in relationships that are

8

important to them. From a more macro social perspective, we expect that as

interpersonal trust increases within the industry, inter-organizational trust between

participating companies, and ultimately the general public's trust in the industry will also

increase.

It is worth noting that this is not a massive marketing effort aimed at changing the

public's perception, or a motivational speech to encourage industry participants to trust

everyone and see the good in people, although both of these results could be side effects.

This is more of a grass-roots effort to encourage those industry participants who value

trust to improve their abilities to build and maintain it.

Additionally, an increase in the body of knowledge pertaining to trust in construction

allows for additional research, also supporting improved effectiveness in the industry.

This work makes a theoretical contribution to the field by providing an updated trust-

building model that incorporates facets of previous models and adds the directional

impact on the relationship resulting from participant behaviors.

1.5 Research Objectives

The objectives of this research fall into two general categories: prescription-driven and

description-driven. The prescription-driven objective aims to prescribe a new reality by

developing and introducing a new tool. The description-driven objectives aim to

describe the current state of reality, or what currently *is*. The objectives have been

divided into these two categories.

1.5.1 Prescription-Driven Objective

Develop a tool for systematizing trust-building methods allowing industry participants to

formalize their efforts to establish, build, maintain and/or rebuild trust.

1.5.2 Description-Driven Objectives

1. Describe current perceptions of trust in the construction industry.

2. Conduct a review on extant literature on the nature of trust, both specific to the

   construction industry and from other fields (e.g., social sciences, behavioral

   sciences, etc.).

3. Determine existing methods for building and rebuilding trust.

4. Determine whether or not individuals can be effectively coached to build trust

   through assignment of trust-building behaviors, and whether or not that trust is

   reciprocated by the counterpart.

5. Collect data on the effectiveness of the tool throughout development and iterate

   to improve validity, usability, and effectiveness.

The prescription-driven objective is the primary objective of this research. The purpose,

as mentioned above, is to develop and test a tool that is capable of improving trust levels

within the industry. Much like a doctor prescribing medicine to change a patient's

current state to an improved future state, the emphasis in this research is to change an

industry participant's current state to an improved future state. The description-driven

objectives will be used to assist in the creation, evaluation and improvement of the tool

until it is capable of meeting the overall purpose of this research.

2. LITERATURE REVIEW

2.1 The Nature of Trust

Trust has been the focus of substantial academic attention in a variety of fields. Psychology, sociology, organizational behavior, economics, and business management all boast substantial bodies of knowledge on the issue of trust. However, the width and breadth of academic literature on the topic is dwarfed when compared to the variety of individual conceptualizations existing in the world on the topic. Stack (1978) observed that:

> "A major problem in the study of trust has been that although all words carry multiple meanings to various listeners, abstract words such as trust have even more associative meanings that most. *Confidence, reliance,* and *faith* are often used interchangeably with the word *trust*; each of these words is also fraught with abstract associations." (Stack 1978, pg. 564, italics in original)

This abstraction and the deeply subjective nature of the topic can make it difficult to communicate on an issue like trust. In order to have an intelligent discussion, a benchmark understanding of the nature of trust along with its definition must be determined. This benchmark understanding will be of paramount importance in creating a tool capable of assisting a variety of individuals with a variety of backgrounds to establish, build, sustain and/or rebuild trust more effectively.

I have settled on a definition of trust from which to approach the subject that is generally agreeable in the literature. Conveniently, academicians have been converging on a definition that appears to include the key principles of trust from their various fields.

For this research, I will use the following definition which has been increasingly adopted by organizational researchers, and was originally proposed by Rousseau et al. (1998):

> "Trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviors of another." (Rousseau et al. 1998, pg. 395)

In McEvily and Tortoriello's (2011) literature review on trust, they note that this definition along with the related conceptualization upon which it is based by Mayer et al. (1995) has been cited nearly 2000 times in organizational literature. According to McEvily and Tortoriello (2011), researchers have focused on two key elements of this definition; (1) the willingness to be vulnerable, and (2) the expectation of favorable treatment by the other party (e.g., Ferrin et al. 2008). Additional analysis of this definition is included in Section 4.2.1 of this document. Using this definition as a foundation, additional characteristics discovered by researchers can be explored to assist in understanding the nature of trust.

As mentioned in the introduction, this research adopts the view that trust is an inherently individual-level phenomenon. This implies that while the *object* of trust may be organizations or groups, the *source* of trust is ultimately the individual (Zaheer et al. 1998). Other potential perspectives on this topic include the theory that trust can be measured and analyzed across varying organizational levels (Figure 2). Currall and Inkpen (2002) explored the dynamics of intergroup and interfirm (i.e., inter-organizational) trust, in addition to interpersonal trust. Currall and Inkpen defined interpersonal trust as the extent of an individual's trust in her counterpart. Interfirm and

intergroup trust are comparable to what other literature defines as inter-organizational

trust, and can be defined as the extent of trust placed in a partner organization by the

members of another organization (Zaheer et al. 1998).
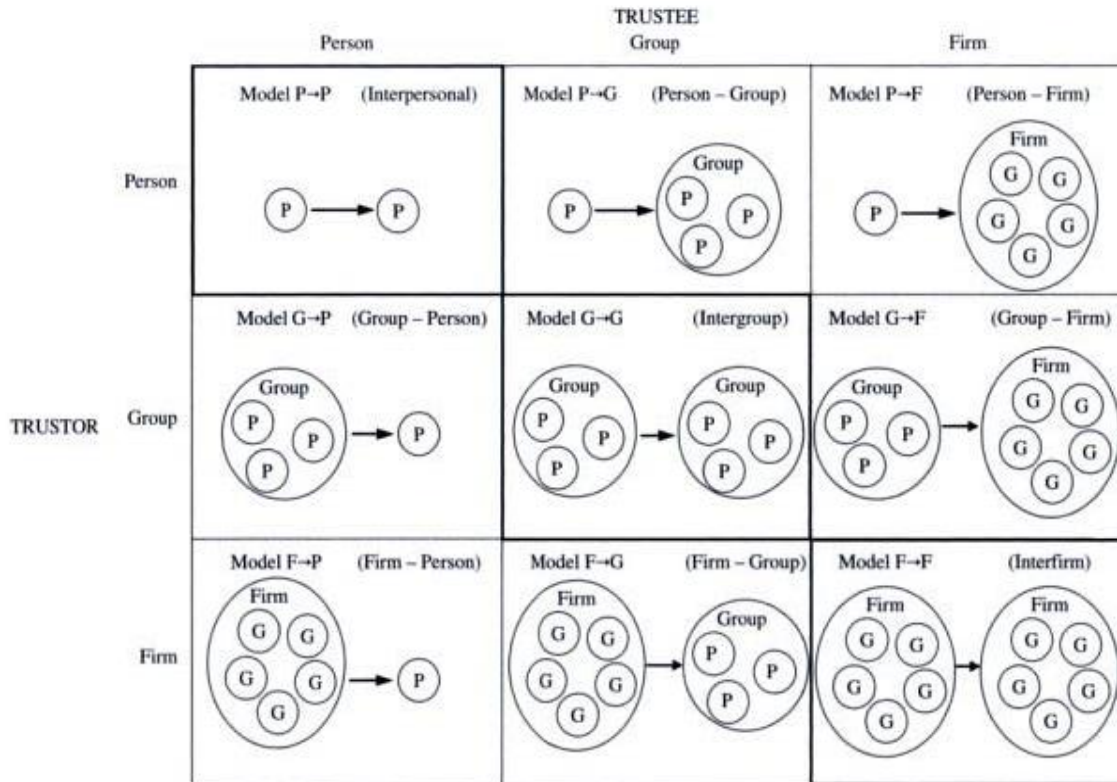
Figure 2: A Multilevel Perspective on Trust
(Currall and Inkpen 2002)

While it may be useful in some respects to analyze trust at these organizational levels, I

argue that while the dynamic nature of trust is amplified by the various personal

interactions involved in intergroup or interfirm relationships, decisions are ultimately

made based on an accumulation and prioritization of the various individual trust levels

14

that are involved. If you back out of the interfirm and intergroup models in Figure 2,

you are ultimately left with the individual trust levels from which they consist.

Additionally, research suggests that the more an individual trusts the representative

(interpersonal trust) for an organization with whom she is dealing, the more inter-

organizational trust exists (Zaheer et al. 1998). This would indicate that at the core of

inter-organizational trust is the network of interpersonal trust relationships between the

individuals included in the organization.

This research is designed to build trust one individual relationship at a time, and

therefore its focus will be on interpersonal trust. An underlying assumption is that an

improvement in interpersonal trust levels will consequently result in overall higher levels

of inter-organizational trust.

2.1.1 Characteristics of Trust

Discussions on trust generally touch on many other inter-related topics. Antecedents to

trust, typical behaviors when trust exists, and the effects of trust are examples of topics

that emerged with research participants during the exploratory phases of this project. In

the analysis of these topics, researchers have discovered likely characteristics of trust.

One of the key questions surrounding research in trust regards its value. In other words,

is trust valuable? Ultimately, each individual will make this decision for herself based

on various life experiences that have affected her attitude towards trust. However, academic literature shows support on both sides of this equation.

Researchers in the social and behavioral sciences have shown that trust can positively affect group performance. Zaheer et al. (1998) found that "firms in exchange relationships may derive competitive advantage from relationships imbued with high levels of inter-organizational trust" (pg. 155). In organizational economics literature, Bromiley and Cummings (1995) theorized that trust was capable of improving project governance by reducing opportunistic behaviour and therefore transaction costs that might otherwise occur in an exchange. Dirks (1999) found trust to have a positive influence, albeit indirect, on group performance. Krishnan et al. (2006) found that firms can benefit from an increased focus on trust when "behavioural uncertainty" is present by allowing for the benefit of the doubt during interactions that could be interpreted in multiple ways. Trust has been recognized as the cornerstone of strategic partnering (Spekman 1988), and a lack of trust was found to be the single biggest stumbling block to the success of alliances (Sherman 1992). Additional advantages include improved flexibility and responsiveness, decreased negotiation costs, and decreased monitoring costs (Barney and Hansen 2006; Egan 1998; Khalfan et al. 2007; Latham 1994). Beyond the impact of trust on performance, research also indicates that a high level of trust is morally desirable because of its positive impact on self-esteem and an individual's sense of security (Baier 1994).

On the other side of this argument, research has also shown that trust can potentially

have negative results as well. Becker (1996) states that "saintly trust," or what Solomon

and Flores (2003) call "blind trust," can actually encourage abusive behavior resulting in

a negative impact on performance. McDermott et al. (1998) detail specific instances in

Indonesia where high levels of trust among a certain network actually prevented the

creation of new business and growth.   Barnes (1981) found that high levels of trust can

also result in excessive reliance on relationships rather than on available hard data.   This

can result in inadequately vetted decisions and suboptimal results. From a business

perspective, it could be argued that high levels of trust might unwittingly discourage

appropriate due diligence in transactions.

Table 1 provides a collection of 15 other characteristics of trust according to the

literature that can be applied to construction. This list was not meant to be exhaustive,

but was designed to expand the common ground from which to move forward into future

research on trust in construction. The items in this table might also provide some

direction for how individuals and the organizations they are a part of can start focusing

on the role of trust.

Table 1: Fifteen Characteristics of Trust Relevant to Construction
(Smith and Rybkowski 2012)

	Description	Reference	Discussion
1	Trust is a social necessity	(Rotter 1967) (Lewis and Weigert 1985) (Fukuyama 1996)	"One of the most salient factors in the effectiveness of our present complex social organization is the willingness of one or more individuals in a social unit to trust others. The efficiency, adjustment, and even survival of any social group depend upon the presence or absence of such trust." (Rotter 1967, pg. 651)
2	Too much trust can be as bad as too little trust	(Wicks et al. 1999) (Jeffries and Reed 2000) (Elangovan and Shapiro 1998) (March and Simon 1958)	"Optimal trust" exists when we create and maintain cautious relationships influenced by a willingness to trust. Trust is not a panacea, and excessive trust can lead to negative outcomes. For example high levels of trust can lead to a desire to resolve issues quickly, accepting the first viable solution instead of searching for the best answer.
3	Trust involves risk	(McEvily and Tortoriello 2011) (Rotter 1967)	Most definitions of trust include an acceptance of risk by the Trustor related to the performance of the Trustee. Trust is only truly necessary when risk is present. It is argued that to trust is a risk, but not to trust is also a risk.
4	Willingness to risk is NOT equal to willingness to trust	(Bohnet and Zeckhauser 2004) (Ashraf et al. 2003)	"It is fundamentally different to rely on another person (trust) than to rely on a random device that offers the same potential outcomes. This is because people are averse to being betrayed." (Bohnet and Zeckhauser 2004, pg. 470)
5	Trust and distrust are different	(Lewicki et al. 1998; McKnight and Chervany 2001)	Trust and distrust are two separate constructs that operate simultaneously. Additionally, low trust is seen as being different than distrust.
6	Trust is dynamic	(Lewicki et al. 1998)	Decisions on whether to trust or not are continuously revised based on the most recent interactions and the latest information.
7	Trusting someone can lead to trustworthy behaviour	(Baier 1994) (Merton 1948)	Trusting, or distrusting, can be a self-fulfilling prophecy. People will often act the way that they perceive they are being treated.

Table 1 Continued

	Description	Reference	Discussion
8	Trust can be impacted by systems	(Heide and Miner 1992)	Systems, structures and processes create a context within which trust can develop or decrease.
9	Trust contributes to economic growth	(Zak and Knack 2001) (Misztal 1996) (Fukuyama 1996)	Trust is considered to be a basis for social solidarity and integral to the creation of prosperity.
10	There are different kinds of trust	(Jeffries and Reed 2000) (Zaheer et al. 1998)	Interpersonal vs. inter-organizational trust (i.e., trust between individuals vs. trust between organizations); Cognitive trust vs. affect-based trust (i.e., trust based on competency vs. trust based on emotional attachment); Relational vs. dispositional trust (i.e., trust pertaining specifically to the counterpart in a dyad vs. an individual trait reflecting expectancies about the trustworthiness of others in general)
11	Trust is domain specific	(Lewicki et al. 1998)	Trust is tied to both people and circumstances. We might trust someone in some situations but not in others.
12	Trust can be measured	(McEvily and Tortoriello 2011)	A number of trust measurement tools exist that have been replicated and statistically verified for internal consistency and reliability.
13	Morality hinges on trust	(Nowak and Sigmund 2000)	Trust and reciprocity are "the basis of all human systems of morality". This implies that when we replace trust with alternatives, our morality is weakened.
14	Trust-building is a competency	(Covey and Merrill 2006)	Trust is something that we can work on and improve. We can do things to build trust just as we can do things to damage it. Recognizing and understanding the things we can do to build trust will allow us to get better at it.
15	Contractor as trust initiator	(Wong et al. 2005)	"If trusting moves are initiated by the contractor, there is a good chance that reciprocal trusting moves from the client will be returned." (Wong et al. 2005, pg. 1052)

NOTE: As trust's impact on performance was mentioned in some detail previously, it has been left off of this list.

Researchers have applied and analyzed a few of the characteristics listed in Table 1

directly to the construction industry (particularly items 3, 6, 8, 10, and 15). Despite this,

there is still opportunity for further development in all 15 areas. Specifically, the

construction industry stands to benefit greatly from additional research on items 2, 4, 7,

8, 13, and 14. This particular project can relate to items 6, 7, 8, 12, 14, and 15. The next

section will further detail existing research regarding item 14 as it is of particular interest

and relevance to this research project.

2.1.1.1 Trust-Building is a Competency

Different upbringings, cultures, family situations, and overall experiences affect an

individual's tendency to trust (i.e., dispositional trust) (Fukuyama 1996; Goto 1996).

However, there seems to be general agreement that mutually positive exchanges and

good communication can increase trust between two individuals (Khalfan et al. 2007).

This implies that if one can improve his ability to communicate, and focus on creating

mutually positive exchanges in his relationships, he should be able to correspondingly

improve his ability to establish, build, sustain, and/or rebuild trust.

In their book, *The Speed of Trust,* Covey and Merrill (2006) claim that the first job of a

leader is to inspire trust. In the conclusion of their book, Solomon and Flores (2003)

include the following statement:

> "Trust is not simply a matter of social or institutional constraints and
> sanctions. It is not a matter of cultural 'atmosphere.' And it is not merely
> a matter of individual psychology ('character') or, more generally, of

human nature. It is, and must be made to be, a matter of conscientious choice." (Solomon and Flores 2003, pg. 153)

Solomon and Flores are suggesting that people who inspire trust make conscientious choices and deliberate actions to build trust in their relationships. Some people seem to be very skilled at building and maintaining trust. This ability is a competency that can be learned, practiced, and improved upon.

2.2 Trust Measurement

Due to the individual nature of trust, measurability and data validity are common concerns. It is generally agreed that interpersonal trust levels are determined by a combination of three factors: (1) interactions (interpersonal); (2) disposition of the Trustor; and (3) institution (trust in the situation or relevant systems) (McKnight and Chervany 2000). This research will focus most specifically on the interaction factor, although the impact of both dispositional and institutional trust must be considered in order to gain as accurate an assessment as possible.

Despite admitted difficulties, a variety of instruments designed to measure trust have been created and rigorously tested over the years. The success of these various tests suggests that adequate scientific measurement of trust *is* possible. Early trust measurement efforts were primarily directed at social psychology, emphasizing personal relationships (e.g., marriage partners and families). A review of these efforts conducted by Wrightsman (1991) includes careful evaluations of the tools utilized.

More recently, McEvily and Tortoriello (2011) conducted a review of over 171 papers

published over the course of 48 years relating to trust and trust measurement. They

found 129 different measures of trust, five of which were ultimately recommended for

use in upcoming trust research. These five measures were selected and suggested for use

in future research based on dimensionality (i.e., uni-dimensional vs. multi-dimensional),

item development process (i.e., literature review, theoretical derivation, etc.), sample(s)

utilized, reliability of the tool (e.g., Cronbach's Alpha), and validity of the resultant data.

The five selected measures are included below as references:

1. Managerial Interpersonal Trust (McAllister 1995)

2. Boundary Role Persons' Trust (Currall and Judge 1995)

3. Organizational Trust Inventory (Bromiley and Cummings 1995)

4. Organizational Trust (Mayer et al. 1995)

5. Behavioral Trust Inventory (Gillespie 2003)

2.3 Building Trust

Understanding that trust can be effectively measured allows exploration into the

possibility of experimenting on building trust. The effects of certain interactions could

conceivably be measurable as snapshots of trust indices for specific relationships.

The stage and nature of a particular relationship will determine the appropriate approach

to managing trust. The extant level of trust will determine what level of risk the Trustor

is willing to accept in relation to the Trustee. As trust is built and relationships

strengthen, higher levels of trust may translate into the ability to take on higher risk

interaction or projects. The ability to consider these interactions or projects will likely

provide previously unavailable opportunities to both the Trustor and the Trustee and

could be viewed as a competitive advantage for the pair (Vangen and Huxham 2003).

At the inception of a relationship, an individual's dispositional trust, his or her

perception of a potential partner's reputation, and the situation or system within which

they will interact set the groundwork for an interaction (Ring 1997). Every interaction

following the inception of the relationship will then be evaluated and stored in what

Steven R. Covey called each party's "emotional bank account" (Covey 1991). Each

interaction acts as a "moment of trust" (Chow et al. 2012, pg. 2) between the two parties,

either depositing or withdrawing from the "emotional bank account." As with any bank

account, in order to build equity or trust, the frequency and magnitude of deposits must

be greater than that of the withdrawals.

This concept was captured by Currall and Epstein and described visually in Figure 3

(Currall and Epstein 2003).
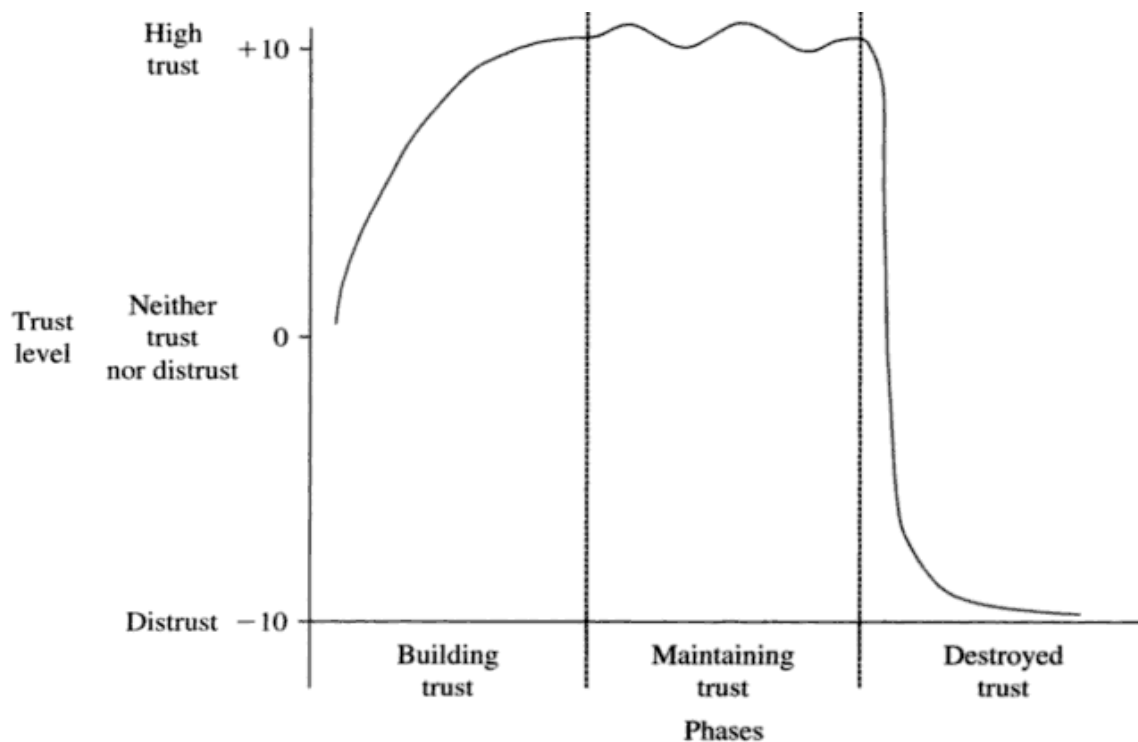
Figure 3: Evolutionary Phases of Trust
(Currall and Epstein 2003)

Interestingly, the level of trust is never a flat line in any of the three phases shown in the figure. This suggests that trust is either being built or it is being eroded, but never static. Extended engagement involving risk with a Trustee where trust is not being eroded will effectively build trust, even if it is not actively recognized. This is the result of recognizing shared values and views which may take place after extended interactions, and enhanced confidence in the behaviors of the other person. The internalization and mutual acceptance of these values and views, along with increased confidence effectively increases trust and reduces the relative level of risk existing in continued interaction (Chow et al. 2012).

The logical question then becomes, *how* do you build/maintain/destroy trust? A number

of trust-building models exist in the literature. Most models contain similar components

but the structures vary. In order to highlight key differences, we will briefly review

three models. The first model (Figure 4) was created by McKnight and Chervany
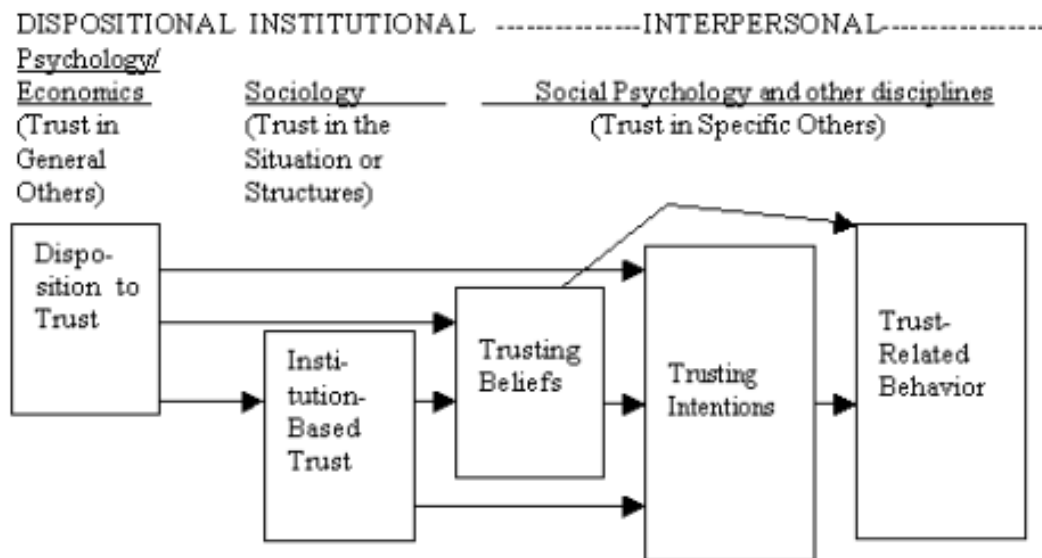
(2001).

Figure 4: Interdisciplinary Model of Trust Constructs
(McKnight and Chervany 2001)

The McKnight and Chervany (2001) model describes how a trusting behavior is the

result of the dynamic interaction between a Trustor's dispositional trust, institutional

trust, and the individual's trusting beliefs and intentions regarding the other person.

Mayer et al. (1995) published their model (Figure 5) which introduces a few other

constructs and an additional, critical relationship to the process.
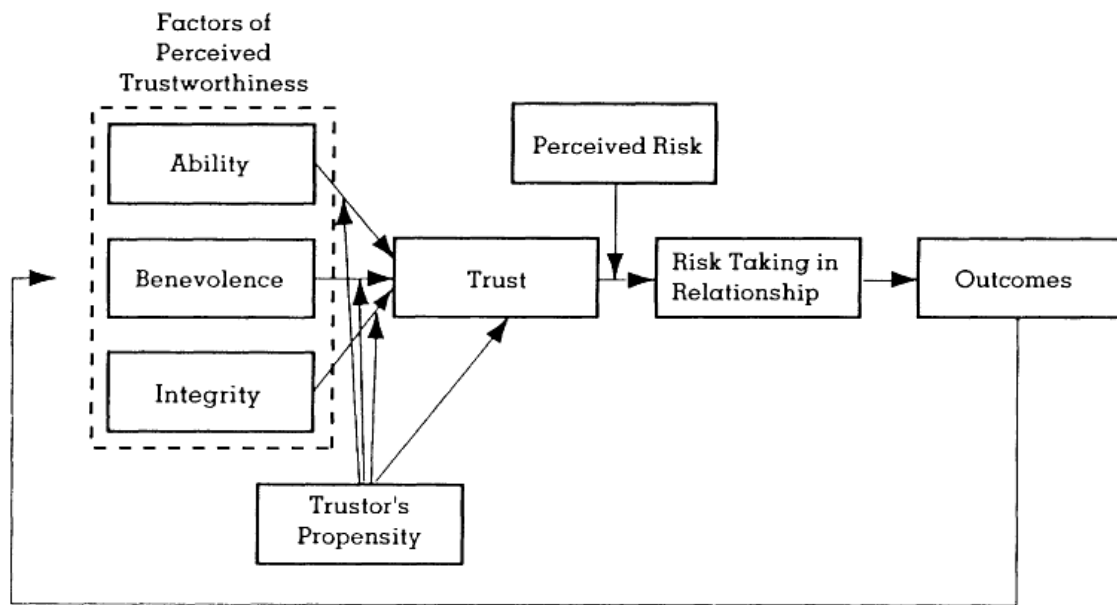
Figure 5: Model of Trust
(Mayer et al. 1995)

This model excludes the impact of institutional trust on the outcome, instead breaking

out the trusting beliefs into specific "Factors of Perceived Trustworthiness."

Dispositional trust is represented as the "Trustor's Propensity," and risk is explicitly

introduced in this model.   The relationship that this model introduces is the arrow

connecting outcomes to the beginning of the model again. This iterative relationship is a

key component of this model of trust.

In describing their model, Mayer et al. (1995) suggested that trust is built over time

based on a series of observations and interactions. This process can be further described

as a cycle. Additional support for a cyclical theory on trust-building was compiled by

Vangen and Huxham (2003). This theory describes trust-building as a loop (Figure 6),

similar to that described by Mayer et al.'s model. The author writes that "each time an

outcome meets expectations, trusting attitudes are reinforced. The outcome becomes

part of the history of the relationship, increasing the chances that partners will develop

positive expectations about joint actions in the future. The increased trust reduces the

sense of risk for these future actions," (Vangen and Huxham 2003, pg. 11).
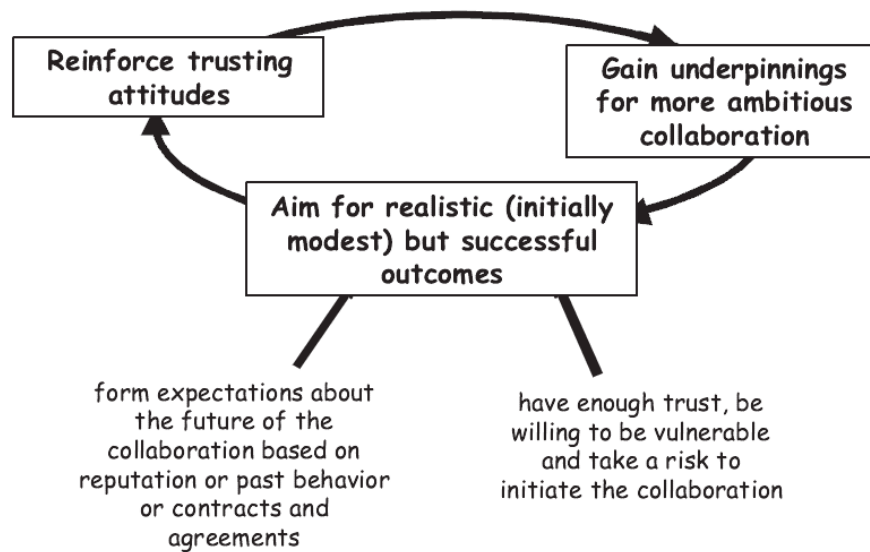
Figure 6: The Cyclical Trust-Building Loop
(Vangen and Huxham 2003)

The cyclical nature of trust in relationships as described in both Mayer et al. (1995) and

Vangen and Huxham's (2003) models is a key theoretical component of this research.

The cyclical nature of trust can be compared to the phenomenon of vicious and virtuous

circles. Virtuous circles occur when mutually causal processes or relationships result in

increasing returns (Masuch 1985). Previous research has also associated the trust cycle

with vicious circles (Luhmann 2000; Sako 1998; Spicer and Pyle 2002). Vicious circles

occur when mutually causal relationships or processes "amplify an insignificant or accidental initial kick, build up deviation and diverge from the initial condition" (Maruyama 1963, pg. 164). Garud and Kumaraswamy (2005) provided additional insight when they described it as a condition where "mutually causal processes feed back into one another to lock a system into a mode of operating that yields progressively negative outcomes" (pg. 10). Vicious circles have been identified in numerous areas such as poverty (Mosley and Verschoor 2005), infections and disease (Wilson and Byrom 1941), spousal abuse (Russo 2002), and even tourism development (MacLeod and Cadieux 1980).

2.3.1.1 Trust and Distrust: Self-Fulfilling Prophecy

Both vicious and virtuous circles, as they relate to trust, are forms of self-fulfilling prophecies. Expanding on what was known at the time as the Thomas Theorem, which stated, "If men define situations as real, they are real in their consequence," Merton (1948) devised the theory of self-fulfilling prophecies. To further clarify the concept, a section of Merton's work is worth including here:

> "The self-fulfilling prophecy is, in the beginning, a *false* definition of the situation evoking a new behavior which makes the originally false conception come *true*. The specious validity of the self-fulfilling prophecy perpetuates a reign of error. For the prophet will cite the actual course of events as proof that he was right from the very beginning." (Merton 1948, pg. 195, italics in original)

This concept has been applied to distrust in the literature. Research has shown that "when one person distrusts another, that person will interpret ambiguous conflict behaviors as sinister in intent and convey distrust through his or her conduct. The

28

person whose behavior is interpreted as sinister, perceiving that he or she is distrusted, tends to reciprocate that distrust" (Simons and Peterson 2000, pg. 4). Distrust breeds untrustworthy behaviors, resulting in a vicious cycle (Boon and Holmes 1991; Creed et al. 1996; Zand 1972). On the other hand, research in organizational behavior also shows that when trust is extended, trustworthy behaviors can result. This falls under a phenomenon known as the Pygmalion Effect (Eden 1993; Rosenthal and Jacobson 1968).

We see from the review of this literature that trust and distrust are not only cyclical in nature, tending towards virtuous or vicious circles, but that approaching a relationship as one or the other can encourage the expected behavior. This is another key point that must be understood in order to proactively approach the issue of building trust.

2.3.2 Methods for Building Trust

Literature on building trust is predominantly theoretical and utilizes case studies as support (Chow et al. 2012; Covey 2009; Khalfan et al. 2007; Morgan and Hunt 1994; Solomon and Flores 2003; Vangen and Huxham 2003). However, extensive work has been conducted experimenting on building trust in the on-line marketplace. A few interesting examples of trust-building methods from this literature include:

1. Feedback mechanisms
2. Third party escrow services

3. Credit card guarantees

(Pavlou and Gefen 2004)

Table 2 contains a review of general trust-building methods, or "trust deposits" to continue the account analogy, from the literature. The methods are listed under the blanket concepts taken from Wong et al. (2008), described as trust types that exist in construction contracting. Parkhe (1999) described similar categories and labeled them as mechanisms through which trust is generated. Each of these mechanisms or types is considered to be within the manager's control. "Cognition-based" trust production results from past interactions, or expectations of future interactions. This can include experiences in the past that create an impression of reliability and consistency. One's reputation contributes to this mechanism. This has also been called "process-based" trust. "Characteristic-based" trust production comes from having similar attributes as one's counterpart; societal or cultural similarities can create familiarity with a counterpart's way of thinking. This is also called value congruence and can lead to "emotional bonds" resulting in trust (Lewis and Weigert 1985; McAllister 1995). This has also been called "affect-based" trust. Parkhe includes a third mechanism, "institutional-based" trust production which stems from formal mechanisms. These formal mechanisms create a structure that provides built-in incentives for cooperative, trustworthy behaviors. However, it is not included as a category in Table 2 because this type of mechanism is likely a functional substitute for trust (Granovetter 1985; Husted 1989).

Table 2: Trust-Building Methods

	Trust-Building Methods	Reference
Process-Based		
1	Make a commitment to the counterpart in the relationship, even a small one, and complete the task - REPEAT	(Covey and Link 2012; Morgan and Hunt 1994)
2	Install formal and informal channels of communication that can improve behavior transparency (e.g., give multiple ways to contact a partner, including personal contact information)	(Parkhe 1999)
3	Have a discussion about future projects and how the relationship with a counterpart could continue to be beneficial	(Morgan and Hunt 1994)
4	Play fair with the other side and be nice	(Axelrod 2006)
5	Maintain the team throughout the project at all costs	(Vangen and Huxham 2003)
6	Proactively bring issues to a partner's attention, especially if they are one's own fault	(Parkhe 1999)
7	Focus on communication - touch bases when it is not expected or required	(Leifer and Mills 1996)
8	Make adaptations to better support the partnership and then talk with a counterpart about it	(Das and Teng 1998)
9	Share credit when accomplishments are made, especially if you deserve the credit - don't claim credit for successes	(Vangen and Huxham 2003)
10	Share the workload fairly – talk about it	(Vangen and Huxham 2003)
11	Hold a meeting to clarify expectations and potential difficulties	(Gulati 1998; Covey and Merrill 2006)
12	Respectfully discuss any barriers to trust one recognizes in a relationship, emphasizing that the relationship is valued	(Covey and Merrill 2006)
13	If one makes a mistake, he should right the wrongs	(Covey and Merrill 2006)
14	Practice accountability – set the expectations first and then follow-up, or have the counterpart follow-up to ensure completion	(Covey and Merrill 2006)
15	Demonstrate concern for the partner's situation	(Wong et al. 2000)
16	Ask the counterpart to help resolve a problem that is currently being worked on	(Khalfan et al. 2007)
17	Recognize and reward the counterpart's trusting behavior	(Khalfan et al. 2007)
18	Review the contract with the counterpart for fairness, specifically match benefits to required efforts	(Khalfan et al. 2007; Wood and McDermott 1999)
Characteristic-Based		
1	Take time to understand the partner's societal, corporate, or family culture	(Parkhe 1999; Sarkar et al. 1998)

Table 2 Continued

	Trust-Building Methods	Reference
2	Take time to understand the partner's interests and goals, both professional and personal	(Parkhe 1999)
3	"Caucus retreat" – set aside a time to interact outside of regular business hours	(Chow et al. 2012)

The majority of the trust-building methods listed fall under the "process-based" mechanism, but it is possible to actively manage each of the categories, including "institutional-based" mechanisms. Each of these items would be examples of deposits, along with the broader terms found in literature such as benevolence (concern), technical competency (results), commitment to being trustworthy (integrity), and/or a track record of trustworthiness (Mayer et al. 1995). Likewise, some examples of withdrawals include failure to keep commitments, secrecy, opportunistic behavior, unfair treatment of the other party, and perhaps most damaging of all, betrayal (Bohnet and Zeckhauser 2004; Elangovan and Shapiro 1998).

2.4 Trust in Construction

As an industry that makes or breaks companies based on their reputations, trust is a concept that generates a considerable amount of "executive air time" in construction. Many corporate mission statements and core value descriptions include reference to the values of trust and integrity. However, despite this higher level emphasis on the subject, on-site management of the concept is virtually nonexistent. On the contrary, research has shown that exchanges between parties in construction are more likely to be based on

fear and/or power than on trust (Egan 1998; Latham 1994; Pretty and Ward 2001).

Others claim that the construction industry actually has a stronger preference for distrust

than the full benefits of cooperation (Wood and McDermott 1999). Opportunism by

team players is readily available in most construction projects and generally comes at the

expense of the other players or the project as a whole (John 1984). Conversely, research

has also identified trust as one of the most effective ways to prevent opportunism

(Walker 2003). The research of Egan (1998), Latham (1994), and Swan (2002) each

supported the idea that trust is critical to the success or failure of construction projects.

The Construction Industry Institute (CII) conducted a study that showed statistical

support from data on 262 projects for the notion that relational trust and project cost are

negatively correlated (CII 1993).

Khalfan et al. presented supply chain participants' perspectives on building trust in

construction (Khalfan et al. 2007). Through case studies, the authors showed that issues

relating to trust (e.g., importance of, barriers to, key positive and negative contributing

factors) for OAEC participants were consistent with similar research done in other

industries. However, other research has also suggested that the creation of trust in the

construction industry differs from other industries because of continuously changing

project structure and conditions, project complexity, and shortened periods of

collaboration (Rosenfeld et al. 1991). This suggests that construction can benefit from

trust-building methodologies and tools designed to meet the industry's specific needs.

2.4.1 Partnering

A solid portion of the available research on trust in construction centers on the practice of "partnering". The 1990's and early 21st century saw many construction firms adopting partnering in an effort to take advantage of the benefits described by early adopters. As with most initial efforts, both successes and failures in partnering have since been documented (Bresnen and Marshall 2000; Howlett 2002). A number of publications were devoted to gaining a better understanding of trust in the context of construction partnering (Black et al. 2000; Harback et al. 1994; Shek-Pui Wong and Cheung 2004; Wong et al. 2008). One study claimed that the most critical factor for success in construction partnering was the development of trust (Larson and Drexler 1997). Partnering is an example of how project delivery methods have and continue to evolve to account for advances in our understanding of trust and its impact on the construction process.

2.4.2 Current Industry Trends

Design software leader, Autodesk Inc., published a whitepaper in 2008 suggesting that a "convergence of forces" is moving the OAEC industry in the direction of integration and collaboration (Autodesk 2008). This appears to be an attempt to correct for an extended period of emphasis on specialization and separation of roles between architects, engineers, and contractors. These lines of demarcation between a project's "team players" have been reinforced by traditional delivery methods and cemented in place by a fear of liability, prompted by our increasingly litigious society. This emphasis on roles

may create clear silos of responsibility, but it hurts our ability to collaborate and to trust.

Literature suggests that in order to stay competitive, project players will no longer be

able to operate as isolated, and often competing, entities. McKinsey & Co. strategists

stated that, "For most global businesses, the days of flat-out, predatory competition are

over… In place of predation, many multinational companies are learning that they must

collaborate to compete," (Bleeke and Ernst 1993, pg. 1). Successful collaboration

requires a high level of trust (Hattori and Lapidus 2004). Companies are learning to step

outside of their comfort zones in an effort to take advantage of the efficiencies available

to those organizations able to collaborate and sustain high levels of trust.

The list of industry trends included in Table 3 combines information from a white paper

published by Autodesk (2008) and a seminal paper jointly sponsored by five

organizations within the OAEC industry in 2010. This publication was a joint effort by

the National Association of State Facilities Administrators (NASFA), the Construction

Owners Association of America (COAA), the APPA: The Association of Higher

Education Facilities Officers, the Associated General Contractors of America (AGC),

and the AIA (NASFA 2010). According to these two publications, the industry trends in

Table 3 are challenging existing project delivery practices and driving change. Each of

these five trends is impacted by trust. A brief description of this relationship is also

included.

Table 3: How Trust Relates to Current Construction Industry Trends
(Trends adapted from Autodesk 2008 and NASFA 2010)

	Industry Trend	Relationship to Trust
1	Globalized work processes	Globalization of the building product supply chain and a trend towards outsourcing have increased potential competition, complicated cost predictions, and made demand for building materials more unpredictable. Local companies are facing increasing amounts of risk as complexities multiply and become harder to manage. Also, the introduction of additional relationships, especially multi-cultural ones, necessitates new competencies in collaborative processes. A multi-cultural workforce is less able to rely on individual similarity and a common background as a basis for trust (Berscheid and Hatfield 1969). The success of these relationships relies heavily on the parties' abilities to create and build trust across new boundaries. Successful companies will be able to sustain trust in the global arena.
2	Need for increased productivity	As profit margins tighten and value demands from owners increase simultaneously, every opportunity to decrease waste must be considered. Higher levels of trust can reduce costly and wasteful practices such as redundancy, excessive bureaucracy, employee turnover, and office politics (Covey and Merrill 2006).
3	Demand for sustainability	Sustainability can be applied to both construction processes (i.e., the avoidance of waste), and the life-cycle of the finished building (i.e., costs of the maintaining and operating the building). When projects suffer from low levels of trust, those costs often become a part of future projects. The industry refers to them as "the cost of doing business" but in actuality they are non-value adding activities and hinder our efforts to reach sustainable buildings. Waste resulting from low trust ultimately has the same impact that waste resulting from rework or extra manpower would have.
4	Increasing complexity of buildings	As building complexity increases, the need for trust also increases. Increased complexity implies that additional specialization or "know-how" is required. The introduction of additional specializations generally requires additional relationships in the form of subcontractors or consultants and the effectiveness of these relationships hinges on trust.
5	Technological evolution (BIM)	BIM is a tool that encourages collaboration between participants. It assists in aligning the perspectives of the various participants with the overall needs of the project, encouraging shared goals and project optimization. Additionally, the coordination of multiple drawings/models requires regular communication and integration to be successful. These increased levels of collaboration and communication are facilitated and supported by trust.

As is suggested by both the Autodesk and NASFA documents, these trends are fuelling interest in Integrated Project Delivery (IPD) and other increasingly collaborative forms of project delivery.

2.4.2.1 Integrated Project Delivery

Construction project delivery has been defined as the "comprehensive process of assigning the contractual responsibilities for designing and constructing a project" (AGC 2011, pg. 3). A project's chosen delivery method creates the framework around which the participants, processes, and practices will be organized. While alternative methods and various hybrids exist, the AGC (2011) claims that current practice is dominated by the following four delivery methods:

1. Design-Bid-Build (DBB)

2. Design-Build (DB)

3. Construction Management at Risk (CMAR)

4. Integrated Project Delivery (IPD)

Data available through 2005 shows non-residential design and construction trending away from the use of DBB and towards the more collaborative model of DB (Jackson 2010). This shift appears to be a result of the inability of DBB to manage emerging industry trends, and to resolve systemic problems that industry practitioners have consistently faced. However, it seems that previous evolutions in project delivery methods such as Design Build (DB) and Construction Manager at Risk (CMAR) have

been unable to reduce the number or dollar amount of claims being made within the industry (Adrian 1988). Although not included in this list, another developing delivery method that appears to be gaining popularity is Public Private Partnerships which adds additional financial and operational stakeholders to the team of project participants (see Akintoye et al. 2003).

Several studies have shown that the industry's practice to select contractors through the competitive bid process, or 'lowest-bid-wins' approach is a source of problems within the industry (Matthews and Howell 2005; Nicholson 1991; Weston and Gibson 1993). The bid-price driven environment initiates a cycle of mistrust, encourages suspicious attitudes, and results in an adversarial culture for those involved (Bresnen and Marshall 2000; Larson and Drexler 1997). This environment is conducive to misaligned goals between project players, a natural tendency to abdicate risk to others, and a general "get mine and get out" attitude amongst the participants. Not surprisingly, these issues also have a strong correlation with project failure (Kadefors 2004).

Included as Appendix A is a study and additional information on competitive versus cooperative tendencies. Appendix A provides the details of a simulation that was adapted and used to assist in teaching the potential long-term impact of competitive behaviors to the construction project delivery process.

In response to these problems, project delivery methods have continued to evolve. IPD is a recent development in construction project delivery methodology. The process is becoming increasingly focused on collaboration and project optimization. IPD has received attention for its purported ability to integrate "people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction" (AIA 2007, pg. 2). According to literature, IPD is a form of relational contracting, as opposed to transactional contracting. Matthews and Howell (2005) defined transactional contracting as contracts dealing with exchanges made for goods and services. Relational contracting is defined as exchanges where "the relationship takes on the properties of a mini-society with a vast array of norms beyond those centered on the exchange and its immediate processes." (Matthews and Howell 2005, pg. 48) Other practiced forms of relational contracting include Project Partnering and Project Alliancing (Lahdenperä 2012).

While application of IPD principles is varied, the general concept appears to have merit in the industry. IPD warrants mentioning during a discussion on trust because of its emphasis on collaboration. In their white paper, the AIA said that IPD is "built on collaboration, which in turn is built on trust" (AIA 2007, pg. 5). Key supporting features of IPD that enhance collaboration and opportunities to develop trust include:

1. Cooperative culture

2. Early involvement of key participants

3. Joint decision-making

4. Shared financial risk and reward

5. Jointly developed project goals

6. Liability waivers among key participants

7. Co-location of teams

(Cohen 2010; Lahdenperä 2012)

Researchers claim that IPD has the potential to create high trust environments between construction project players. Participants working on IPD projects should therefore experience higher levels of interpersonal trust with their counterparts than those operating under traditional methods. Literature on trust supports the notion that practices, structures, processes and routines for dealing with partner organizations can create or eliminate the context within which interpersonal trust can be built and/or maintained (Heide and Miner 1992).

2.4.2.2 The Last Planner System®

One final trend that deserves attention for its impact on building trust in construction is the Last Planner System® of Production Control (LPS), developed by Glenn Ballard and Greg Howell (LCI 2012). The LPS is a production planning and control system designed for use on construction projects to improve planning and production. Many companies conduct sophisticated evaluations upon completion of a construction project that document "lessons learned". Practitioners use post-occupancy evaluations to

provide information regarding improvements that could be made. Likewise, it is common to conduct not-so-sophisticated evaluations upon completion of any kind of project to help avoid making the same mistakes twice.

Ideally, these opportunities for improvement are then acted on in preparation for future projects to increase effectiveness the next time around. Despite concerted efforts to resolve them, some problems in the construction industry continue to persist. One study showed that only about 50% of the activities planned for any given week are completed by the end of that week (Ballard and Howell 1998). The LPS attempts to resolve a number of prevalent construction project problems. According to the Lean Construction Institute (LCI) website, LPS is made up of the following five elements:

1. Master Scheduling (setting milestones and strategy; identification of long lead items)
2. Phase "Pull" planning (specify handoffs; identify operational conflicts)
3. Make Work Ready Planning (look ahead planning to ensure that work is made ready for installation; re-planning as necessary)
4. Weekly Work Planning (commitments to perform work in a certain manner and a certain sequence)
5. Learning (measuring percent planned complete, deep dive into reasons for failure, developing and implementing lessons learned)

The key point as it relates to this research is to improve the completion rate of activities that are being committed to (item 4). In the LPS, this completion rate of activities is represented by the metric, Percent Planned Complete (PPC). PPC is the simple calculation of number of commitments kept divided by the number of commitments made. A key point with this metric is that it does not measure productivity, per se, as with most construction reporting. Instead, it is a measure of variability from expected or committed task completion to actual task completion. As a participant's ability to keep commitments increases through use of the LPS, variability decreases, and reliability and predictability between project players increase.

Although trust is not equal to reliability or predictability, there seems to be a clear positive relationship (Mayer et al. 1995). The association between PPC and trust levels has yet to be measured but it seems a reasonable assumption that as PPC levels increase, trust levels will correspondingly increase.

2.5 Assessment of Prior Work

Literature on trust is primarily theoretical in nature. There is support for the idea that trust is beneficial to group performance, and that the ability to build and maintain trust is a competency that can be learned and improved upon. There is also support for the idea that trust can be adequately measured. This is important because this also means that by utilizing pre- and post-tests, the effect of interventions on interpersonal trust levels can be measured and analyzed.

42

Trust in construction is understudied considering the inherent need for interaction and reliance among construction team members. Past research has confirmed the value of trust in the industry, and also shown an increasing need for collaboration in the modern market. Partnering in construction and the issues of trust surrounding it received appropriate academic attention in the 1990's but recent work is sparse. The majority of extant literature is generally descriptive in nature; however recent work is pushing towards a more prescriptive, formalized method for building trust (Chow et al. 2012). Despite this push, I was unable to find a tool designed to actively manage trust on a project. This is the gap that exists in both literature and industry.

3. METHODOLOGY

3.1 Design Science Research

In order to accomplish the purpose and objectives of this research as listed in sections

1.3 and 1.5, Design Science Research (DSR) methodology, also called Constructive

Research in accounting literature (Lukka 2003), has been adopted. This methodology

has received attention and support in fields such as business administration, information

systems and technology, medicine, and engineering research (Aken 2004; Hevner et al.

2004; Kasanen and Lukka 1993; Lukka 2003) in part due to its apparent ability to align

the academic side of a given field with its industry counterpart.

It has been suggested that DSR is capable of assisting with the relevance or utilization

problem that exists in many academic fields (e.g., Aken 2004; Kaplan and Johnson

1987). In management research, this issue has been called the "rigor-relevance

dilemma" (Whyte 1991). Aken explains that this dilemma occurs when "theory is either

scientifically proven, but then too reductionistic and hence too broad or too trivial to be

of much practical relevance, or relevant to practice, but then lacking sufficient rigorous

justification" (Aken 2004, pg. 221). Researchers realized that their work was not only

underutilized by practitioners (Beyer and Trice 1982), but according to some, even

ignored (Porter and McKibbin 1988). The goal of DSR is to "produce innovative

construction, intended to solve problems faced by the real world and, by that means, to

make a contribution to the theory of the discipline in which it is applied" (Lukka 2003, pg. 1).

Research in construction science is a good fit for DSR because of the field's "applied" nature. Researchers have suggested that industry players, namely architects, engineers and urban planners, deal with problems that can be appropriately resolved using DSR (Aken 2004; Schön 1999). By selecting a methodology that supports real-world application, I hope to avoid what Meredith et al. (1989) decried as research that is high in "academic prestige" at the expense of research more relevant to real-life problems. This portion of the methodology is admittedly more of a literature review on DSR. However, since this methodology is somewhat controversial, I believe the guidelines and key differences are worth discussing in this context, prior to detailing the specific protocol of this project.

3.1.1 Design Science Research Guidelines

The guidelines for DSR, as published by Hevner et al., are provided in Table 4 to create the framework for the discussion regarding the differences between DSR and "traditional" research methods contained in Section 3.1.2.

Table 4: Design Science Research Guidelines
(Hevner et al. 2004)

Guideline	Description
Guideline 1: Design as an Artifact	DSR must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of DSR is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective DSR must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	DSR relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	DSR must be presented effectively both to technology-oriented as well as management-oriented audiences.

3.1.2 Descriptive vs. Prescriptive Research

Early work and conceptual support for DSR were provided by Simon's (1996) seminal book, *The Sciences of the Artificial*. In his work, Simon describes a difference between natural and artificial phenomenon. Artificial phenomena exist in human creations such as organizations and information systems. March and Smith (1995) point out that scientists can contribute to not only the study of these phenomena, but also the creation of them. This dual capacity allows for scientific involvement in both sides, as opposed to natural phenomena which by definition occur without intervention and can merely be described or explained.

According to the work of March and Smith, natural science, or more traditional research in the "hard sciences," is generally aimed at understanding and explaining reality, and can thus be classified as descriptive research. Alternatively, DSR attempts to *create* things that serve specific purposes or needs (Denning 1997). Products from design science are tested against the value or utility they bring, generally based on the value-determining question – "does it work?" (March and Smith 1995, pg. 253) This type of work is classified as prescriptive research. In other words, where "natural sciences are descriptive and explanatory in intent, design science offers prescriptions and creates artifacts that embody those prescriptions" (March and Smith 1995, pg. 254). Hevner et al. (2004) described the difference and association between the two as follows:

> "The goal of [natural] science research is truth. The goal of design science research is utility… Our position is that truth and utility are inseparable. Truth informs design and utility informs theory." (Hevner et al. 2004, pg. 80)

Where the two primary activities of natural science are to discover and justify, design science focuses on building and evaluating (March and Smith 1995). Table 5, adapted from Aken (2004), describes the main differences between the two approaches.

Table 5: Main Differences between Descriptive and Prescriptive Research
(Adapted from Aken 2004)

Characteristic	Descriptive Research	Prescriptive Research
Dominant Paradigm	Explanatory sciences	Design sciences
Focus	Problem focused	Solution focused
Perspective	Observer	Player
Logic	Hindsight	Intervention-outcome
Typical research question	Explanation	Alternative solutions for a class of problems

47

Table 5 Continued

Characteristic	Descriptive Research	Prescriptive Research
Typical research product	Causal model; quantitative law	Tested and grounded technological rule
Nature of research product	Algorithm	Heuristic
Justification	Proof	Saturated evidence

For additional analysis and exploration on the differences between descriptive and prescriptive research, please refer to Holmström et al. (2010).

Because the key deliverable of this project was a functional tool for building trust, this research was very prescriptive in nature. I used an innovative tool to create or suggest an intervention and affect the resultant outcome. The focus was on a solution that was created, tested, evaluated and iterated in an effort to achieve a desired outcome. The success of the tool is measured by its ability to achieve the goal of increased trust between project participants. It is heuristic in nature in that it provides an alternative set of solutions for the problem and is evaluated on a trial and error basis. Aken (2004) described this process as the creation of a *design exemplar*. Instead of an algorithmic prescription which generally has a quantitative format, the effect of which can be shown on the basis of observation and statistical analysis, *design exemplars* provide a general prescription which is then translated by the user to the current problem.

3.1.3 Potential Benefits and Risks

Testing this tool in the context of its anticipated application, or on the construction job site, introduces additional variables to the research design that may be difficult to manage. Similar to some clinical research, the heuristic approach can make it difficult, if not impossible, to draw conclusions about causal determinants. However, the ability to test this tool in the context of its designed use also provides validity that can arguably be lacking in true laboratory experiments. Research suggests that despite its weaknesses, sufficient supporting evidence can be obtained using this method, in addition to improved assurances of effectiveness in the intended context of application (Aken 2004). In this way, the solution can be tested without being overly reduced by the need for quantification, giving more holistic results. The starting point is what Pawson and Tilly (1997) called the basic realist formula: *mechanism + context = outcome*.

In an effort to maintain rigor in this process, I tested the tool iteratively in both a quasi-experimental design using students as subjects, and as a series of case studies using industry practitioners as subjects. This approach provides support for the known risks associated with DSR, while at the same time capitalizing on the known benefits.

Table 6 summarizes known potential benefits and risks of constructive research, or DSR, as listed in Lukka's (2003) analysis of the methodology.

Table 6: Potential Benefits and Risks of DSR
(Adapted from Lukka 2003)

Benefits	Risks
Access to new interesting research sites	High relevance of study results can be perceived by the participants as being "too delicate" to be published (Lukka 2003, pg. 13)
Participants get critical analysis of relevant problems	Cannot maintain the commitment of the target organization or participant
Gap between research and practice is narrowed	Participants fear losing control of business secrets
Practitioner has interest in providing honest and relevant data	Anticipating and managing side-effects or confounding variable (March and Smith 1995)
Demands thorough prior knowledge in order to be implemented	Neutrality of the researcher
	May be viewed by journal editors and peer reviewers as an un-established methodology

As mentioned, the risks were considered and managed during the project to minimize their potential negative impact, and the benefits highlighted to maximize their positive impact.

3.1.4 The Model and Process

The process for creating the solution or artifact in this project followed the general structure of Van Strien's (1997) "regulative cycle". This cycle is made up of five main steps:

1. Identification of a problem

2. Diagnosis of the problem situation

3. Creation of a plan of action

4. Intervention aimed at affecting change

5. Evaluation of the new situation

(Van Strien 1997)

One of the key features of the regulative cycle is the iterative nature it suggests, made possible by the essential step of evaluation. This model is similar to those proposed by various quality management theorists. The Deming Cycle consists of four similarly simple steps: Plan-Do-Check-Act (PDCA) (Deming 2000). *Six Sigma* practitioners preach define, measure, analyze, improve and control (DMAIC) (Pyzdek 2003).

Researchers have further detailed this cycle into a model for DSR implementation. Figure 7 provides the steps that will be followed to achieve the objectives of this research. In addition to the steps, the model includes representations of the knowledge transfer or flow occurring between the steps and also the outputs associated with each of the steps.

Knowledge Flows	Process Steps	Outputs
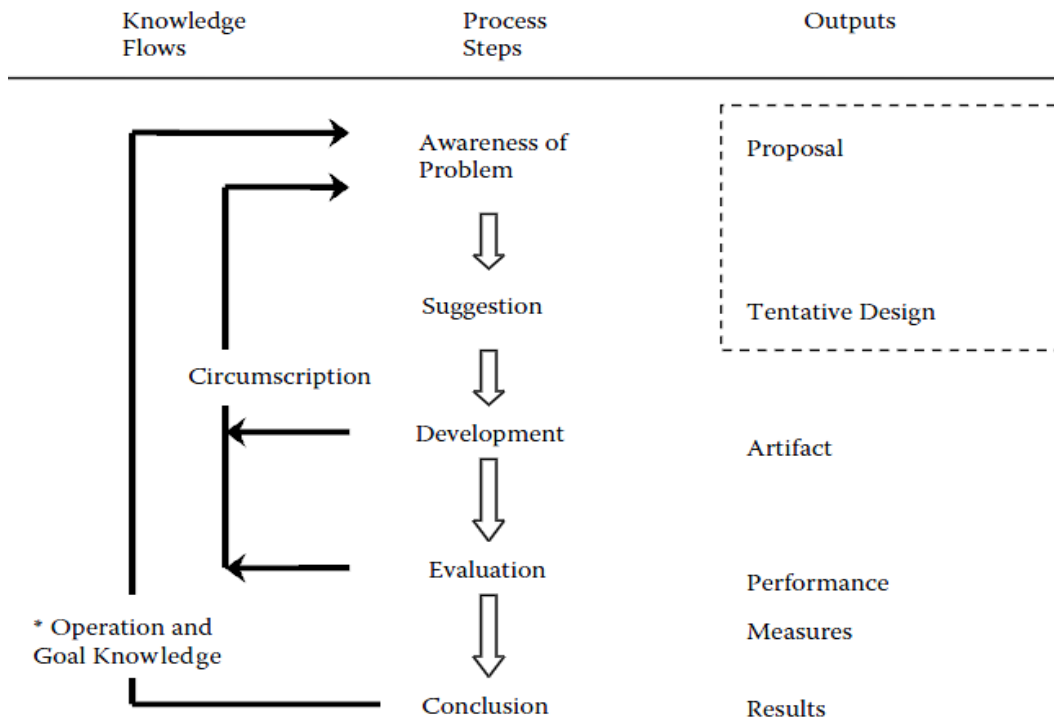
Figure 7: The General Methodology of Design Science Research
(Vaishnavi and Kuechler 2007)

These five steps create the framework for this research model. Figure 8 and Table 7 show the anticipated schedule for this research project, in the context of Vaishanvi and Kuechler's steps.
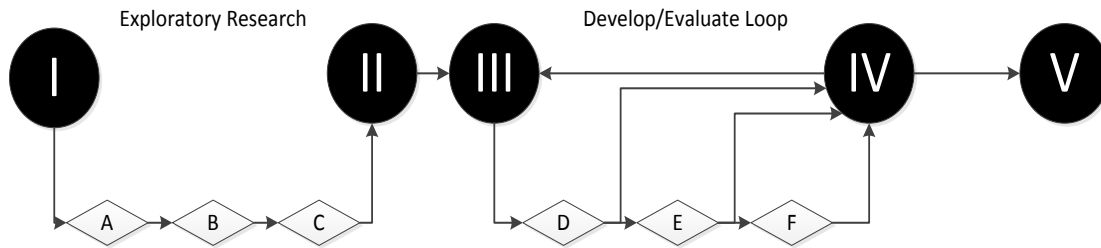
Figure 8: Timeline of Events

Table 7: Anticipated Schedule of Events

Phase		Description	Dates
I		Awareness of the Problem	August 1, 2011
	A	Semi-structured Interviews	August 1, 2011 – August 21, 2011
	B	Observations	August 1, 2011 – August 21, 2011
	C	Questionnaires (Appendices B and C)	December 5, 2011 – November 20, 2012
II		Suggestion	August 1, 2012
III		Development	
	D	α-Testing (internal analysis, Appendices D and E)	September 1, 2012 – November 27, 2012
	E	β-Testing Stage I (first-run study with student participants, Appendices F-N)	February 11, 2013 – April 23, 2013
	F	β-Testing Stage II (case studies with industry participants, Appendices O and P)	April 25, 2013 – June 10, 2013
IV		Evaluation – conducted following each stage of development phase	November 1, 2012 – May 24, 2013
V		Conclusion	June 10, 2013

In the following sections, the steps taken during this project, along with details about how each was approached, are described. Sections 3.1.4.1 – 3.1.4.5 define the project research protocol.

3.1.4.1 Phase I - Awareness of the Problem

Based on early exploratory research and recent industry trends I believe that the construction industry suffers from a generally low level of trust. Industry practitioners seem to value the concept but do not have effective ways of managing it. Exploratory research was conducted in accordance with "naturalistic inquiry" theory in the form of typical ethnographic methods (Guba and Lincoln 1985). Specifically, I utilized semi-structured interviews, observations and questionnaires to gain direction and understanding of the current situation and the problem. "Theory emerges from the inquiry…it is not given a priori" (Guba and Lincoln 1985, pg. 224). The results of these exploratory efforts can be found in section 4.2. In addition to the early data collection, personal experience and an extensive literature review were utilized to support preliminary findings. Extant research supports the theory that trust can add value to cooperative endeavors, but that methods for building trust are disjointed and seemingly difficult to implement.

3.1.4.1.1 Semi-Structured Interviews

Exploratory semi-structured interviews provided early direction for the research and an "awareness of the problem." These opportunities were used to confirm relevance of the

topic to industry members, and to open avenues for the directions of this research. The interviews were comprised mainly of open-ended questions designed to avoid limiting participants' responses. This format provided the necessary flexibility appropriate for a "naturalistic inquiry" of this kind (Guba and Lincoln 1985) and afforded a range of opinions and perspectives.

Possible questions were developed before-hand as general guidelines for the semi-structured interviews. These questions were based on points of interest found during the literature review, and personal curiosities. Additional questions were asked depending on responses. A description of the research participants involved in the semi-structured interviews is included in Section 3.2.1.1, and results from the interviews can be found in Section 4.1.1.

3.1.4.1.2 Observations

Typical observations were conducted over the course of 1-2 days on four different job-sites. This process included sitting in on team meetings and observing the various daily interactions of on-site project personnel. Beyond an initial introduction, my involvement was contained to merely observing with no input or dialogue. A description of the research participants involved in the observations is included in Section 3.2.1.2, and results can be found in Section 4.1.2.

3.1.4.1.3 Questionnaires

Two exploratory questionnaires were conducted as further support for the direction of this research. The first questionnaire (Appendix B) was a modified and formalized version of the semi-structured interviews described in Section 3.1.4.1.1. Effective open-ended questions and relevant topics from the interview process were used to create the questionnaire in an effort to provide additional support for the interview findings. Additionally, data from the observational portion of this research was used to guide the line of questioning.

Based on the responses to the first questionnaire, the second questionnaire (Appendix C) was created to gain some additional insight and to account for potential discrepancies from the administration of the first questionnaire. It includes one additional question, and minor alterations to questions 1 and 2. Also, unlike the first questionnaire, it was administered in two phases so as to avoid unintentionally leading participants in the direction of trust-related responses. A description of the research participants involved in the questionnaires is included in Section 3.2.1.3, and results can be found in Section 4.1.3.

3.1.4.2 Phase II - Suggestion

According to Vishnaivi and Kuechler (2007), the suggestion phase follows immediately behind the recognition of a problem and introduces a tentative design or solution for the problem. The exploratory data coupled with my personal experience in the industry

provided sufficient exposure and understanding to create a suggestion for resolving this problem. The suggestion was a trust-building tool. The first conception of this tool, or artifact, was developed during the summer of 2012 while considering the implications of the LPS and "lookahead" planning on relationships. This artifact was designed as a way to solve the perceived problem of low interpersonal trust levels on construction job sites.

3.1.4.3 Phase III - Development

DSR literature uses the word *instantiation* to describe the realization of an artifact in its environment. This is one of the four possible research outputs from DSR (March and Smith 1995). Researchers have defined this type of artifact as a form of *technological rule*. Bunge (1967) defined a *technological rule* as an "instruction to perform a finite number of acts in a given order or with a given aim" (pg. 132), while Aken defined the same as "a chunk of general knowledge, linking an intervention or artifact with a desired outcome or performance in a certain field of application" (Aken 2004, pg. 228). From this perspective, this tool developed as a technological rule in the form of an artifact. Aken further explains that technological rules are not universal laws, but a general prescription for a class of problems that should be tested within the intended context of application. They should not be used as recipes, but to assist users in developing intuition based on the core concepts and principles of the rule (Hopp and Spearman 1996). Development of this artifact follows this approach by attempting to guide users of the tool to effective management of relationships without necessarily prescribing exact sequences of actions.

3.1.4.3.1 α-Testing

After the potential solution to the problem was considered during the "Suggestion"

phase of the project, I began developing the artifact. The creation, internal review and

analysis, and ultimate adjustment of the artifact constituted the α-testing stage of this

project. Over the course of approximately three months, feedback from committee

members and helpful fellow students was received and processed internally to develop

the tool. The first two versions (see Appendix D and E) of the trust-builder tool were

developed as part of this internal α-testing.

3.1.4.3.2 β-Testing

Following completion of the α-testing, β-testing was conducted in two progressive

stages.

3.1.4.3.2.1 Stage I – Student Sample

The goal of Stage I was to determine whether or not trust could be effectively built in

teams by asking participants to implement pre-conceived strategies. A quasi-experiment

using a sample of 139 students was conducted to determine whether or not this artificial

introduction of trust-building behaviors could impact trust levels within a group. A

slightly altered version of the Trust-Builder Tool Ver. 2.0 (Appendix E) was

administered to the student sample in order to accomplish this objective. The somewhat

simplified tool (Appendix F) was used iteratively in a systematic process for this stage of

the β-testing in accordance with Figure 9 and Table 8.

(Intrvn = Intervention)
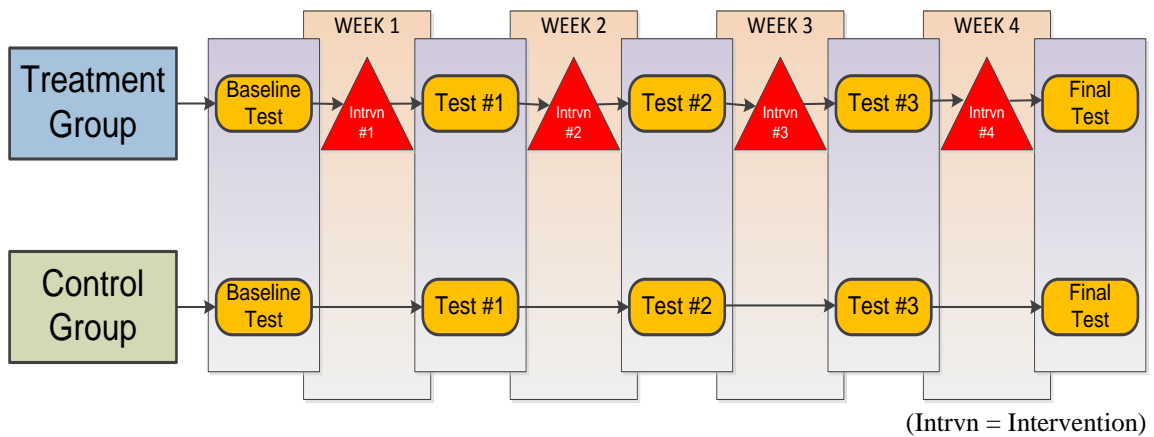
Figure 9: Research Design Implementation Strategy

Every student was asked to complete a benchmark survey at the beginning of Week 1, and then another survey on each following Friday until the final survey was distributed at the end of Week 4. For analysis, Tests #1, #2 and #3 acted as both pre- and post-tests for the adjacent tests. Table 8 details the completion dates of each test during Stage I of the β-testing.

Table 8: Completion Dates for β-Testing Stage 1

Description	Completion Dates
Baseline Test	2/11/13
Test #1	2/15/13
Test #2	2/22/13
Test #3	3/1/13
Final Test	3/18/13

Because of the first-run nature of this study, students were deemed acceptable as research subjects for the primary data collection. These students were selected because

they were participating in group projects designed to simulate actual construction projects, necessitating extended interactions between the group members. The remainder of this section will focus on the research design for this stage of the project, but additional information on the student sample, rationale for selection and compliance with Institutional Review Board requirements is included in Section 3.2.2.

Research participants were assigned to teams of between three and six members depending on the number of students enrolled in each class. There were 26 upper level student groups made up of 100 students, and 13 lower level student groups made up of 39 students participating in this study. Utilizing random number assignments, half of the sample became treatment groups and the other half control groups. One member from each of the treatment groups was randomly selected to implement a series of trust-building interventions within their group. This individual is called the Trustor in this research. The Trustor was asked to implement one intervention with each member of his or her team on an individual and weekly basis. The intervention for the week was given to the Trustors via email each Friday after taking the test, along with a follow-up to determine with which members of the group they were able to complete the intervention. A reminder email was also sent on Tuesday of each week. This process continued over the course of a little over four weeks in accordance with Figure 9 and Table 8.

As shown in Figure 9, there are four different interventions used in this study. The four interventions were developed based on the framework for trust in construction developed

by Wong et al. (2008). Two interventions were based on the "cognition-based" list and the two on the "affect-based" list. These interventions were selected because of their relatively high "goodness-of-fit" rankings as determined by the structural equation modeling conducted by Wong et al. (2008), and their relative ease of implementation by the student Trustors. The selected interventions were as follows:

A. Create an opportunity to have additional interaction with the other party, either work or personal to facilitate better understanding between the parties (cognition-based).

B. Make a specific effort to contact and communicate with the other party when it is **not** expected or required (cognition-based).

C. During a decision-making process, specifically discuss the other party's needs and how or if they are being met (affect-based).

D. Dedicate time to discuss and understand the other party's personal details and background (family, hometown, high school, hobbies, etc.) in order to understand them better (affect-based).

The week in which each particular intervention was implemented was randomly selected. Each Trustor was asked to attempt all four interventions with each of his or her team members over the course of this portion of the project. All Trustors were conducting the same intervention during the same week. For the purposes of this stage of the research, the intervention itself and even the details of the completion of the intervention were not of critical importance. The effect of making this suggestion in the

treatment groups was analyzed. This was designed to allow us to understand whether or not coached and deliberate interventions into the various group relationships could impact the levels of interpersonal trust existing between team members.

The test, or survey, was the same each time it was administered, and is included as Appendix F. This test is based on a trust measurement tool created by McAllister (1995). McAllister's tool was designed to measure interpersonal trust and, according to McEvily and Tortoriello (2011), has been replicated 12 times by other researchers since its inception. This is more outside replication than any of the other reviewed tools. Results show the complete tool's reliability index or internal consistency (Cronbach's Alpha) at between 0.89 and 0.91 where anything above 0.9 is considered "excellent" (Kline 1999). In keeping with McAllister's conclusion that the two primary categories of trust behaviors, cognition-based and affect-based, best represent distinct forms of interpersonal trust items, I used the items in those two categories in my test. Fewer questions also served to minimize test fatigue in the subjects. The selected test items for the student β-testing along with their respective categories are included in Table 9.

Table 9: Interpersonal Trust Measures Used for Stage I of the β-Testing
(Adapted from McAllister 1995)

Trust Type	Item
Affect	We have a sharing relationship. We can both freely share our ideas, feelings, and hopes.
	I can talk freely to this individual about difficulties I am having at work and know that he/she will want to listen.
	We would both feel a sense of loss if one of us was transferred and we could no longer work together.
	If I shared my problems with this person, I know he/she would respond constructively and caringly.
	I would have to say that we have both made considerable emotional investments in our working relationship.
Cognition	This person approaches his/her job with professionalism and dedication.
	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.
	I can rely on this person not to make my job more difficult by careless work.
	Most people, even those who aren't close friends of this individual, trust and respect him/her as a co-worker.
	Other work associates of mine who must interact with this individual consider him/her to be trustworthy.
	If people knew more about this individual and his/her background, they would be more concerned and monitor his/her performance more closely. (reverse coded)

Prior to the benchmark test, the project was described by the various instructors to the students as a study on teamwork using the script included as Appendix G. Specific mention of trust as the focal point was carefully avoided throughout the study in an effort to avoid causing research participants to change behavior as a result of knowing that they are being measured. This phenomenon is known as the Hawthorne Effect (Dickson and Roethlisberger 1939). Additional scripts were created for each week the

test was administered to ensure continuity between the various professors administering the tool. Each professor was instructed to read the prescribed script, hand out the survey, collect them upon completion and seal them in an envelope that was provided. The scripts are included as appendices H, J, K, and L.

In order to maintain confidentiality, and in accordance with the IRB approval protocol, student responses were collected and sealed in an envelope that was delivered to a third-party for data input. Student names were replaced with a unique numerical identifier and kept on a key separate from the data set. Collated data void of personal identifiers was then returned to me in a spreadsheet for analysis. The completed forms containing the student identifiers were locked up until Spring 2013 grades were distributed, at which time they were returned to me to confirm accuracy of data input. Following this confirmation, the original forms and numerical identifier key were destroyed.

As the purpose of this research is to develop and test a tool that builds interpersonal trust within the construction industry, this stage of the research design allowed for a better understanding of whether or not deliberate, planned actions or interventions can positively impact trust levels between team members. This design does not necessarily attempt to collect data regarding the effectiveness of the various trust-building methods. Data from this process was then transferred to similar contexts in the case studies and then generalized for further testing (Eisenhardt 1991).

At the end of Stage I, the students were asked to complete one final follow-up survey (see Appendix M). The follow-up survey is made up of only two questions and was designed to triangulate and support the previously collected data. The script included as Appendix N was used to introduce the follow-up survey to the students.

Stage I of the β-testing was the primary quantitative data collection effort for this project. IBM SPSS statistical software was used to analyze the collected data, create charts, and for significance testing.

3.1.4.3.2.2 Stage II – Case Studies

The second stage of the β-testing consisted of three case studies. The case studies were started approximately two weeks after completion of the first-run study with the students. This testing was included to give an indication of the tool's generalizability to industry and to receive additional feedback from the desired end user. On their own, the case studies are insufficient to obtain generalizability. However, when used as a form of triangulation for the results from the earlier stages of this project, they support the overall objectives of the research.

Case studies were selected as a supporting methodology for this project because of their ability to focus on application of the tool in context. The "on-the-job" context available through this approach provides a richness of data that is otherwise very hard to obtain. Case studies are typically utilized at the beginning of a research project as a form of

theory development. I decided to use them as a form of corroboration or confirmation for data previously collected in this research. Having used students as my primary sample, it seemed appropriate to support those findings with some industry application of the tool. As the final strategy employed in this research, I was also able to focus on and draw connections between key points from the other strategies, allowing me to avoid some of the recognized weaknesses of case studies, namely: (1) the potential for over-complication, and (2) difficulty of determining causality due to complexity of variables (Groat and Wang 2002). In accordance with DSR methodology, the results from Stage I were used to evaluate and revise the tool prior to industry testing.

In order to maintain appropriate rigor for case study methodology, the data collection and analysis were based around the following key elements to a case study report in accordance with Leedy and Ormrod (2005, pg. 138):

1. Rationale for studying the case.

2. Detailed description of the facts related to the case.

3. Description of the data collected.

4. Identification and discussion of patterns found.

5. Synthesis and generalizations to a larger scheme of things.

A description of the data collected during each case study as it relates to each of the listed elements is included as results in Section 4.1.5.2.

66

According to Yin's case study typology, these case studies are "exploratory" in purpose (Yin 2008). Yin describes an "exploratory" case study as one that meets the following three structural descriptions:

1. Linear-Analytic: following the typical article format of problem statement, literature review, methods and results.

2. Chronological: narrative sequence of events.

3. Theory-Building: dependent on logic of theory development.

My case study logic is linear in nature because each situation is approached as a microcosm of the typical article format. Results will be analyzed chronologically, as necessitated by the before and after testing inherent to the design of the tool. And finally, my case studies rely heavily on the logic suggested by my theory and model for trust-building as put forth in Section 4.2.2. Therefore, I will describe these case studies as being "exploratory" per Yin's typology.

The research participants for this stage were given version 3.0 of the Trust-Builder Tool (Appendix O) along with a description of its intended use and the theory behind its creation. Stage II β-testers were asked to test the tool over the course of two weeks with no less than three project-related relationships. Telephone interviews were then conducted with the participants to receive feedback and results, along with the information compiled from the completed spreadsheets. See section 3.2.2.2 for details

on the selection and specifics of the research participants involved in Stage II of the β-testing.

In all three case studies, I gave the participants the same direction and explanation via telephone while reviewing the Trust-Builder Tool version 3.0 on our respective computers. For the sake of potential replication of these case studies, key points from that conversation are included.

The tool was initially described on a conceptual level, using the two-week and six-week lookahead practice for scheduling and task completion as a starting point for understanding the concept. A two-week lookahead analyzes tasks that need to be completed in the next fourteen days. The constraints preventing completion of these tasks are identified and analyzed, including mapping how the constraints will be removed and determining who the responsible party is for that removal. Likewise, the Trust-Builder Tool encourages the person using it to identify upcoming relationships that deserve specific attention and encourages their thorough analysis. This can be a relationship that already enjoys a high level of trust, or one that needs to be built up. Version 3.0 of the tool is an Excel spreadsheet designed for easy use. Blue cells require user input and cells are programmed to calculate, share and transfer data as needed. The tool is broken into two stages, each of which has its own tab in the spreadsheet.

Beginning with Stage I of the tool, the respondent is asked to enter an individual or "Trustee" name for analysis. Once a Trustee has been selected, the following steps are encouraged as guided by the Trust-Builder Tool:

1. Establish a current state or baseline trust index using eleven questions similar to those used during Stage I β-testing. Reponses to the eleven questions are automatically calculated and averaged upon completion. This number becomes their "Current Trust Index" for the relationship in question.

2. Analyze the current state of the relationship in order to better understand why they feel the way they do about the subject. Respondents are encouraged to consider the following questions and issues:

    a. If the current trust index is high:

       1) Why is it high?

       2) Am I being honest with myself?

       3) The question I scored lowest was _____. I might be able to improve this by _____.

    b. If the current trust index is low:

       1) Why are they low?

       2) Should I be doing business with this person?

       3) The question I scored lowest was _____. I might be able to improve this by _____.

    c. Also, consider the following types of trust that could be influencing your trust index:

1) "System-based" - Is the trust level heavily dependent on the system within which you are interacting with this person? What could you do to improve the system?

2) "Cognition-based" - Is the trust level heavily dependent on the Trustee's competence? How competent are they? Do they have too much responsibility for their individual capabilities?

3) "Affect-based" - Is the trust level heavily dependent on the Trustee's character? Would understanding them better help? Why do they act the way they do?

Possible reasons for low scores on the initial trust index should then be reviewed and listed. This practice helps the respondent to uncover underlying issues that may otherwise remain buried and prevent interactions that may increase levels of trust in the relationship. The tool includes a link to various root cause analysis tools available to assist in this process if necessary.

3. Based on their responses, the individual is then encouraged to select a "Trust-Building Method" for implementation in the relationship and to set a date for completion. The tool includes a drop-down menu of 20 trust-building methods from the literature for possible use. Selecting a method brings up suggestions specific to that method to help in the implementation. Respondents can also fill in their own method, in which case a few general suggestions for trust-building show up to encourage highly effective interactions.

4. The final step of Stage I is to do the selected method on the date scheduled.

5. Stage 2 is the follow-up to Stage I. After completing the decided upon trust-building method, the respondent is asked to open the spreadsheet again to the Stage 2 tab and follow the guidelines. Pertinent information from the Stage I is automatically transferred to this page for reference.

6. The respondent is asked once again to complete an assessment of the Trustee using the same eleven questions. Upon completion of the follow-up assessment, the tool will automatically pull the previous trust index over for comparison.

7. Respondents are then encouraged to make notes or comments about the outcome and record expectations or commitments that may have been made in the previous interaction with the Trustee.

Case study participants were also asked to keep a notebook nearby to record their thoughts while using the tool. I asked them to provide feedback in five general categories:

1. Usefulness of a tool of this nature from a conceptual standpoint. Would this be a waste of time or a valuable management technique?

2. Design and usability of the Excel spreadsheet for accomplishing the tool's objectives.

3. What, if anything, they learned about themselves and/or their Trustees as a result of using the tool.

4. Accuracy of trust index based on test questions and trust-building method applicability.

5. Open-ended, general feedback and questions.

Optimal implementation of the Trust-Builder Tool would necessitate the repeated use of the tool. This iterative feedback and analysis would facilitate continued management of the various relationships and allow for progress and efforts to be documented. Due to time constraints, the case study participants were only able to complete one run through of the tool for each of their three Trustees. As the general goal of the case studies was to introduce the tool into the anticipated context of its ultimate application, this limited use was deemed adequate, though not ideal. This format still allowed obtainment of some support for conclusions from Stage I and direction for the future of the tool. Table 10 details the test items that were included in version 3.0 for the trust measurement portion of the tool.

Table 10: Interpersonal Trust Measures Used for Stage II of the β-Testing
(Adapted from McAllister 1995)

Trust Type	Item
Affect	We have a sharing relationship. We can both freely share our ideas, feelings, and hopes.
	I can talk freely to this individual about difficulties I am having at work and know that he/she will want to listen.
	We would both feel a sense of loss if one of us was transferred and we could no longer work together.
Cognition	This person approaches his/her job with professionalism and dedication.
	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.
	I can rely on this person not to make my job more difficult by careless work.

Table 10 Continued

Trust Type	Item
	Most people, even those who aren't close friends of this individual, trust and respect him/her as a co-worker.
Affiliative Citizenship Behavior	I take time to listen to this person's problems and worries
Assistance-Oriented Citizenship Behavior	I help this person with difficult assignments even when assistance is not directly requested.
Monitoring and Defensive Behavior	I find that this person is not the sort of co-worker I need to monitor closely.
	The quality of work I receive from this individual is only maintained by my diligent monitoring.

While seven of the eleven items are from the test used for the students, four additional

items from McAllister's (1995) original test were included covering behaviors other than

cognitive and affect-based. This version of the tool includes items more suited to

professional relationships.

Version 3.0 of the Trust-Builder Tool also includes a list of 20 trust-building methods

taken from the literature review. Some of them are included in Table 2, but were

rephrased and shortened in Table 11 for easier interface with the tool user. Table 11

includes the list of methods used in the tool along with the suggestions for

implementation that accompany user selection of each individual method.

Table 11: Trust-Building Methods in Version 3.0 of the Trust-Builder Tool

	Trust-Building Methods	Reference	Suggestions
1	Declare Your Intent	(Covey and Link 2012)	1. Double check your motivation, trust cannot be built and maintained if you are only trying to manipulate someone
			2. You have to have their best interests, or the project's best interests at heart
			3. Tell them why you are involved in the project or in the relationship and how you see it being beneficial (BE HONEST!!)
2	Make a Behavior-Specific Request	(Covey and Link 2012)	1. Have a frank discussion on where they are falling short, AVOID ATTACKING THEM PERSONALLY by instead discussing behaviors that could be improved (e.g., "when you _____, it makes it hard for me to _____", as opposed to "you are _____ so it is hard for me to _____")
			2. Express a sincere desire to work together and build trust
3	Listen	(Covey and Merrill 2006)	1. Give the other person an opportunity to share their side of the story and don't interject your own version. JUST LISTEN!
			2. You can practice active listening techniques like restating what you heard and asking questions for clarification of certain points
4	Talk Straight	(Covey and Merrill 2006)	1. Don't beat around the bush, assess your situation and discuss it openly and honestly
			2. Communicate so clearly that you can't be misunderstood
5	Create Transparency	(Covey and Merrill 2006)	1. Share more information than is expected, personal or business related
			2. Show them that you trust, usually trust must be extended before it is received
6	Right Wrongs	(Covey and Merrill 2006)	1. If you have made mistakes in this relationship, be the bigger man and apologize
			2. If there is a way to make recompense beyond an apology, do whatever it takes

Table 11 Continued

	Trust-Building Methods	Reference	Suggestions
7	Show Loyalty	(Covey and Merrill 2006) (Khalfan et al. 2007)	1. Avoid back-biting or gossiping, not just about the other person but in general, talk about people as though they were there with you 2. Stand up for the other person when the opportunity arises and you will see their loyalty to you, and thereby their trust in you increase dramatically 3. Express gratitude when loyalty is shown and make sure it is reciprocated at the next opportunity 4. Give credit to others
8	Deliver Results	(Covey and Merrill 2006)	1. The best way to improve trust based on competence is to show you are competent, or to give your counterpart an opportunity to show you they are competent 2. In order to move to the next level, you have to be delivering on the current expectations from the relationship 3. Give yourself or the other person an opportunity to prove it
9	Clarify Expectations	(Covey and Merrill 2006) (Khalfan et al. 2007) (Wood and McDermott 1999) (Gulati 1998)	1. Clearly define the job tasks required of the other person and yourself, preferably BEFORE you start 2. Make sure you are both on the same page 3. If there is a contract, review the terms and make sure both of you understand what the other party expects
10	Practice Accountability	(Covey and Merrill 2006)	1. Clarify accountability on tasks, and then hold the other person AND yourself accountable 2. Give them an opportunity to be successful, to deliver 3. Express gratitude when expectations are met
11	Make and Keep a Commitment	(Covey and Merrill 2006)	1. Any commitment, big or small, just make a commitment and follow through 2. This is the quickest way to build trust and the fastest way to destroy it
12	Dedicate Time to Discuss and Understand the Other Person's Background and Personal Life in Order to Understand Them Better	(Parkhe 1999) (Sarkar et al. 1998) (Chow et al. 2012)	1. Go to lunch 2. Go golfing 3. Plan a "caucus retreat" 4. At the least, take a moment to understand where this person is coming from so that you can understand their actions better

Table 11 Continued

	Trust-Building Methods	Reference	Suggestions
13	Communicate More than Required or Expected	(Chow et al. 2012) (Leifer and Mills 1996)	1. Contact this person at a time when it is unexpected and NOT required 2. You can use this time to discuss the project at hand, or just work on your relationship
14	Discuss the Other Person's Needs and How to Meet Them	(Vangen and Huxham 2003) (Das and Teng 1998)	1. Try to understand the other person's needs from your relationship and discuss what that looks like to them 2. This can also be a time to review workloads and make sure that both parties feel it is fair 3. Make adaptations to better support the partnership and then talk with your counterpart about it
15	Track Record	(Khalfan et al. 2007)	1. Like calling references, if you are unfamiliar with someone you should contact previous partners and co-workers in order to gain a better understanding of the individual in question
16	Discuss Communication	(Parkhe 1999)	1. Find out what the other person's preferred method of communication is (e.g., texting, email, phone call, face-to-face) 2. This can protect your relationship from potential misunderstandings based on unresponsiveness or difficulty communicating
17	Discuss the Long-Term Benefits of Your Relationship	(Morgan and Hunt 1994) (Liker 2004)	1. Having a long-term perspective for a relationship helps us work better together 2. Find the long-term benefits of maintaining your relationship and discuss them with the other person
18	Unexpected Help	(Khalfan et al. 2007)	1. Help this person with something they are working on even if it is outside your scope of work 2. Alternatively, you can ask this person for help with a problem you are trying to solve
19	Establish Pain-Sharing and Gain-Sharing	(AIA 2007)	1. When your pain and gain are tied together, concern about betrayal is lessened and cooperative behaviors increase. Find a way to alter the relationship so that your counterpart knows you are committed.
20	Alignment Exercise (Appendix P)	(CII 1997)	1. This is a specific exercise you can conduct in order to understand what the other party's underlying objectives are and how they line up with yours

Table 11 Continued

	Trust-Building Methods	Reference	Suggestions
--	Fill in the Blank Option	(Parkhe 1999)	1. Make sure you are doing this for the right reason 2. Start with small, measured, specific steps instead of huge steps - trust-building is a process

This list is not all-inclusive and could potentially be expanded or contracted in future versions of the tool based on the responses to the first few questions on the survey. I included this list and the suggestions as a way to jumpstart the respondent's thoughts about how best to build trust within the specific relationship they are considering. The tool allows for the respondent to fill in their own trust-building method if they prefer something besides the options provided. The overall goal is to force the respondent to formalize their process for managing these relationships and find a way to systematically work to improve them.

3.1.4.4 Phase IV - Evaluation

Continued evaluation of the artifact is integral to the DSR process (Hevner et al. 2004). This phase considers the effectiveness and efficiency of the developed artifact, along with its impact on the user. The primary goal is to determine whether or not the artifact did what it was intended to do (March and Smith 1995). Criteria of value or utility become metrics that can be used for analysis.

The primary analysis approach for the data collected during Stage I was a one-way ANOVA where the data was broken into various groupings for simplified analysis. In some instances, independent-samples t-tests were also used when only two groups were being compared. Linear regression was also used to forecast data trending and some correlation was used to determine the relationship between the final follow-up survey and main survey results. These methods allow for determination of the significance of the difference between the various groups that will be discussed in detail in the results section. Multiple or "repeated" measurements over Stage I's four weeks improved the validity of the data and lessened the likelihood of potentially confounding variables due to participant mood changes or unusual individual circumstances. In essence, this analysis is capable of providing support for or against the hypothesis that deliberate intervention by the Trustor can positively impact the levels of interpersonal trust existing within a group. Although not conducted for this project, this data could be cross-analyzed for additional conclusions using a repeated-measures between-subjects ANOVA with a grouping variable.

Additional *Post Hoc* testing was conducted to analyze potential differences based on the chosen trust-building intervention. Anticipated additional data collection includes the following:

- Impact of Trustor intervention completion percentage on average overall change in trust index
- Reciprocal feedback showing impact on Trustee's trust index

- Comparisons between male and female participant responses

- Comparison of average overall change in trust indices of participant's who received the lowest initial scores

- Comparison of average overall change in trust indices of participant's who received the highest initial scores

- General feedback on the process/tool

In the continuing effort to triangulate the data, additional analysis and data validation was conducted by administering the follow-up survey (Appendix M) to the research participants. This survey was administered to all student β-testers at the end of the semester. As a willingness to continue a relationship is a strong indicator of trust, this survey allowed for an additional comparison of treatment groups to control groups to see if there is any significant difference in responses. Additionally, the follow-up survey includes an explicit scaled question regarding whether or not the respondent trusts the person in question.

Each of these evaluation approaches "provides feedback information and a better understanding of the problem in order to improve both the quality of the product and the design process" (Hevner et al. 2004, pg. 78). Researchers suggest that this "build-and-evaluate loop" be iterated several times in order to find the optimal solution (Markus et al. 2002). This reciprocal nature between the development phase and the evaluation phase is critical to the DSR process, and was a key component of my research design.

3.1.4.5 Phase V - Conclusion

This phase signifies the completion of the research effort. In essence, this project was deemed complete when:

1) Data had been collected which significantly supported or rejected the null hypothesis (NULL = *there is no difference between the methods/groups so the tool has no effect on the sample)*

2) The DSR process had contributed to the theoretical body of knowledge on trust in construction.

The project could reach conclusion *despite* deviations in the behavior of the artifact based on original intentions *if* there is a contribution to the theoretical body of knowledge on the subject. The proactive approach to building trust that is a key component of this project stands to make a significant contribution to trust theory regardless of the results. There is sufficient support for the idea that a theoretical contribution is possible whether the artifact is ultimately successful in its purpose or not (Lukka 2003).

3.2 Data Sources

Phase I and Phase III of this project necessitated external data sources. In both cases, human subjects were needed to explore, test and develop the Trust-Builder Tool. As mentioned previously, Phase I was primarily exploratory in nature while Phase III involved a much more targeted application and testing of the Trust-Builder Tool. A

description of the various participants and their recruitment, along with this project's two

Internal Review Board (IRB) approvals is included in this section.

3.2.1 Phase I Research Participants

Research subjects involved during Phase I were selected based on availability and

willingness to participate in this project. They were recruited and administered to in

accordance with Texas A&M University's IRB protocol #IRB2011-0442. Prior to the

participation, all subjects were asked to review the research information sheet included

as Appendix Q per the approved human subjects research guidelines.

3.2.1.1 Semi-Structured Interview Participants

Semi-structured interviews were conducted with willing members of the CIAC and their

project teammates during the early spring and summer of 2011. I requested their help

via a mass email that introduced the topic. I scheduled appointments with those that

responded and were willing to share their time. Participants included owner's

representatives, project managers, superintendents, and some subcontractors. Most of

the interviewees worked in the Houston or Dallas/Fort Worth markets.

3.2.1.2 Observation Participants

Observations were primarily conducted during the project meetings. At the beginning of

these meetings, I would briefly explain the nature of my involvement in their meeting

and the previously mentioned information sheet was made available to everyone

involved. The participant pool during the observations was expanded to include architects, engineers, BIM engineers, foremen and tradesmen. My observations were limited to projects in the Houston and Dallas/Fort Worth markets.

3.2.1.3 Questionnaire Participants

The first questionnaire (Appendix B) was given to four employees in various positions within a general contracting firm from the CIAC. Respondent positions included project manager, estimator and project engineer. The second questionnaire (Appendix C) was administered to 17 participants in two different batches. The first batch was administered to nine upper level and graduate level students in the Construction Science Department at Texas A&M University. The second batch was administered to eight employees from another general contracting firm associated with the CIAC. Respondent positions included vice presidents of operations from a number of different markets, the director of operations, project managers, a vice president of preconstruction, superintendents, and a director of marketing.

3.2.2 Phase III Research Participants

There were two primary external data sources, or categories of research participants that were involved during the β-testing of the artifact. Requirements for the participant involvement during the β-testing were somewhat more stringent as the application of the tool in context became a key component of the research design. All participants were recruited and administered to in accordance with Texas A&M University's IRB protocol

#IRB2013-0104. Like Phase I, the β-testing during Phase III was divided into subsets and different subjects were used depending on the goals of each subset. Prior to the participation, all subjects were asked to review the research information sheet included as Appendix R per the approved human subjects research guidelines.

3.2.2.1 β-Testing Stage I Participants

Stage I was conducted on students enrolled in the Capstone classes (COSC 440, 41, 442, 446) and Construction Graphics classes (COSC 175) of the Construction Science Department at Texas A&M University for Spring of 2013. Students were a good subject group for this stage of the research because of the comparative statistical power available in their numbers. We tested 100 upper level students enrolled in the Capstone courses, complemented by a smaller sampling of 29 first-year students in the Graphics course. The Capstone students will have already experienced a semester-long internship with a construction company and will likely be graduating in May or August of 2013. The Graphics students will be tested as a comparison group, but their data will not necessarily be grouped with the Capstone students in order to avoid potentially excessive confounding variables. These two groups of students were selected because of the group projects included in each course. In addition to lasting the duration of the semester, these projects were designed to simulate real-world construction project experiences and are an adequate and appropriate representation of relational interactions on actual projects.

By utilizing students for this study we were able to minimize potential confounding

variables and improve the validity of results. I recognize that a bias exists with student-

based research data but believe that due to the innovative nature of this project, the

selected students are an appropriate sample for this first-run study. This kind of

approach is common in the fields of psychology and social science where students are

used regularly as an indicator of the wider applicability of a process or a tool. Literature

exists that supports both sides of the debate on the generalizability of student data to a

non-student population (Calder et al. 1981; Lynch 1982; Peterson 2001). As one of the

objectives of this research is to contribute to the theory on trust-building in construction,

I have agreed with Calder et al. (1981) that a student population, despite generalizability

issues, is a good place to start building the case for theory generalization. Sears (1986)

lends support to the idea that student samples are appropriate when testing to see if

something *can* happen. In this case, if trusting behaviors can be artificially introduced

into a group setting and have a positive impact on trust levels. I accept that the data

from Stage I of the β-testing is not perfectly generalizable to the construction industry at

large, but these results will still hold theoretical value and contribute to the body of

knowledge on the subject. Perhaps even more importantly, these results provide a

suitable platform for the future development of the Trust-Builder Tool.

3.2.2.2 β-Testing Stage II Participants

As mentioned previously, Stage II is a follow-up to the β-testing of Stage I. For Stage II,

three active members of the industry community were asked to test version 3.0 of the

Trust-Builder Tool (Appendix O) which was updated based on the results of the first run

study with the students. Case study subjects were selected based on their willingness to

participate and give feedback on the tool. This group was made up of a construction

manager and a project manager from two different general contracting firms located in

Texas, and a construction manager working for a healthcare owner in Colorado.

3.3 Assumptions

As in most research, a number of assumptions have been made to facilitate the

completion of this project. They are as follows:

- A high level of trust is *desirable* in project teams and partners, and conversely, a
  low level of trust and/or distrust is *undesirable*.

- Extant research from the social and behavioral sciences, specifically the trust
  measurement tool created by McAllister, is generally applicable and appropriate
  for application to the construction industry and its participants.

- Student data and analysis is an appropriate stepping stone to industry application
  of the tool.

- Interpersonal trust can be effectively built through extended interactions with an
  individual.

3.4 Scope and Boundaries

Due to the mixed methods approach undertaken for this research project, some phases

have slightly different scopes than others. Data from Stage I of the β-testing is limited to

responses from students in the College of Architecture at Texas A&M University. While two courses (7 total sections) that met the requisite criteria were used to increase the sample size, the data is still limited as to the wider generalizability outside of this population. The student population of Stage I also limited the magnitude and nature of interventions that could be implemented. In an effort to increase intervention completion, interventions were simple and designed to be easily accomplished by a busy student within a week's timeframe in the middle of the semester.

As indicators of potential wider generalizability, the sample of research participants involved in the interviews, observations, questionnaires and Stage II of the β-testing was expanded to focus on construction industry personnel. Due to regional access and funding restrictions, this data is limited to that received from industry players working primarily in the Texas market.

In general, although the topic of trust is arguably applicable to all industries, the scope of this project is limited to interactions and relationships involved in the construction project delivery process in one capacity or another. Findings are specific to construction-related relationships and may not have applicability outside of this context. A description of the limitations of this study is included in Section 5.4.

3.5 Validation

Random assignment, the "repeated measures" design, along with the mentioned control groups for comparison improve the validity of the data for this project. In order to improve the validity of the trust indices, multiple measurements or indicators were taken at each pre- and post-test, the average of which should strengthen response accuracy. Generally speaking, responses were considered useable if the following criteria were met:

1) The research participant completed a minimum of one pre-test and one post-test allowing for an analysis of variance between the various groups.

2) The response to the reverse-coded question on the survey verified intentionality of participant's responses. On rare occasion, the comment section was used to override what appeared to be a contradictory response to the reverse-coded question.

3) Trustor involvement in the intervention process as evidenced by responses to follow-up emails showed completion of the intervention a minimum of 75% of the time.

And finally, in accordance with Lukka's suggestion, the final step in avoiding bias in this process was the sincere critical reflection of the findings (Lukka 2003, pg. 14).

4. RESULTS AND DISCUSSION

4.1 Project Results

4.1.1 Semi-structured Interviews

This section includes the questions used during the semi-structured interview process, a generalized synthesis with implications based on the responses, and a few sample responses supporting the generalization. This exploratory data was used to guide and direct the next stages of this research project.

1. Question: What are your biggest challenges on a project?

    - **Generalization/Implications**: Relational issues are prevalent challenges in the industry. As such, trust is a relevant issue to the industry, especially considering the current system and nature of doing business.

      Sample Responses

      - "Biggest challenge was trust between team members."

      - "Trust is higher in Heavy Civil; we could work on a handshake there. There is no trust in commercial. Because everyone subs everything out, there are too many relationships to manage." (paraphrased)

      - "People are less likely to trust when times are tough."

      - "Unlike the 'good old days', now everything is subbed out so you lose control and you increase your risk."

2. Question: What kind of behaviors would increase/decrease your trust in your

   project counterparts?

   - **Generalization/Implications**: Specific behaviors that we can manage

     and control to some degree impact the levels of trust we have in our

     relationships. This may seem obvious, but recognition of this concept

     changes the paradigm that trust is something that is out of our control –

     that you either have it or you don't. This implies that it can be managed.

     Sample Responses

     - "When a guy comes in and says, 'I can do this, been doing it for 30

       years…' you know you can't trust him. When someone comes in and

       says, 'what can I do to help?' you know you can trust them."

     - "Transparency [builds trust]."

     - "Open sharing of information that the other person isn't expecting

       [builds trust]."

     - "Consistency - a person whose pattern of behavior has traits and

       qualities of consistent and reliable ethical behavior [builds trust]."

3. Question: What consequences might result from high/low trust relationships on a

   construction project?

   - **Generalization/Implications**: Low trust creates what Covey and Merrill

     (2006) call a "trust tax" in interactions. This is a form of waste that is

     occurring on construction projects. High trust, on the other hand, creates

     a "trust dividend" that can save time and cost (Covey and Merrill 2006).

- "When we [architect] don't trust the GC, we have to do the work for
  them (e.g., call the subs)."

- "We trust each other so we don't even have to wait for a signed
  change order. This saves time."

4. Question: Has project delivery method or contract type ever impacted your
perception of trust on a project?

- **Generalization/Implications**: Participant responses suggest that more
  collaborative project delivery methods are preferred by practitioners, and
  that trust is a necessary component for increased collaboration.
  Additionally, it seems that traditional systems can actually change
  behavior towards counterparts, even within the same relationships.

  Sample Responses

  - "Our first job with Company XYZ (name withheld) was hard bid.
    Once trust was built with them on that job, the next job was
    Construction Manager At Risk (CMAR)."

  - "From personal experience, IPD, or whatever you call it, is the best
    way to do a job… IPD is trying to bring back the benefits of the 'good
    old days' within today's business structure."

  - "We had the same team working on an IPD project and a DBB
    project. One day I got a call from the owner and he asked me why I
    was treating him so differently on the DBB project." (paraphrased)

90

5. Other noteworthy statements made during interviews:

    - "We actually include a conspicuous clause in our contract stating that they [the subcontractors] are responsible for everything, even others mistakes."

    - "Our relationship with [the owner] allows confidence and trust that we can proceed even if GMP is not yet finalized."

    - "Just keep the architect and engineer away from here because all they do is cause me problems."

    - **Generalization/Implications**: A construction job site has many examples that build or damage trust, from deliberate deception to apparently misaligned objectives between project players.

4.1.2 Observations

Key points and behaviors noted during the observations are included below along with their possible implications. I believe they are indicative of the current state of trust on the visited job-sites. The observations are divided into categories of low-trust and high-trust examples:

4.1.2.1 Examples of High-Trust Behaviors

a. Project representatives were talking about a certain sub on another job that had committed to getting something done, superintendent says, "If he said it, he'll get it done."

b.   Concrete subcontractor committed to a completion date for a section of grade beams, but also said he could probably do it quicker.

c.   Utilized a BIM of the project on a smart board to ensure communication was clear and understood by everyone at the meeting.

d.   Owner asked the GC, "What can we do to help?" after being informed that the project was a little bit behind. The GC responded by giving credit to the architects for staying late and working weekends to try to help them catch up.

  - **Generalization/Implications**: Some people seem to be capable of building and maintaining trust. However, for those who want to build and maintain trust more effectively, examples of behavior and suggestions for approaches would be helpful.

4.1.2.2 Examples of Low-Trust Behaviors

a.   Following a subcontractor meeting in which various commitments were made by a particular sub, the project superintendent said, "I just felt a lot of hot air go up my [edited for language]."

b.   After a subcontractor reported that they did not know that they were supposed to replace a certain fixture, the superintendent responded by yelling, "That's not my problem!"

c.   Referring to his superintendent completing a certain project, the project manager says, "He's been telling me an hour for 6 weeks now."

d. This particular project was up against its deadline, project manager says, "I don't need team players right now, I just need to get it done."

e. Owner of a concrete company promised a certain slab was level; the project manager said he would have his person check it Friday to make sure.

f. While walking a job site, a subcontractor said that he wanted to push the architect in the ditch and bury him.

g. While talking about a certain contractor about to start work on the job, another subcontractor said, "You're climbing in bed with the devil." Despite the poor reputation and understood inherent difficulties, this subcontractor was still awarded the job in order to meet their minority requirement.

h. First question in a meeting between owner, architect and GC was from the architect directed at the GC regarding a schedule update. The contractor did not have it, and the architect later admitted that he already knew that, apparently wanting to point it out to the owner.

i. Adversarial seating arrangement during a meeting, setting one side against the other.

j. Architect audio recorded the entire meeting.

- **Generalization/Implications**: These examples describe typical practices and comments that support a vicious cycle of low trust and/or distrust, whether we realize it or not. In order to reverse this trend, we must make a proactive and deliberate effort to focus on our relationships and lead out in trust-building.

4.1.3 Questionnaires

Like the interviews and observations, the questionnaires were used as part of the first

step in the DSR process - "Awareness of the Problem." The questionnaires are both

included as appendices for reference.

4.1.3.1 Questionnaire 1

The questions, followed by a synthesis and generalization of the responses, along with a

few sample responses from the first questionnaire (Appendix B) are as follows:

1. Question: Think of a project that you participated in that you would consider to

   have been successful. If you had to pick the biggest contributing factor to this

   success, what would it be? Why?

   - **Generalization/Implications**: High levels of trust as evidenced by

     effective collaboration, is perceived as being a key ingredient to

     successful projects.

     Sample Responses

     - "Trust. Trust provided a platform for good teamwork and enabled

       collaboration, which benefited the project. All project participants

       trusted one another and worked toward a common goal. On one

       project we occasionally gathered the project team together and met at

       the Owner's dining room table."

     - "A sense of trust between the owner, architect and builder. The

       reason is because there is an efficiency gained when you are not

always watching your back. You don't have to manage the project

from a legal/claims management standpoint."

- "Teamwork. When everyone keeps in mind the same end goal, and

agrees upon the same end goal, a very collaborative team environment

can be created among all parties involved. Collaboration leads to

better planning, better execution, and an overall better end result."

- "Collaboration. No matter what was thrown at us, (including adding a

skylight on a circular tower after the roof system was completely

installed), we knew that everyone was on board to work their hardest

to overcome the issue. Lag time in between hand-offs was basically

non-existent, cutting way back on wasted time."

2. Question: What were the major differences between your experiences on lean vs.

DBB/CSP projects? Was it worth it?

- **Generalization/Implications**: A heightened awareness and focus on

trust and collaboration as cultivated during lean project delivery seems to

be able to effectively improve trust levels and collaborative abilities.

Sample Responses

- "…an upfront approach to encourage collaboration and continuous

improvement, as is the case with Lean will benefit a project. *The*

benefit on Lean projects is that [continuous]

improvement/collaboration are stated goals that the project

participants focus on. DBB and CSP project lends itself to

compartmentalized thinking, which could result in added strain on a

project as unresolved items are identified later in the project's

development." (emphasis added)

- "As stated above, the biggest factor in project success is trust between

the parties, particularly from the owner's side. Lean concepts are

important, but owner trust is not exclusively a Lean concept."

3. Question: What do you think contributes most to a high-trust job environment?

Why?

- **Generalization/Implications**: Specific behaviors listed such as doing

what you say and extending trust to others (i.e., allowing vulnerability)

are in line with previous research on antecedents to trust.

Sample Responses

- "Integrity. Keeping your word to others and ethical treatment of

others develops a trustworthy relationship between team members

that is hard to compromise."

- "Doing what you say. Everyone is busy and project stakeholders

need to rely on other team members. You don't have time to double

check the work of others and you depend on them doing their work

correctly. A high level of trust is developed when your team

members go above and beyond what is commonly expected."

- "Vulnerability. Allowing yourself to be corrected by one of the foremen as a positive thing would really establish trust across the entire project team."

- "The owner being comfortable with the builder and being able to trust the builder. Usually the builder has some trust in the design team. However the total environment of trust usually starts with the owner."

- "Transparency. No hidden agendas and openness allows collaboration."

- "Honesty and extending trust before requesting trust. It's more important to give trust to allow others to trust you."

4. Question: What do you think contributes most to a low-trust job environment? Why?

- **Generalization/Implications**: Low-trust behaviors lead to reciprocal low-trust behaviors.

  Sample Responses

  - "When the owner does not trust the builder or architect, this flows through to all the relationships on the project."

  - "Not being able to have input hurts trust, but not as much as having input that is ignored."

  - "Ego. A person's ego leads to poor communication, lack of follow through (possibly because of inability to complete a task) and poor team performance. A project needs to be able to rely on its team

97

members and/or seek out team members with different expertise to complete an assignment."

- "Lack of follow through on commitments. If people do not follow through with their commitments, then a lack of trust begins to brew in the environment."

- "Lack of communication. It would seem that things are hidden and not as they should be. Lots of suspicion."

- "The lowest bid mentality. Once you lose respect for capabilities or commoditize the players, it's easy to blame, rather than fix, it's easy to dehumanize the other team members and just look at them as transactors in a 'contract'."

- "Lack of honesty and hidden agendas. Once someone displays a lack of integrity or dishonesty everything else will be questioned."

5. Question: Do you think that the level of trust on a project influences the productivity and overall project success? In what ways?

   - **Generalization/Implications**: This data supports previous research that higher levels of trust have a positive effect on team performance.
     Sample Responses
     - "Yes. People are more willing to go the extra mile and meet their commitments to the project team if there is a strong trusting relationship between all parties. If there is a level of distrust amongst

the team, then team members will constantly be looking out for

themselves and not looking towards achieving the common goals."

- "Yes. If you trust your management or team, you are more willing to

put forward your best effort. The fear of failure or uncertainty

associated with the unknowns is removed. Individuals are able to

perform at their best and know that their efforts will be rewarded and

all team members will benefit. When you lose trust, everything is

eroded and everyone begins to look out for his or her own interest.

This may not lead to a failed project, but the overall value that could

have been created is diminished."

- "Trust is the foundation that allows Lean practices to be used on a

project. There is no collaboration or communication without trust,

and therefore no Lean."

Data gathered from the first questionnaire lent support to the interview and observation

findings and further confirmed the value and applicability of the topic to industry

participants. Additionally, this data provided some support for the idea that simply

making trust a deliberate action item can positively affect the entire team and process.

4.1.3.2 Questionnaire 2

Questionnaire 2 (Appendix C) was very similar to questionnaire 1 with minor changes in

the wording of a few questions, the inclusion of one additional question, and a slight

change in administration as noted in the methodology. Sample responses from the

second questionnaire were included in Section 4.1.3.1 where questions were unchanged.

This section includes additional results that were obtained as a consequence of the minor

changes to the questionnaire between the two administrations.

It is interesting to note that when asked what the top three contributing factors to a

successful project were (slight alteration to question #1 from the previous questionnaire)

only a few responses included a specific mention of trust. However, trusting behaviors

were regularly included as explanations for why listed factors were important to project

success. This was particularly noticeable in the factor most commonly listed –

teamwork. Table 12 shows the top five factors and the number of times they appeared in

response to question #1.

Table 12: Top Five Factors Contributing to Successful Projects

	Factors Contributing to Project Success	Number of Times This Factor Listed in a Respondent's Top Three (17 Total Respondents)
1	Teamwork (Trusting Relationships, Collaboration)	13
2	Effective Planning	9
3	Effective Leadership	4
4	Shared Responsibilities and Team Member Specialization	5
5	Communication	4

Due to the high likelihood of respondents not having had experience with Lean project delivery, question #2 was reworded. The new question, generalization of the responses and implications, along with sample responses from the industry respondents follow:

1. If you could pick a project delivery method (e.g., Design-Bid-Build, Design-Build, Construction Manager at Risk, Integrated Project Delivery, etc.) for your next project, what would it be? Why?

    - **Generalization/Implications**: The responses were widely scattered and generally inconclusive.

      Sample Reponses

      - "CMAR. It is more collaborative…"

      - "IPD. It brings all the best technologies, innovation and teamwork into the equation. At least it makes these things a possibility. This is the cutting edge of construction delivery and the best possible way to ensure that all project stakeholders meet their goals."

      - "DB. It's where my experience is. It generally results in collaborative owner/contractor relationships. It allows us to add value early when we can do something about it. Less errors. More time to plan. More input on constructability."

Interestingly, of the eight industry respondents to this questionnaire, all of whom work for the same general contractor, three picked CMAR, three picked DB, one picked IPD, and one didn't select a specific delivery method. This is worth noting because if eight

leaders of the same general contracting firm disagree on what the best way is to deliver a project, it is not surprising that the industry has failed to move to and fully embrace any of the newly emerging delivery trends. The ability of these various evolutions of project delivery methods to create highly successful team environments has not been generally accepted or proven at this point.

The question that was added to the second questionnaire, a synthesis and generalization of the responses, and a few sample responses follow:

1. What are some alternatives to "trust" that you see employed in your projects or workplace?

    - **Generalization/Implications**: The construction industry has a set of common practices that are implemented in situations where trust is low that allow us to "get by" without addressing the root cause of the problem.

      Sample Responses

      - "Micromanagement"

      - "Exclusion"

      - "Fighting through problems"

      - "Going around problem source"

      - "Contracts"

      - "Loud voices"

      - "Command/Control style"

- "Inspection"

- "Double and triple checking"

- "Intimidation"

- "Rewards and incentives"

- "Planning my work with contingency to avoid uncertainties and have some leeway"

It is my belief that many of these practices actually perpetuate vicious cycles of low-trust behaviors, thereby supporting the predominant low-trust mentality in and around the construction industry.

4.1.4 α-Testing of the Artifact

The artifact underwent a few major revisions during the α-testing process, or internal review process. Results from the α-testing in the form of recognized problems with version 1.0 (Appendix D) are listed in Table 13, along with the corresponding changes made in version 2.0 (Appendix E).

Table 13: α-Testing Results – Problems Recognized and Adjustments Made

	Problems with version 1.0	Resultant adjustment in version 2.0
1	Clarification of "Trust Index" needed in order to minimize input mistakes (e.g., understanding if 1 is a better trust index than 10).	Graphically enhanced the "Trust Index" to include Low to High scale with an arrow.
2	Benchmark understanding of "Trust Index" also needed (i.e., what does a trust index of 10 look like?).	Included brief descriptions of what a few of the indices might look like. This should make it easier for people to accurately rate their trust level with their counterpart.
3	Internal validity concern – Will respondents just compare their "Beginning Trust Index" and arbitrarily increase it on the "Resulting Trust Index" because of self-presentation bias, faking, or because they know they are being asked about trust?	Separated the artifact into two different stages. Consequently, when respondents are filling out stage 2, they will not be looking at their stage 1 Trust Index. It is not likely that participants will remember what they put on stage 1, therefore encouraging a more honest response in stage 2.
4	Inadequate space for response and analysis by the respondent.	Response box sizes were increased and "Comment" was added to help clarify how the boxes should be used.
5	Lack of clarity on what information should go in some of the boxes (e.g., "Root Cause Analysis" may not mean anything to the respondent)	Added questions and additional explanation to the title boxes of the various sections. This should clarify to respondents how they should respond.
6	Lacking a feedback loop necessary for continued improvement of the artefact.	Added an additional box at the end of stage 2 for feedback regarding the effectiveness of the tool in accomplishing its design.

Upon completion of the α-testing, the tool was prepared for wider exposure to the

various external reviewers.

4.1.5 β-Testing of the Artifact

As detailed in the methodology, β-testing was conducted in two stages in order to obtain

additional feedback for the continued development and evaluation of the tool.

4.1.5.1 Stage I

Stage I of the β-testing was designed to reduce variables in order to isolate the effect of the tool in a group setting. The survey was simplified and delivered repeatedly in order to assess its impact. Stage I consisted of administration of the tool to two different classes with different student populations. I have included a detailed descriptive and inferential statistical analysis of the Capstone classes' results as the majority of the data comes from that group. The data from both classes was not combined for analysis to avoid additional potential confounding variables resulting from the differences in samples. Section 4.1.5.1.1 does include some overall descriptive and inferential comparisons *between* the Capstone and COSC 175 classes. However, the sample size and response rate of the COSC 175 data did not justify a detailed separate inferential analysis of the control and treatment group data specific to this class.

The significance level for inferential analyses was set at $p = 0.05$. The p-value indicates the likelihood that the results occurred by chance. *P*-values less than 0.05 indicate that the result would be highly unlikely under the null hypothesis (no relationship), and therefore show support for the hypothesis. Effect size calculations and evaluations vary depending on the analysis, the details of which are included in the following sections.

4.1.5.1.1 Capstone vs. COSC 175

The overall response rate over the five tests and the collected data points for each class are included in Table 14. The table includes each class' average Trustor intervention

completion rate along with the resultant available quantitative data points from Stage I of the β-testing.

Table 14: β-Testing Stage I Response Rates, Intervention Completion Rates and Resultant Data Points by Class

Class	Survey Response Rate	Trustor Intervention Completion Rate	Resultant Data Points (approximately)
Capstone	84%	81%	15730
COSC 175	59%	80%	2350

The resultant data points include each item or response for every completed survey. Non-responders were generally students that missed class on the day the test was administered. Despite using the same exact scripts and approach to collecting the data, the response rate for the lower-classmen (COSC 175 students) was substantially lower than for the upper-classmen (Capstone students).

The key metric used to determine the effectiveness of the treatment was the change in trust levels experienced by the participants over the course of the project. The change in trust index was calculated by taking the latest available trust index of a relationship and subtracting the earliest available trust index for the same relationship. Table 15 shows the descriptive statistics for the overall change in trust index for both classes where class is the independent variable and overall change in trust index is the dependent variable.

Table 15: Descriptive Statistics for Overall Change in Trust Index by Class

Class	N	Mean	Standard Deviation (SD)
Capstone	312	0.2398	0.8489
COSC 175	53	0.5041	0.8101

The N values are higher than the number of respondents because each participant is completing the survey between two and five times, depending on the number of teammates they have. For example, although there are only 100 student participants from the Capstone classes, Table 15 shows an N value of 312 because each student completed surveys regarding three other individuals. An independent-samples t-test conducted on this set of data indicated a significant difference between the class averages where $t(363) = -2.110$, $p = 0.036$ (two-tailed), suggesting that there *was* statistical significance in the difference between the class and the average overall change in trust index. This finding was somewhat surprising in that it indicated that the lower-classmen were able to build trust more effectively than the upper-classmen. In order to determine the magnitude of the difference, the effect size was also calculated: eta squared (η^2) = 0.012. Cohen proposes the following guidelines for interpreting the η^2 value (Cohen 1988, pg. 284-287):

- 0.01 = small effect

- 0.06 = moderate effect

- 0.14 = large effect

According to Cohen's guidelines, the calculated value of $\eta^2 = 0.012$ in this case indicates

a small effect size meaning that the difference was small despite the significance

suggested by the *p*-value.

As a follow-up to this comparison, I decided to compare the initial trust index for both

classes. I expected that on average, the initial trust index would be higher for the

Capstone classes as the students have had time to build relationships and establish higher

levels of trust during their time in the program in comparison to the COSC 175 students

who are likely meeting each other for the first time. This would also allow for a greater

amount of relative increase in COSC 175 scores. The baseline test results were used for

this initial analysis. Table 16 reports the descriptive statistics where class is the

independent variable and initial trust index is the dependent variable.

Table 16: Descriptive Statistics for Initial Trust Index by Class

Class	N *	Mean	SD
Capstone	269	5.4214	0.8874
COSC 175	64	5.0021	1.1529

*N values differ from Table 16 because some students were not present for the baseline test
therefore their responses were not included in this analysis

An independent-samples t-test on this data confirmed the hypothesis that class was also a

significant indicator of initial trust level. The t-test for equality of means returned *t*

$(331) = 3.195$, $p = 0.002$ (two-tailed). Despite this significance, the effect size for this

set of data was between small and moderate according to Cohen's eta squared value interpretation. In this instance, $\eta^2 = 0.03$.

Both classes' overall average trust index for each of the five tests were also calculated and analyzed. At this point in the analysis, the class data had not been separated into control and treatment groups. Table 17 compares the overall class averages:

Table 17: Overall Average Test Trust Index by Class

Class	Baseline	Test #1	Test #2	Test #3	Final Test
Capstone	5.4214	5.6070	5.6192	5.7433	5.7645
COSC 175	5.0021	5.0938	5.3022	5.4607	5.7774

Both sets of data show support for an assumption listed in Section 3.3 that is critical to this research: interpersonal trust can be effectively built through extended interactions with an individual.

This assumption is supported by the fact that in both classes, the overall trust levels of the students increased incrementally in each consecutive test. This suggests that trust is being built, as perceived by the team members. It also suggests that the number of people perceiving an increased level of trust and/or the magnitude with which trust levels increased was greater than the number of people who perceived broken or decreased levels of trust during the same span of time. Figure 10 shows this trend:
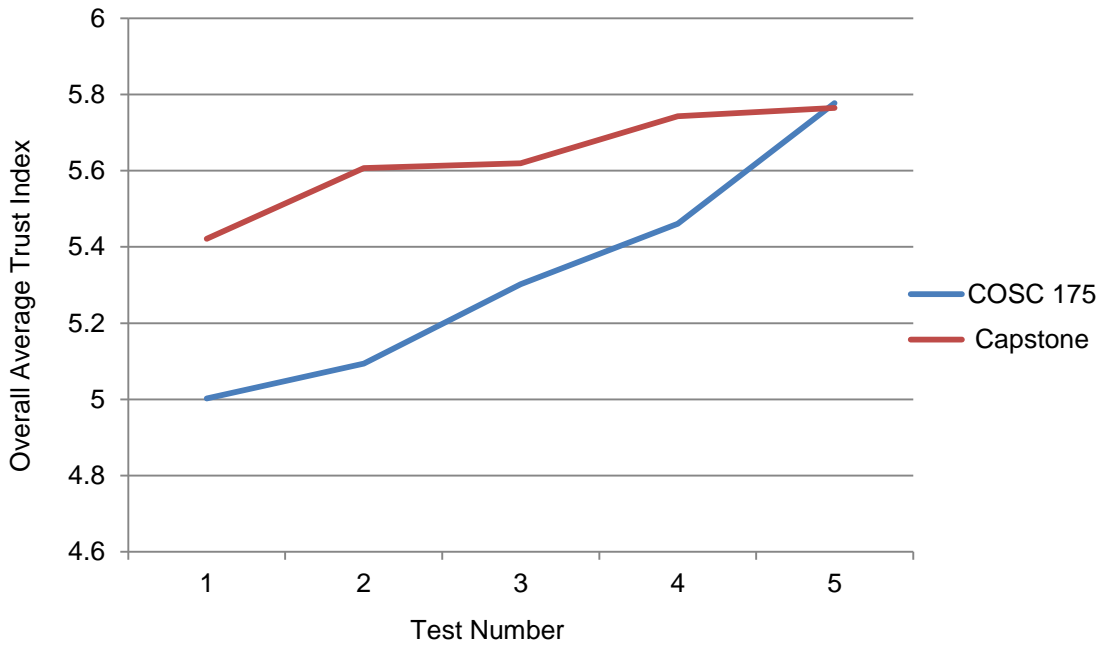
Figure 10: Average Overall Trust Index by Test – COSC 175 vs. Capstone

In addition to describing the results included in Table 17, Figure 10 also graphically illustrates the results included in Tables 16. It is clear that the average between the classes was significant at the initial test, and also that the COSC 175 students experienced a higher overall change in trust levels over the five tests.

The slope of the lines in Figure 10 are determined by the difference between the average scores of each pre- and post-test. Table 18 shows these differences:

Table 18: Average Overall Change between Tests by Class

Class	Delta 1	Delta 2	Delta 3	Delta 4
Capstone	0.1855	0.0122	0.1241	0.0212
COSC 175	0.0916	0.2085	0.1585	0.3167

110

On average, the Capstone students experienced their biggest overall change in trust index between test #3 and the final test (delta 4 = 0.3167). The COSC 175 students experienced their biggest overall change between the baseline test and test #2 (delta 1 = 0.1855). This information is valuable in that if both groups had experienced their largest change in trust index levels in the same interval, there would have been reason to more closely analyze what happened during that interval. As it is, there is no support in this data for any theory specifying when the greatest impact opportunity is for building interpersonal trust within group interactions.

4.1.5.1.2 Male vs. Female

An independent-samples t-test was conducted to compare the baseline trust index for males and females. There was no significant difference in scores between the men (mean = 5.387, SD = 0.8596) and women (mean = 5.6052, SD = 1.0094) where t (266) = -1.507, p = 0.133 (two-tailed).

Likewise, the overall change in trust index data between men (mean = 0.2234, SD = 0.8558) and women (mean = 0.3164, SD = 0.8193) was analyzed and no significant differences were found where t (310) = -0.737, p = 0.462 (two-tailed).

4.1.5.1.3 Treatment vs. Control

As mentioned earlier, the data used for this portion of the analysis came exclusively from the Capstone classes. Although the large amount of data collected allowed for

additional analysis and hypothesis testing, the primary goal of this portion of the project was to determine whether or not I could "artificially" introduce a trust-building intervention into a group setting and affect the levels of interpersonal trust between the various relationships. The key indicator for this hypothesis is the overall change in trust index experienced by the various participants. As a reminder, this number was determined by subtracting the trust index of the latest available test, in most cases the final test, from the earliest available test, in most cases the benchmark test. Using the change in trust index as the primary dependent variable for some of these comparisons mitigates the potentially confounding variable of each individual's propensity or disposition to trust, which is likely to be different for each participant. Also, the randomized control group approach provides additional internal validity to the results.

The first test attempted to determine whether or not there was any statistical significance in the difference between the two groups' initial trust index, as measured by the baseline survey. Using an independent-samples t-test, I found no significant difference between the treatment group (mean = 5.4809, SD = 0.8722) and the control group (mean = 5.3647, SD = 0.9039) where t (266) = -1.070, p = 0.285 (two-tailed). With this understanding, I proceeded to an analysis of the remaining tests.

Figure 11 shows the average trust indices experienced by members of the treatment groups in comparison to those of the control groups across all five tests.
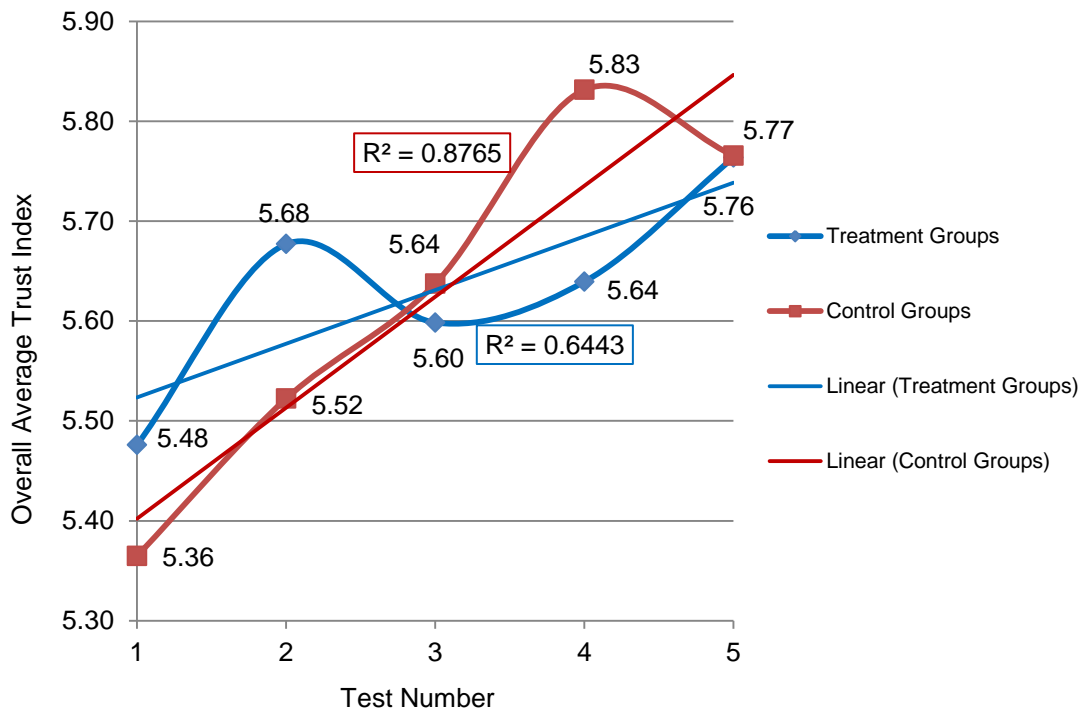
Figure 11: Average Overall Trust Index by Test - Treatment vs. Control

The initial analysis of the control and treatment group data did *not* support the

hypothesis that a deliberate trust-building intervention by the Trustor in the treatment

group would positively impact the levels of interpersonal trust existing within a group.

It is clear from Figure 11 that the treatment groups seemed to actually be building trust

at a slower pace than the control groups. The two linear regression lines indicate the

best possible line for predicting future scores based on extant data. It is interesting to

note that the slope of the treatment linear regression line is 0.0537, less than half of the

control group's linear regression slope of 0.1111. The R^2 values, also known as the

"Coefficient of Determination" for the linear regression lines included in Figure 11

indicate that the line for the control groups is more accurately describing and predicting

the data points than the line for the treatment groups (R^2 value closer to 1), although both

R^2 values are relatively strong. The results might also suggest that the Hawthorne Effect

was in operation on this data. However, various techniques were used in the design of

this test in an attempt to minimize any potential impact (see Section 3.1.4.3.2.1).

To get a better feel for how things were trending with each group, I averaged the change

in trust index between each of the five tests. Analyzing the change in trust in this

manner shows a different trend than that seen when only looking at the average score.

Figure 16 shows the average change or delta between each of the tests for both groups.

Interval 1 represents the change between the baseline test and test #1. Interval 2

represents the change between test #1 and test #2, and so on. It should be noted that the

average change between tests described in Figure 12 is not equal to the difference

between the average trust index scores shown in Figure 11, as evidenced by negative

average changes in some instances. This is a result of some participants randomly

missing tests, so their changes were transferred to the next interval in the data

calculation.
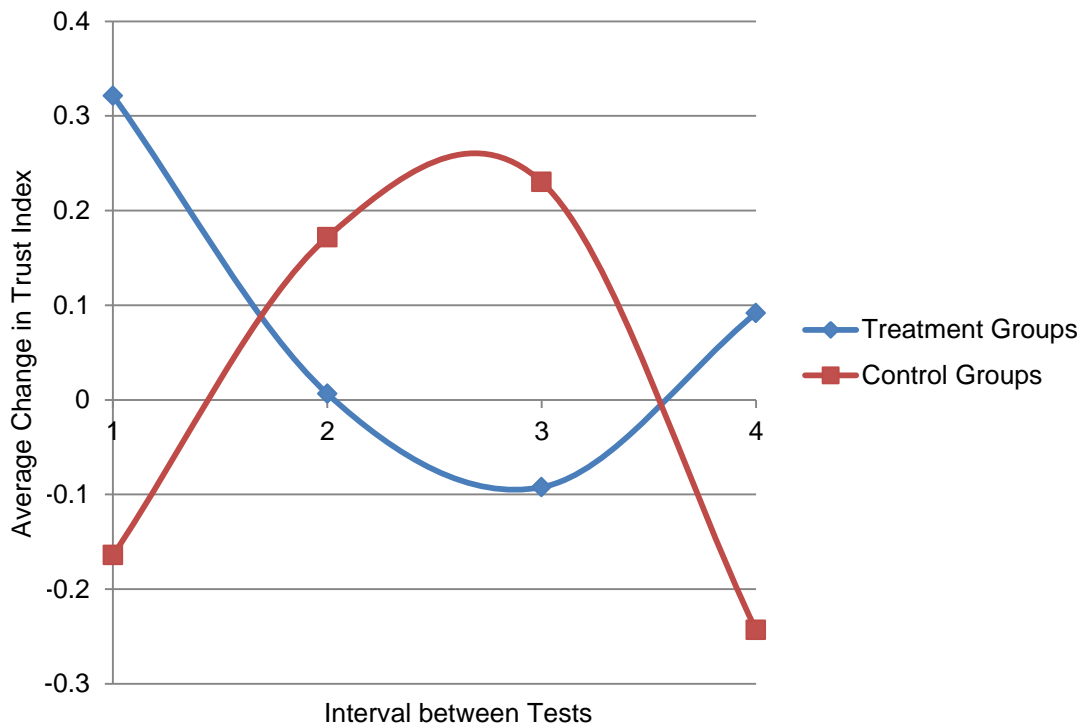
Figure 12: Average Change in Trust Index between Tests

The trending here is interesting, although not conclusive. Figure 12 shows that the change for the control groups, while initially increasing, started to trend downward in interval 4, the time between test #3 and the final test. In contrast, the change experienced on average for the treatment groups began to trend upward in the final interval.

The *overall* average change in trust index was then analyzed between the two groups, again using an independent-samples *t*-test. The results of the test showed no significant difference between the overall change in trust index between the treatment group (mean

= 0.1728, SD = 0.8195) and the control group (mean = 0.3067, SD = 0.8748) where t (310) = 1.395, p = 0.164 (two-tailed).

Figure 13 shows the frequency of the responses for both the treatment and control groups. Each bar represents the number of times that the change in average overall trust index for an individual in each group fell within the indicated range. There is a similar distribution between the two groups, with what appears to be a slight difference in favor of the control group on the positive side. The treatment group responses are more heavily concentrated in the central increments of the distribution.
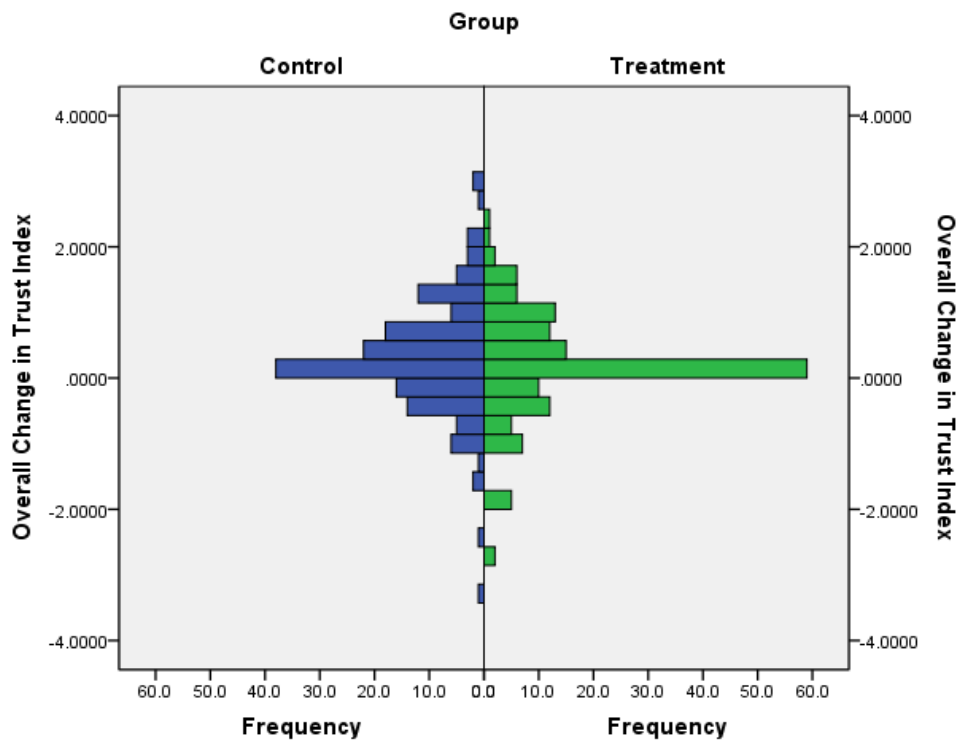
Figure 13: Frequency of Average Overall Change in Trust Index – Treatment vs. Control

An independent-samples t-test comparing the initial trust index of the two groups found that the average initial trust index of the treatment group was higher than the control group, but was also insignificant at $t\ (266) = -1.070$, $p = 0.285$ (two-tailed).

4.1.5.1.4 Treatment vs. Control vs. Trustors

Due to the significant role the Trustors played in the project, the next angle of analysis involved removing their data from the treatment groups. This allowed me to test the hypothesis that additional focus on the other individuals in their group in the form of intervention implementation would increase the interpersonal trust levels of the Trustors at a rate greater than the other two groups. Literature suggests that one way to begin building trust is to extend it to one's counterpart (Covey and Merrill 2006). This is also in line with the Virtuous Cycle of Trust-Building Model introduced in this research.

Once again, I started with a comparison of the initial trust index as determined by the baseline survey. I tested first to see if there was any statistical significance in the difference between the three groups' initial trust index. Using a one-way ANOVA, I found no significant difference between the treatment group without the Trustors (mean = 5.4100, SD = 0.8867) the control group (mean = 5.3647, SD = 0.9039) and the Trustor group (mean = 5.6936, SD = 0.8882) where $F\ (2, 265) = 1.885$, $p = 0.154$. With this understanding, I proceeded to an analysis of the average overall change in trust indices of the three groups.

Table 19 shows the descriptive results for the analysis of the overall change in trust

index between the treatment, control, and Trustor groups. The means are then

reproduced in Figure 14 to graphically show the relationship between the numbers.

Table 19: Descriptive Statistics for Average Overall Change in Trust Index by Group

Group	N	Mean	SD	Standard Error (SE)
Control	156	0.3067	0.8748	0.07
Treatment	119	0.0955	0.8278	0.076
Trustor	37	0.4216	0.8489	0.1233
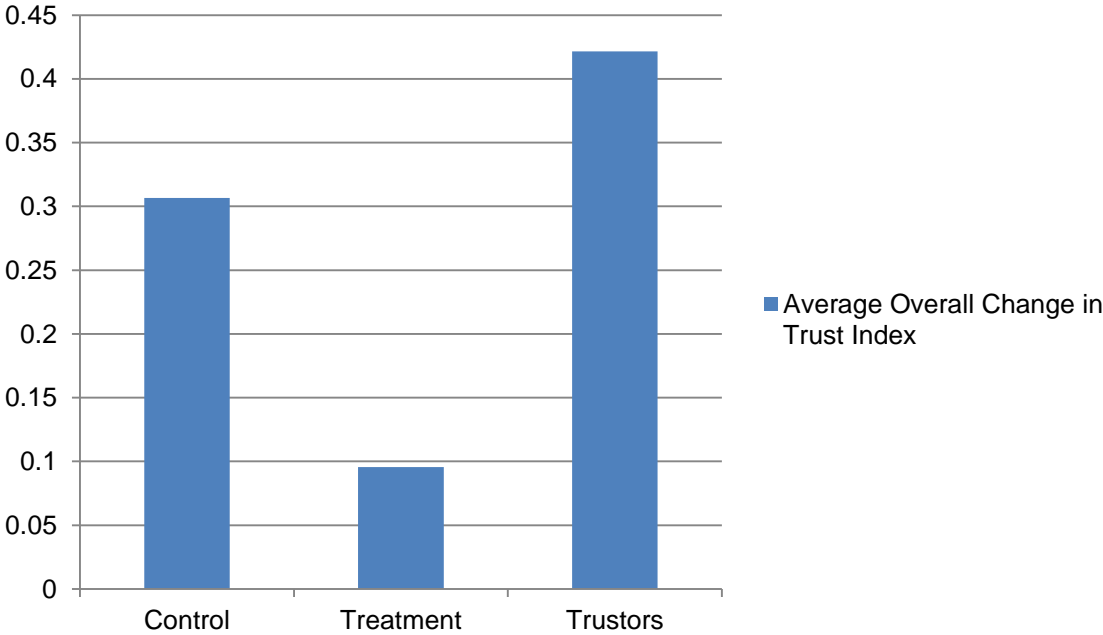
Figure 14: Average Overall Change in Trust Index by Group

In order to better understand the distribution of this data set, I created a histogram indicating the relative frequency of responses from each group. The plotted curves are polynomial regression lines that represent the distribution of each dataset as accurately as possible. Figure 15 describes a slight skew in all three sets of data to the left, signifying that it is not a perfectly normal distribution.
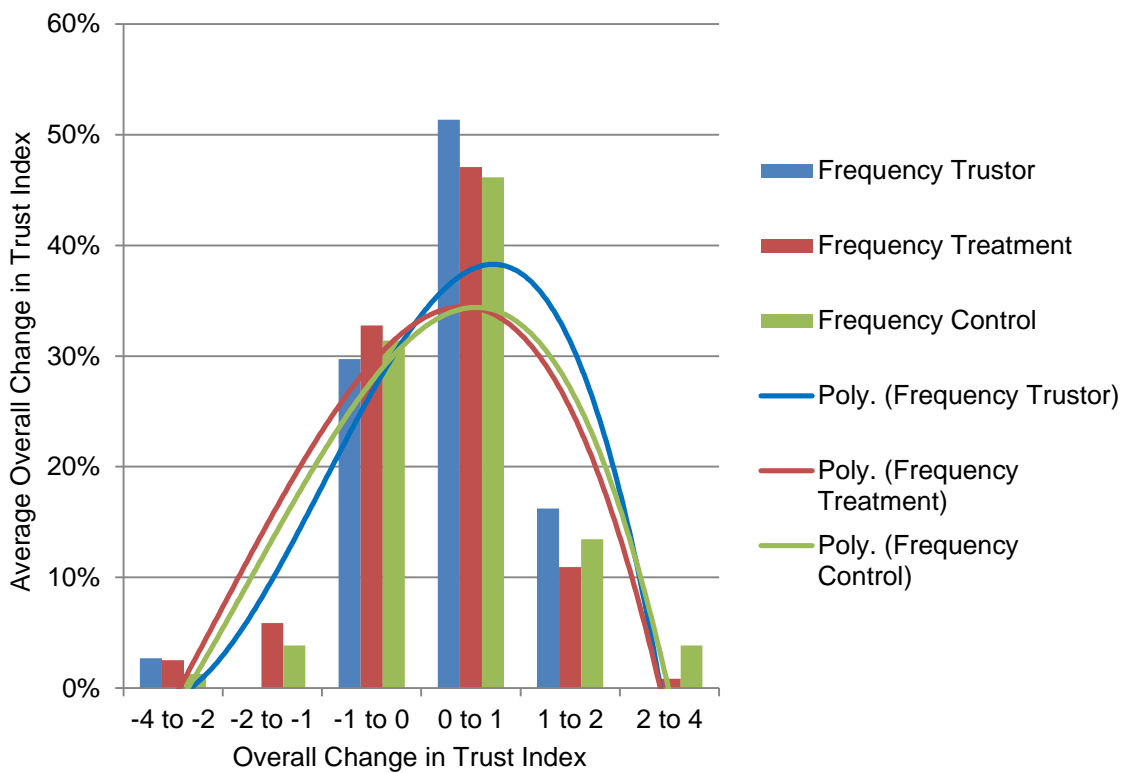
Figure 15: Relative Frequency of Average Overall Change in Trust Index by Group
(Poly. = polynomial regression)

The control and treatment group curves are very similar with the control curve beginning and ending slightly ahead of the treatment group. It is also clear that the Trustor group contains a higher concentration of participants experiencing a change in trust index in

the "0 to 1" and "1 to 2" categories. Also, the Trustor group curve shows a somewhat less normal curve pattern, skewing slightly more to the left.

Based on this set of data, a one-way between-groups analysis of variance (ANOVA) was conducted to determine the significance of the apparent differences between the groups. This analysis showed some statistical significance in the differences between the groups, although not in the way that I originally expected. Table 20 details the ANOVA output for the comparison across the three groups.

Table 20: ANOVA Output for Average Overall Change in Trust Index by Group

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	4.400	2	2.200	3.094	0.047*
Within Groups	219.708	309	0.711		
Total	224.108	311			

* Indicates significance at the 0.05 level

This table indicates that at $F (2, 309) = 3.094$, $p = 0.047$. Despite reaching statistical significance, the actual magnitude of the difference between the mean scores of the groups was still relatively small. The effect size was $\eta^2 = 0.02$.

Figure 16 shows the data as a boxplot for additional analysis. The numbers next to the circles and stars represent specific cases from the dataset that were identified as being outliers; stars representing the most extreme cases.
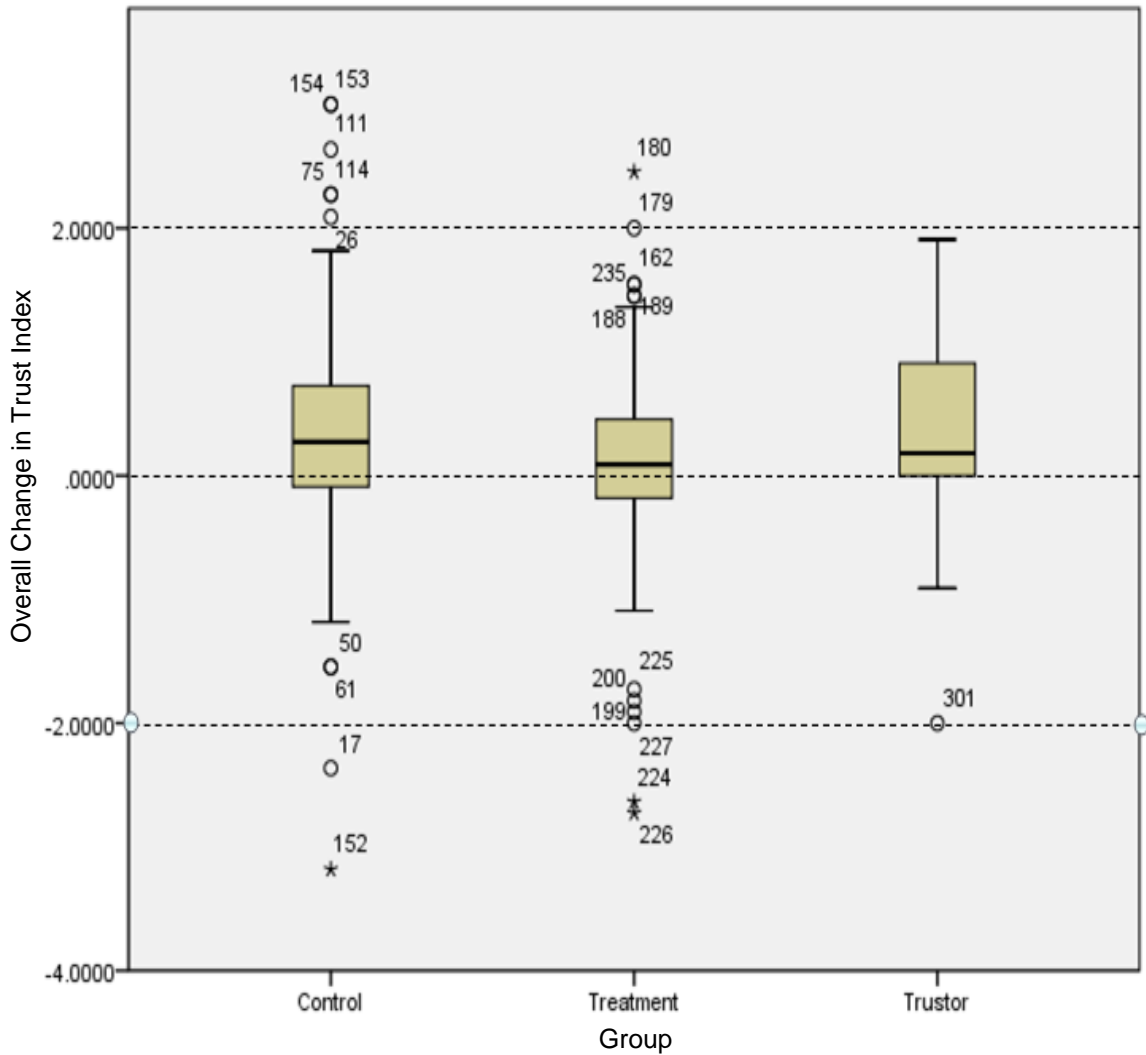
Figure 16: Boxplot of Average Overall Change in Trust Index by Group

As is common in statistical analysis, the outliers were then removed from the data and the ANOVA test was run again to see how the results would change. Table 21 and Figure 17 detail the descriptive statistics output for the same analysis shown in Table 19 and Figure 14 but without the outlier data included.

Table 21: Descriptive Statistics for Average Overall Change in Trust Index by Group with Outliers Removed

Group	N	Mean	SD	Standard Error (SE)
Control	146	0.2853	0..6513	0.0539
Treatment	107	0.1283	0.5565	0.5380
Trustor	36	0.4889	0.6373	0.1062
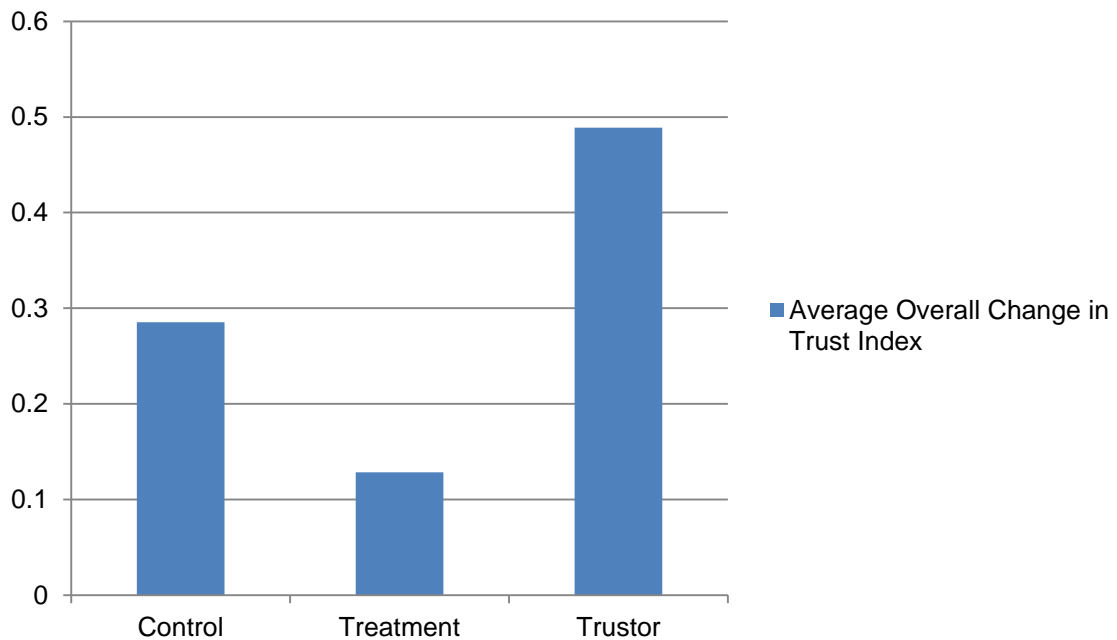
Figure 17: Average Overall Change in Trust Index by Group with Outliers Removed

Removal of the outliers caused a slight increase in the difference between the low and high groups as shown in Table 21. Another one-way ANOVA was conducted on the updated set of data to determine how impactful the outlier cases were. Table 22 shows the ANOVA output.

Table 22: ANOVA Output for Average Overall Change in Trust Index by Group with Outliers Removed

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	3.791	2	1.896	4.994	0.007*
Within Groups	108.552	286	0.380		
Total	112.343	288			

* Indicates significance at the 0.01 level

In contrast to the previous analysis, this table indicates that at $F(2, 286) = 3.791$, $p = 0.007$. The significant differences suggested by this analysis were accompanied by an increase in the η^2 value to 0.034.

As the ANOVA test and its associated F statistic are considered to be an "omnibus" test, meaning that it returns a non-directional overall significance statistic, additional post-hoc testing was necessary to determine where the significant difference was between the groups. The Tukey HSD test indicated the mean score for the treatment group was significantly different from the Trustor group, but that there was no significant difference in any of the other comparisons. Table 23 includes the results of the Tukey HSD post-hoc test.

Table 23: Tukey HSD Post-hoc Test Results for Average Overall Change in Trust Index by Group with Outliers Removed

Group (I)	Group (J)	Mean Difference (I – J)	SE	Significance
1 Control	2 Treatment	0.1540	0.0784	0.123
	3 Trustor	-0.2066	0.1146	0.171
2 Treatment	1 Control	-0.1540	0.078	0.123
	3 Trustor	-0.3606	0.1187	0.007*
3 Trustor	1 Control	0.2066	0.1146	0.171
	2 Treatment	0.3606	0.1187	0.007*

* Indicates significance at the 0.01 level

The Tukey HSD post-hoc test shows that the significant difference indicated by the one-way ANOVA calculation of the three groups exists between the treatment group and the trustor group.

It was not surprising to find the Trustor average to be higher than the other two groups. However, it was surprising to see that the only significant difference in means was actually between the Trustors and the treatment group. The increase in Trustor levels of trust was expected as a result of those individuals attempting to build relationships with their team members at an increased pace through implementation of the interventions. The cause for the comparative and significant lack of increase in trust experienced by the treatment group is unclear. Possible explanations for this difference include the idea that the artificial or contrived nature of the interventions actually had the opposite effect on the Trustees, rendering the relatively minimal increase in trust evident in the data.

Alternatively, perhaps because the Trustors were randomly selected regardless of their leadership potential or abilities, their attempts to support and in some instances lead their groups may have negatively affected their group perceptions and ratings.

4.1.5.1.5 Treatment Group Internal Analysis

To further explore the relationships within the treatment groups themselves, I reconfigured the data to compare the trust indices of each group member *except* the Trustor. That data was then broken into two groups for an internal analysis: (1) responses regarding the Trustor and (2) responses regarding everyone else in the group *except* the Trustor. This analysis allowed me to study whether or not the Trustors attempting the interventions actually had a negative impact on the overall change in trust indices regarding them, in comparison to the way the other group members were viewed and rated.

With only two groups again, an independent-samples *t*-test was once again used to compare the average overall change in trust index by treatment group members without Trustor data included. There was no significant difference in treatment group scores regarding the Trustors (mean = 0.1867, SD = 0.9063) and the scores regarding the rest of the team (mean = 0.0543, SD = 0.7923) where t (117) = -0.806, p = 0.422 (two-tailed) with an extremely small effect size or η^2 value of 0.006. Despite statistical insignificance partially due to the relatively small sample size, the difference in average scores between the two groups refutes the potential explanation that the smaller overall

change in trust relating to Trustors was because of what may have been perceived as artificial efforts to build their teams by implementing the interventions. The average overall change reported by the treatment group members that were *not* Trustors was higher for Trustor group members than for the other group members. This indicates that the participants *receiving* the lowest overall change in trust index score over the five week experiment were the treatment group members who were not Trustors, although not to a statistically significant level.

4.1.5.1.6 Additional Comparative Analyses

I want to include here three other interesting analyses that I conducted using different portions of the collected data from Stage I of the β-testing. Because these analyses required the removal of large portions of the data similar to the internal analysis of the treatment groups detailed in Section 4.1.5.1.5, I was unable to obtain statistically significant results in any calculations, but the differences that exist in averages across the three groups suggest that these may be areas to explore further in the future. The first two analyses were conducted using the grouping (treatment without Trustors vs. control vs. Trustor) as the independent variable and the average overall change in trust index as the dependent variable.

The first comparison was regarding the average overall change in trust index on the individual in a participant's team that they initially ranked the *lowest* in comparison to their other team members. Where there was a tie in the initial ranking, I proceeded to

the following tests until the tie was broken to determine which individual's data would be included. As the one-way ANOVA calculation indicated a statistically insignificant difference in means across the three groups ($F (2, 97) = 1.124$, $p = 0.329$), I will focus on the descriptive results for discussion here which are shown in detail in Table 24, and graphically in Figure 18.

Table 24: Descriptive Results Comparing Average Overall Change in Trust Index by Group Regarding Teammate with Lowest Initial Score

Group	N	Mean	SD	Standard Error (SE)
Control	50	0.2495	1.1052	0.1563
Treatment	37	0.2604	0.8754	0.1439
Trustor	13	0.6853	0.5348	0.1483
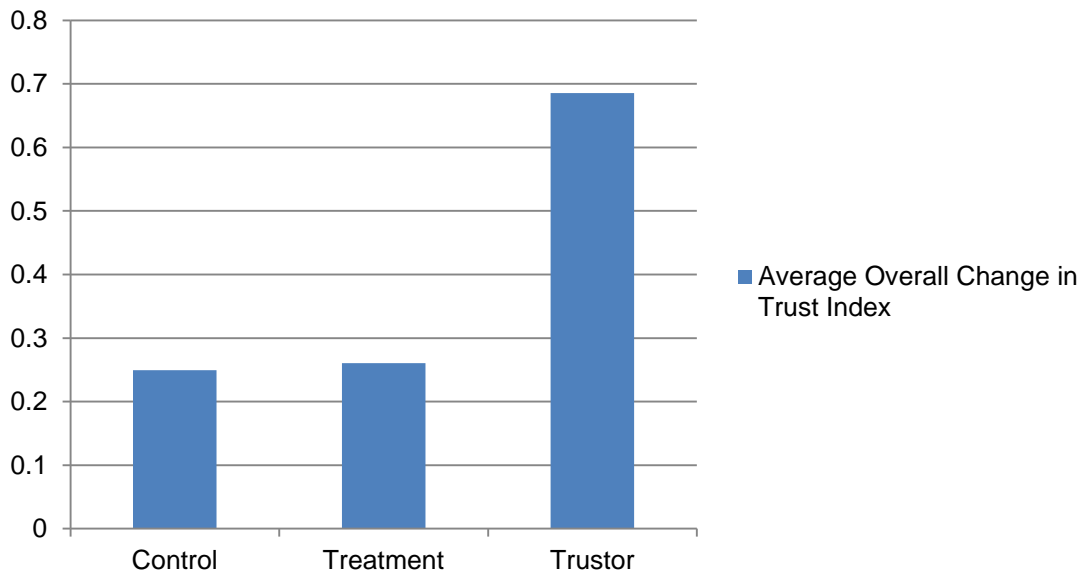
Figure 18: Average Overall Change in Trust Index for Lowest Initial Score by Group

The difference in the sample is evident in Figure 18. With an average almost three times higher than the other two groups, the Trustors seem to have perceived a higher or improved change in trust levels with the lowest initial score recipient than the other research participants did with their lowest initial score recipient. This could imply that the use of tool like this is particularly effective with individuals who would rank comparatively low in an initial baseline test. Some support for this theory was also found during the case studies conducted during Stage II of the β-testing, and is detailed in Section 4.1.5.2.

The second comparison was the opposite of the first, regarding the average overall change in trust index on the individual in a participant's team that they initially ranked the *highest* in comparison to their other team members. As before, where there was a tie in the initial ranking, I proceeded to the following tests until the tie was broken to determine which individual's data would be included. As the one-way ANOVA calculation once again indicated a statistically insignificant difference in means between the three groups (F (2, 97) = 2.282, p = 0.108), I will include here the descriptive results which are shown in detail in Table 25, and graphically in Figure 19.

Table 25: Descriptive Results Comparing Average Overall Change in Trust Index by Group Regarding Teammate with Highest Initial Score

Group	N	Mean	SD	Standard Error (SE)
Control	50	0.1557	0.7777	0.1111
Treatment	37	-0.1278	0.7359	0.1210
Trustor	13	0.3049	0.6161	0.1709
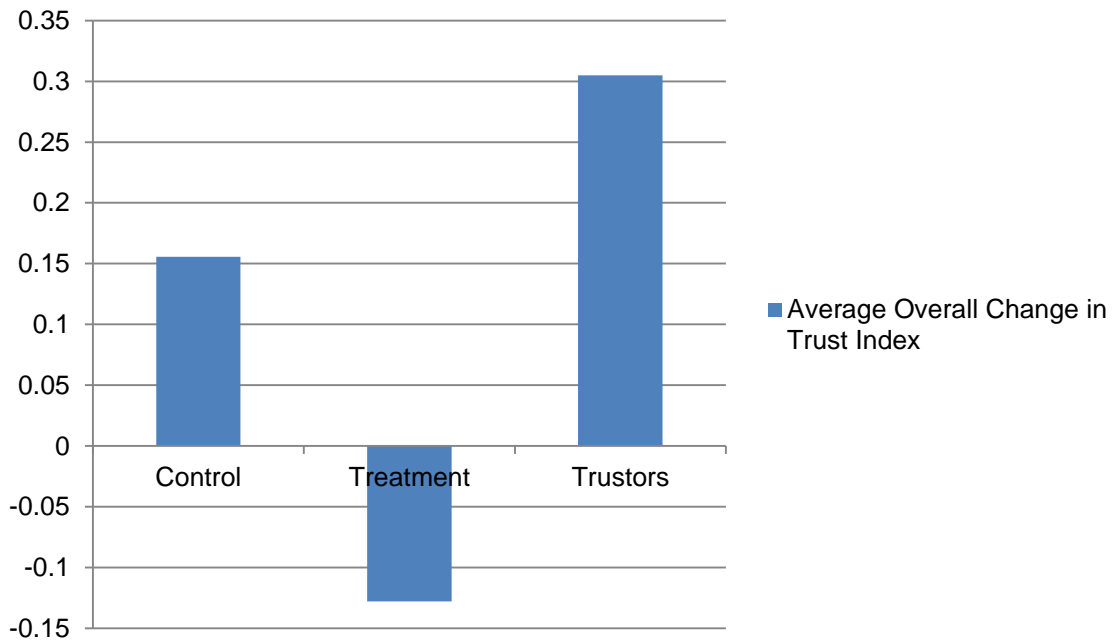
Figure 19: Average Overall Change in Trust Index for Highest Initial Score by Group

Although not to the same degree as the lowest initial score analysis, Trustors seem to have also perceived a higher or improved change in trust levels with the highest initial score recipient than the other research participants did with their highest initial score recipient.

The third analysis includes data regarding the intervention completion rate of the Trustors. Again, due to the comparatively small sample size when broken down in this way, there was no statistical significance found in any of the differences. Table 26 is a matrix including the average overall trust indices of the various groups within the treatment groups (Trustors, treatment groups, treatment group regarding Trustors, treatment group regarding everyone but the Trustor).

Table 26: Average Overall Change in Trust Index by Trustor Intervention Completion Percentage

Group	Trustor Intervention Completion %			
	100	90-99	80-89	< 80
Trustor	0.3455	0.5152	0.1636	0.5758
Treatment without Trustor	-0.0374	0.4209	0.1157	-0.0758
Treatment group regarding Trustor	0.0779	0.5253	0.0404	0.1061
Treatment group regarding everyone BUT Trustor	-0.1313	0.3687	0.1439	-0.1485

There were no clear patterns in the data so conclusions are hard to draw. However, the extreme data points from this set, although statistically insignificant, might suggest avenues for future research. The highest change in trust index occurred in the Trustors who completed less than 80% of the interventions. Three of the four Trustors in this category completed 75% of the interventions. The next highest change occurred in the treatment group members regarding their perceptions of the Trustors that completed 90-99% of the interventions. The lowest change in trust index occurred in the treatment

group members regarding everyone *but* the Trustor where the Trustor completed less than 80% of the interventions. The second lowest change occurred in the same group but with Trustors that completed 100% of the interventions.

4.1.5.1.7 Follow-Up Survey Results

The follow-up survey was designed to provide support for the previously detailed findings. This section will primarily focus on the tests that found statistically significant differences to see if the follow-up survey supports those findings. The survey consisted of the following two statements, with scaled responses between 1 and 7 available to the respondents where 1 = Strongly Disagree and 7 = Strongly Agree:

1. I would like to work with this person again on another group project.

2. I trust this person.

I started off by testing the responses to the two questions for the anticipated positive and significant correlation indicating that the response to one variable was generally an accurate predictor of the other corresponding variable's value. The scatterplot in Figure 20 contains the responses of all the participants and shows a linear regression based on the data.
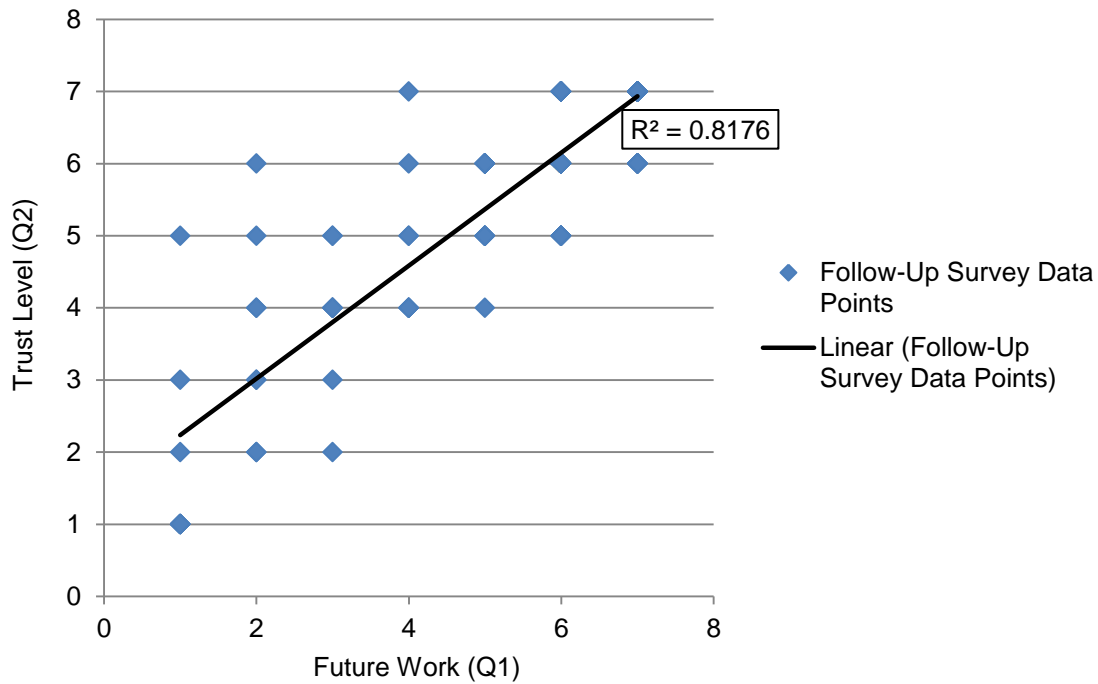
Figure 20: Follow-Up Survey Questions 1 & 2 Scatterplot

Figure 20 is unable to graphically display all of the data points because many of them overlap, but the R^2 value of 0.8176 is indicative of the strength of the predictive ability of the linear regression. The two variables have a strong positive correlation, $r = 0.904$, $n = 279$, $p < 0.001$. The majority of the data points follow the line very closely. Cohen proposes the following guidelines for interpreting the strength of the correlation indicated by Pearson's r value (Cohen 1988, pg. 79-81):

- Small where $r = 0.10$ to 0.29

- Medium where $r = 0.30$ to 0.49

- Large where $r = 0.50$ to 1.0

With an *r* value of 0.904, the relationship between the two questions is considered strong by Cohen's guidelines. This strong correlation between the follow-up survey questions was expected based on extant literature. The two items in the follow-up survey are asking a similar question in different ways. On the same premise, I expected the data from the follow-up question to also correlate with the findings from the tests. Table 27 contains Pearson correlation coefficients and significance levels for the relationships between some key variables available in the data.

Table 27: Correlation Matrix of Variables

		Future Work (Q1)	Trust Level (Q2)	Avg. Overall Change in TI	Gender	Group (Treatment, Control, Trustors)
Future Work (Q1)	Pearson Correlation (*r*)	1	0.904	0.173	-0.028	0.018
	Significance (2-tailed)		0.000*	0.001*	0.645	0.768
	N	279	279	279	279	279
Trust Level (Q2)	Pearson Correlation (*r*)	0.904	1	0.166	0.013	0.007
	Significance (2-tailed)	0.000*		0.005*	0.829	0.908
	N	279	279	279	279	279
Avg. Overall Change in Trust Index	Pearson Correlation (*r*)	0.173	0.166	1	0.042	-0.020
	Significance (2-tailed)	0.004*	0.005*		0.462	0.719
	N	279	279	279	279	279

Table 27 Continued

		Future Work (Q1)	Trust Level (Q2)	Avg. Overall Change in TI	Gender	Group (Treatment, Control, Trustors)
Gender	Pearson Correlation (*r*)	-0.028	0.013	0.042	1	-0.086
	Significance (2-tailed)	0.645	0.829	0.462		0.130
	N	279	279	279	279	279
Group (Treatment, Control, Trustor)	Pearson Correlation (*r*)	0.018	0.007	-0.020	-0.086	1
	Significance (2-tailed)	0.768	0.908	0.719	0.130	
	N	279	279	279	279	279

* Indicates significance at the 0.01 level

In addition to the relationship between the two follow-up survey questions, Table 27 shows statistically significant correlations exist at the $p = .01$ level between both questions and the average overall change in trust index from the tests. Unfortunately, the actual correlation coefficient is small in both cases meaning that although we can be confident in the results themselves, the variables themselves are *not* strongly correlated ($r = 0.173$ for question 1 and $r = 0.166$ for question 2). The difference could potentially be a result of the timing of the administration of the survey, as the follow-up survey was conducted on or near the last day of class. By this time, the group project was completed and students were getting ready for graduation. It is possible that students may have been in a comparatively relieved state of mind and remembering their previous group interactions with a somewhat more positive spin than in the heat of the final project. It is

also possible that larger changes in average overall change in trust index data points could still be comparatively low trust indices depending on the initial baseline trust index. This could be the cause of the lack of correlation between the two variables.

In order to look a little closer, I decided to look for correlation between the final test trust index and question 1 from the follow-up survey. Table 28 compares the three groups' average final test scores with their responses to question #2 from the follow-up survey.

Table 28: Comparison of Follow-Up Question 2 and Final Test Trust Index

Group	Average Final Test Trust Index	Average Follow-Up Survey (Q2)
Control	5.7657	6.1818
Treatment	5.6517	6.2054
Trustors	6.0688	6.2000

Using the final test results as an imperfect but related comparison, it is apparent that the follow-up survey elicited a more positive reaction than the final test. The comparison is imperfect in that although the final test and question 2 of the follow-up survey were both designed to measure the same issue (interpersonal trust level) the final test was made up of 11 questions in comparison to the simplified individual question of the survey. It could be argued that the design and makeup of the final test is a more accurate representation of the actual level of trust the responding party is experiencing as it requires consideration of different situations and behavioral responses. The tests were

135

administered approximately one month apart with the final test being conducted on

March 18th, 2013, and the follow-up survey being conducted beginning on April 22nd,

2013. It was expected that trust levels would have continued to increase over the final

month of the group interactions, as they had during the testing. This trend is evident in

the data.

A test for correlation between respondents' final test trust index and their answers to

question 1 and 2 on the follow-up survey was also conducted. Table 29 includes the

results of this correlation analysis.

Table 29: Correlation Matrix for Follow-Up Survey and Final Test Trust Index

		Future Work (Q1)	Trust Level (Q2)	Final Test Trust Index
Future Work (Q1)	Pearson Correlation (r)	1	0.904	0.425
	Significance (2-tailed)		0.000*	0.000*
	N	279	279	227
Trust Level (Q2)	Pearson Correlation (r)	0.904	1	0.426
	Significance (2-tailed)	0.000*		0.000*
	N	279	279	227
Final Test Trust Index	Pearson Correlation (r)	0.425	0.426	1
	Significance (2-tailed)	0.000*	0.000*	
	N	227	227	254

* Indicates significance at the .01 level

Table 29 shows statistically significant correlations exists at the $p = .01$ level between both questions and the final test trust index. The relationships are stronger than the correlation between the questions and the average trust index ($r = 0.425$ for question 1 and $r = 0.426$ for question 2). Again, although the results are statistically significant, according to Cohen's guidelines, these values would be considered of medium strength (Cohen 1988).

In keeping with the previous model of comparing treatment vs. control before breaking out the Trustor group, an independent-samples t-test was conducted for each follow-up question to search for statistically significant differences in responses. The t-test for question 1 showed no significant difference in responses between the control group (mean = 6.0076, SD = 1.7232) and the treatment group (mean = 6.0952, SD = 1.3362), t (277) = -0.477, $p = 0.633$ (two-tailed). The t-test for question 2 showed no significant difference in responses between the control group (mean = 6.1818, SD = 1.5275) and the treatment group (mean = 6.2041, SD = 1.1161), t (277) = -0.140, $p = 0.889$ (two-tailed).

The data was then divided into the three primary groups of treatment, control, and Trustors for the next part of the analysis. Descriptive results for questions 1 and 2 from the follow-up survey are included in Table 30 and the various inferential analyses are included after the table.

Table 30: Descriptive Results of Follow-Up Survey Responses by Group

Question	Group	N	Mean	SD	Standard Error (SE)
Future Work (Q1)	Control	132	6.0076	1.7232	0.1500
	Treatment	112	6.1161	1.3473	0.1273
	Trustors	35	6.0286	1.3170	0.2226
Trust Level (Q2)	Control	132	6.1818	1.5275	0.1330
	Treatment	112	6.2054	1.1322	0.1070
	Trustors	35	6.1936	1.0792	0.0793

A one-way ANOVA analysis of the data did not show significant support for the differences in the data from the follow-up questions as it relates to the three primary groups. Question 1 returned a p value of 0.855 where $F(2, 276) = 0.157$. Question 2 returned a p value of 0.990 where $F(2, 276) = 0.010$. This data suggests that the differences in response to either question do not seem to be significantly related to group membership.

Ultimately, the follow-up survey did not provide additional statistically significant support for the initial findings. As I mentioned, I expect this to be the result of the timing of the test in relation to course completion and graduation. However, the correlations between the data as discussed do provide support for the validity of the test itself as it relates to an individual's perceived trust level, and for the strong connection between one's willingness to work with an individual again and the interpersonal trust level one has in that person.

The final portion of Stage I involved a follow-up email to the Trustors with questions regarding their experience implementing the interventions. I sent this email after the semester had ended so my response rate was rather poor, but the feedback I did receive was valuable and worth including here for reference and support. The questions are followed by selected responses from the Trustors.

- Question: What were your thoughts about the role you played?
    - "I really liked the role of 'team leader' that I played during the interventions. I was able to implement what you were asking and get genuine answers from my team members because they had no idea what was going on."
    - "I thought it was very simple. Each week I would attempt to facilitate discussion in regards to the intervention topic. Again, very simple."
    - "I thought it was cool that I was chosen as the 'leader' and that I could help in doing the research. I had never done anything like this so it was interesting to see how it turned out."
    - "Sometimes it felt like I was pushing for answers, especially when asking about their family, but it was accepted well."
- Question: Did it feel awkward to attempt the interventions? If so, in what way?
    - "I don't think it was awkward at all to complete the interventions. I actually thought it was quite entertaining because I was almost doing a secret interview. My team members sometimes gave me looks as to say, 'why are you asking me this?'"

139

- "Not really. For the most part it was normal conversation."

- It felt awkward at times because I didn't want them to think I was trying to get too personal, but it really wasn't that bad."

- Question: Any suggestions that would have made the intervention process better?

    - "I think the process was pretty great throughout, as you can tell by now I think it was a good idea to choose one member from each team who you felt was reliable to do the interventions."

    - "I think it went well and opened me up to asking questions about family and such, which seems to be very common in the industry."

- Question: Did you feel that attempting the interventions ever actually made a difference in your relationships with your group members? Any examples?

    - "I believe it did help because after I tried contacting each team member everyone opened up and it was not awkward when we met to do assignments."

    - "In terms of the interventions impacting relationships, I think it is very case-by-case-based. One of my team members took very well to the interventions and we became much closer and learned a lot more about each other. The other was not nearly as responsive."

    - "Unfortunately, no. However, I feel that that might be because of my group. Outside of [team member], the architects were really hard to get

to. They never wanted to meet up to work on our project although I tried
tirelessly (for both the better of the project and in my role)."

- "I think we became closer and trusted each other more when we knew
more about each other."

- Question: Did you ever learn anything about one of your group members as a
result of attempting an intervention that you wouldn't have otherwise known,
that impacted your level of trust in them? Please explain.

  - "I definitely learned things about my team members that I may not have
learned otherwise. Did it affect the 'trust' I had in them, I would say that
one of my team members revealed themselves as much more reliable and
dependable through the intervention process while the other really
showed that they had no real interest in our group and its overall success.
So you could say that I was able to establish a better level of trust and
dependability with one of my group members through the intervention
process."

  - "Well, there was one time where I wasn't able to make it to class on a
day we had two assignments due because I had physics tutoring and I
asked [team member] if he could turn it in for me. He drove to campus
and picked it up from me and got it turned in so that was really big that I
could trust him with that. If I hadn't reached a certain level of respect and
trust for him I would have never asked him to do that, but *because of the*

interventions I think that level was reached much sooner." (emphasis

added)

- "I don't think there was a specific question or instance, but we didn't

    know each other before the group, and now I feel as if we trust each

    other to get a job done. I think learning about each other made it so we

    weren't strangers anymore but friends."

- Question: Do you have any other feedback that you have about the exercise?

  - "It was a great group experience and I am happy with the grades that we

      received. I think the exercises helped tremendously and I was glad to be

      a part of your research."

  - "I learned that when you show interest in the person, and their family

      that they work harder and they start to care more about the group and

      you as a person."

The key point supported by this follow-up email to the Trustors is the claim that

attempting the interventions had a positive impact on the relationships that may not have

otherwise occurred, or at least been delayed. It is evident in their comments that

conducting the interventions was not overly burdensome and that it produced a

perceived benefit in their team relationships.

Based on the results from Stage I, the tool was revised and updated for the initial

industry testing. Table 31 shows the problems that were realized with version 2.0 and

the resultant adjustments made to version 3.0 of the tool.

Table 31: β-Testing Stage I Results – Findings and Adjustments Made

	Findings from Stage I implementation of conceptual tool	Resultant adjustment in version 3.0
1	Difficulty identifying a single trust index for baseline measurement	Eleven behavioral questions are included to allow respondents to indirectly determine their baseline trust index based on how they believe they would act with the individual in question.
2	Additional automation necessary for usability	Cells were formatted to include links between stage I and stage II of the tool. Drop-down menus were included with links to a database for the completion dates, trust-building methods and suggestions for implementation.
3	Unclear where user input was required	Cells requiring user input were highlighted in a consistent color to allow for easier identification by the user.
4	Clarification of what is expected for first time users	Comments were added to cells and drop down menus with instructions and guiding questions to direct the user through the various steps of the tool.
5	Clarification of trust-building method implementation and specifics needed in order to facilitate completing them	Created suggestions based on the literature for each of the included trust-building methods.
6	Need ability to internally compare baseline trust index to updated trust index and comparative size of change.	Upon completion of the "Updated State" questions during Stage II, the tool automatically retrieves the baseline trust index from Stage I and shows a percentage change between the two.

Upon evaluation of Stage I data, version 3.0 (see Appendix O) was finalized and

prepared for implementation by industry participants during Stage II.

4.1.5.2 Stage II

This section details the results of the three case studies conducted following completion

of Stage I of the β-testing. Each case study is reported and analyzed separately and then

common findings and support for and/or conflicts with the data from Stage I are

discussed. The case study reports are categorized by the key components of a case study

report previously described in the methodology (see Section 3.1.4.3.2.2), with the

exception of the fifth element, "Synthesis and generalizations to a larger scheme of

things", which constitutes the final sub-section of Stage II and reviews all three case

studies and their mutual generalizability with the data from Stage I.

4.1.5.2.1 Case Study A

Rationale for studying the case:

Part of the rationale behind the selection of the case studies was to involve multiple

different types of industry participants. This was accomplished by asking for

participation from people working for different parties to the construction contract, and

in differing positions. Since this was the first industry application of the Trust-Builder

Tool, this approach allowed me to obtain a wider range of feedback to assist in the

further development of the tool.

In addition to the respondent's willingness to participate in the project, Case Study A

was selected because his affiliation with a large healthcare conglomerate. The individual

that tested the tool represents an owner in multiple capital construction projects and

deals directly with contractors, architects, engineers and subcontractors on their behalf. As the owner's construction manager, Case Study A was in a unique position to interact with all other members of the construction project delivery process.

Detailed description of the facts related to the case:

As mentioned, the Trustor for Case Study A is a construction manager for a healthcare conglomerate working mostly in Colorado. This individual was initially contacted on February 12th, 2013, in relation to participating in this project. The project introduction, explanation and actual testing of the tool commenced on May 1st, 2013. The follow-up interview was conducted on May 9th, 2013, via telephone.

As requested, Case Study A tested the Trust-Builder Tool with three Trustees. The positions/relationships of the Trustees to the Trustor were as follows:

1. Trustee #1 - Project Manager for a General Contractor currently working with Case Study A's corporation.

2. Trustee #2 - Direct report employee of Case Study A Trustor. This individual was specifically chosen in response to my request that one of the Trustees be selected based on a relatively low level of interpersonal trust.

3. Trustee #3 - Owner of electrical subcontractor who does a lot of work with Case Study A's corporation.

Description of the data collected:

Data was collected during this case study via telephone interviews, emails, and through completion of the Excel spreadsheet that is version 3.0 of the Trust-Builder Tool. Figures 21 and 22 contain the trust indices, root cause analysis, and comment portions from Stage 1 and Stage 2 of the completed tool for Case Study A's Trustee #1.

Current State			
Step 1	Current Trust Index (Today's Date) Wednesday, May 01, 2013		**Root Cause Analysis** Why do you feel this way? Pay specific attention to extreme scores.
	Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	7	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	6	Difference in expectations that will cure itself.
3	I can rely on this person not to make my job more difficult by careless work.	6	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	5	He can be straight forward, and subs have issue with style
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	4	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	3	Not appropriate, since he reports to me
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	6	
8	I take time to listen to this person's problems and worries.	6	
9	I help this person with difficult assignments even when assistance is not directly requested.	4	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	6	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	5	
	Current Trust Index	5	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 21: Case Study A - Completed Stage 1 for Trustee #1

146

Updated State		
Updated Trust Index (Today's Date) Tuesday, April 30, 2013		**Implementation Comments/Notes**
Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	6
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	6
3	I can rely on this person not to make my job more difficult by careless work.	6
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	6
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	5
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	4
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	6
8	I take time to listen to this person's problems and worries.	6
9	I help this person with difficult assignments even when assistance is not directly requested.	5
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	6
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	6

(Step 1)

		Suggestions:
Updated Trust Index	5.64	Good Job! Your ability to effectively interact with this person seems to be increasing, take on another project with them and run this tool again!
Previous Trust Index	5.27	
Trust Index change (%)	6%	

Figure 22: Case Study A - Completed Stage 2 for Trustee #1

Case Study A selected the trust-building method, "Communicate more than required or expected" for implementation with Trustee #1 and selected a completion date of May 8th, 2013. The intervention was completed as scheduled. The trust index increased from 5.27 to 5.64, or 6%. The respondent commented that questions 5 and 6 may not be appropriate for the CM/GC relationship and/or boss/employee relationship, suggesting that it might be beneficial to create a trust calculator based on the different relationships instead of having only one.

Figures 23 and 24 contain the trust indices, root cause analysis and comment portions from Stage 1 and Stage 2 of the completed tool for Case Study A's Trustee #2.

Current State		
Current Trust Index (Today's Date) Wednesday, May 01, 2013		**Root Cause Analysis** Why do you feel this way? Pay specific attention to extreme scores.
Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	6	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	4	Difference in expectations that will cure itself.
3	I can rely on this person not to make my job more difficult by careless work.	5	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	4	He can be straight forward, and subs have issue with style
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	5	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	5	Not appropriate, since he reports to me
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	5	
8	I take time to listen to this person's problems and worries.	6	
9	I help this person with difficult assignments even when assistance is not directly requested.	6	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	5	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	5	
Current Trust Index		5	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 23: Case Study A - Completed Stage 1 for Trustee #2

Updated State		
Updated Trust Index (Today's Date) Wednesday, May 08, 2013		**Implementation Comments/Notes**
Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	6	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	5	
3	I can rely on this person not to make my job more difficult by careless work.	5	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	5	
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	5	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	6	
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	5	
8	I take time to listen to this person's problems and worries.	6	
9	I help this person with difficult assignments even when assistance is not directly requested.	6	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	5	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	5	
Updated Trust Index		5.36	Suggestions:
Previous Trust Index		5.09	Good Job! Your ability to effectively interact with this person seems to be increasing, take on another project with them and run this tool again!
Trust Index change (%)		5%	

Figure 24: Case Study A - Completed Stage 2 for Trustee #2

148

Case Study A accidentally included the same comments in the root cause analysis

sections of all three Trustees. However, the scores are specific and different and the

phone follow-up confirmed the intention of the respondent. For this instance, Case

Study A again selected the trust-building method, "Communicate more than required or

expected" for implementation with Trustee #2 and selected a completion date of May 8th,

2013. The intervention completion date was incorrect as it showed a date earlier than

the start date, but the phone interview confirmed intervention completion on May 8th,

2013. The trust index for Trustee #2 increased from 5.09 to 5.36, or 5%.

Trustee #2 was specifically selected by Case Study A because of a lack of trust in this

individual based on previous decision making. Case Study A expected the initial

baseline trust index to actually be lower than it was. The higher score indicated to him

that even though he might not like Trustee #2's approach to some issues, perhaps he was

focusing too much on a single experience rather than taking into account the individual's

whole body of work. Case Study A said that the fact that Trustee #2's score was higher

than expected was actually "reassuring", helping him to see that perhaps this individual

was more competent than he had originally believed. Case Study A commented that the

tool was particularly helpful and useful in this relationship as it helped him to perceive

Trustee #2 in a more positive way, encouraging the extension of trust.   Also, Case Study

A suggested that question #2 from the study might need to be divided into two questions,

as he believes that a person can be prepared but not competent.

Figures 25 and 26 contain the trust indices, root cause analysis and comment portions

from Stage 1 and Stage 2 of the completed tool for Case Study A's Trustee #3.

	Current State		
Step 1	Current Trust Index (Today's Date) Wednesday, May 01, 2013		Root Cause Analysis Why do you feel this way? Pay specific attention to extreme scores.
	Strongly Disagree (1) ➞ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	6	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	5	Difference in expectations that will cure itself.
3	I can rely on this person not to make my job more difficult by careless work.	5	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	5	He can be straight forward, and subs have issue with style
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	4	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	5	Not appropriate, since he reports to me
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	6	
8	I take time to listen to this person's problems and worries.	6	
9	I help this person with difficult assignments even when assistance is not directly requested.	6	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	6	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	7	
	Current Trust Index	6	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 25: Case Study A - Completed Stage 1 for Trustee #3

150

Figure 26: Case Study A - Completed Stage 2 for Trustee #3

Case Study A again selected the trust-building method, "Communicate more than

required or expected" for implementation with Trustee #3 and selected a completion date

of May 8th, 2013. This was accomplished by calling the subcontractor to confirm that

bills were being paid on time and that they had what they needed from him. Stage 2

confirmed completion of the intervention on May 8th, 2013. The trust index increased

from 5.55 to 5.91, or 6%. Feedback specific to Trustee #3 included remarks about

difficulty answering questions 8 and 9 because of the nature of this specific relationship.

Case Study A mentioned that it is very difficult to help Trustee #3 resolve problems or

difficult assignments since Trustee #3 is an expert in his field. Case Study A felt that all

that he could offer was broad details to try to help. Also, question #8 was hard to answer

in that if the two don't interact very frequently, sharing of personal issues and problems might actually have the opposite effect and actually lower interpersonal trust levels.

The following list includes additional concerns, questions, suggestions, and overall feedback from Case Study A:

- "…when I went back and looked at my first evaluation, I thought I was harsh in some areas."

    - Case Study A wondered if he might have just been feeling better on the day that he completed Stage 2 due to the weather or improved rest.

    - Suggested that multiple baseline tests might improve the accuracy of the initial trust index.

- Completion of the Trust-Builder Tool took about 5 minutes for each stage.

- Excel layout of the tool could be improved by freezing cells that don't need input and improving the dropdown boxes so that text is larger and easier to access and select.

- Suggested that instructions be included for Step 2 on Stage 2 to clarify how it should be used.

- Inclusion of a description of what a "5" was in comparison to a "7" in the rankings. For example, "5 = good" and "7 = excellent".

- Saw usefulness of the tool on a macro level in that if used effectively within an organization, you could plot trendlines for employees and perhaps "pick up on warning signs" regarding personnel.

- He suggested I include more detail in the "root cause analysis" section of the tool. He thought that it would be helpful especially for low-trust relationships. He compared it to a Human Resources report that he had recently completed that asked for a detailed explanation of the reason behind a certain negative response he had made.

- Overall, he said that the tool was "good and helpful", especially in the case of the low-trust relationship.

Identification and discussion of patterns found:

Perhaps the most interesting pattern evident in Case Study A's testing of the tool is the fact that the trust index increased in all three instances. There are a number of possible explanations for this phenomenon. Perhaps the Hawthorne Effect impacted Stage 2 responses, or perhaps, as suggested by the respondent, he was just feeling happier on the day that Stage 2 was completed. Notes built into the tool and encouragement during the introduction of the tool to the Case Study respondents to be as honest as possible were designed to mitigate potential trust index inflation due to the Hawthorne Effect, but it is still a possibility.

Case Study A's comments regarding Trustee #2 and the implementation of the tool in that relationship were also interesting and valuable. Case Study A mentioned that because he had completed the analysis of the Trustee #2, he had actually realized that this person was more trustworthy than originally expected. This implies that

relationships can be improved in the process of analyzing them, regardless of whether or not an intervention is implemented. Taking inventory about why someone feels the way they do about another person, in this instance allowed for a better understanding and an improved perception of the individual in question. Case Study A indicated that this improved perception of his counterpart would impact the way that they interacted going forward, theoretically allowing for an improving relationship based on the Virtuous Cycle of Trust-Building Model.

4.1.5.2.2 Case Study B

Rationale for studying the case:

Case Study B was selected because of his position within a national general contracting firm. Having recently taken an entry level position with the firm, his perspective and experience provide a different angle from which to review the usefulness of the Trust-Builder Tool. He is still relatively early in the process of building relationships with those that he works both within and without his organization. Case Study B is a project engineer and is heavily involved in interactions with subcontractors and tradespeople.

Detailed description of the facts related to the case:

Case Study B was initially contacted on April 22nd, 2013, in relation to participating in this project. The project introduction, explanation and actual testing of the tool commenced on May 7th, 2013. After a few delays and extension requests by the respondent, it was apparent that Case Study B was struggling to find adequate time to

test the tool. This problem is representative of one of my overall concerns about the wider industry application of the Trust-Builder Tool. It is clear in his use of the tool as shown in Figures 27-32 that he was only able to complete the minimum required to fulfill his commitment to me. Ultimately, the follow-up interview for clarification and additional data was conducted via an email chain started on May 25th, 2013 and ending on May 27th, 2013.

As requested, Case Study B tested the Trust-Builder Tool with three Trustees. The positions/relationships of the Trustees to the Trustor were as follows:

1. Trustee #1 – Co-worker

2. Trustee #2 – Subcontractor

3. Trustee #3 – Co-worker

Description of the data collected:

Like Case Study A, data was collected via telephone interviews, emails, and through completion of the Excel spreadsheet that is version 3.0 of the Trust-Builder Tool. Figures 27 and 28 contain the trust indices, root cause analysis and comment portions from Stage 1 and Stage 2 of the completed tool for Case Study B's Trustee #1. It is apparent that Case Study B did not utilize the root cause analysis portion of the tool. However, his responses to my follow-up questions indicate that the tool still supported an internal analysis for each relationship. It seems that even though he did not fill the

paperwork out, he mentally conducted a substantive root cause analysis of his trust indices.

	Current State	
Current Trust Index (Today's Date)		**Root Cause Analysis**
Monday, April 29, 2013		Why do you feel this way? Pay specific attention to extreme scores.
Strongly Disagree (1) ➝ Strongly Agree (7)		Comments:
1 This person approaches his/her job with professionalism and dedication.	6	
2 Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	6	
3 I can rely on this person not to make my job more difficult by careless work.	2	
4 Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	6	
5 We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	6	
6 I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	5	
7 We would both feel a sense of loss if one of us was transferred and we could no longer work together.	5	
8 I take time to listen to this person's problems and worries.	5	
9 I help this person with difficult assignments even when assistance is not directly requested.	4	
10 I find that his person is NOT the sort of co-worker I need to monitor closely.	5	
11 The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	5	
Current Trust Index	5	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 27: Case Study B - Completed Stage 1 for Trustee #1

156

Updated State		

Updated Trust Index (Today's Date)

Tuesday, April 30, 2013

Implementation Comments/Notes

	Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	7	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	7	
3	I can rely on this person not to make my job more difficult by careless work.	1	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	7	
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	6	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	7	
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	7	
8	I take time to listen to this person's problems and worries.	6	
9	I help this person with difficult assignments even when assistance is not directly requested.	6	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	7	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	7	

		Suggestions:
Updated Trust Index	6.18	Good Job! Your ability to effectively interact with this person seems to be increasing, take on another project with them and run this tool again!
Previous Trust Index	5.00	
Trust Index change (%)	19%	

Figure 28: Case Study B - Completed Stage 2 for Trustee #1

Case Study B selected the trust-building method, "Dedicate time to discuss and understand the other person's background and personal life in order to understand them better" for implementation with Trustee #1 with a completion date of May 25th, 2013. The intervention was completed as scheduled. The trust index increased from 5.00 to 6.18, an increase of 19%. Although Case Study B failed to complete the root cause analysis portion of the tool, unlike Case Study A, he *did* fill in the "Future commitments and Expectations" portion of the tool, documenting his commitment to "continue to communicate about work and personal life". He set a completion date of June 7th, 2013, for this commitment.

Figures 29 and 30 contain the trust indices, root cause analysis and comment portions

from Stage 1 and Stage 2 of the completed tool for Case Study B's Trustee #2.

	Current State		
Step 1	**Current Trust Index (Today's Date)** **Monday, April 29, 2013**		**Root Cause Analysis** Why do you feel this way? Pay specific attention to extreme scores.
	Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	4	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	5	
3	I can rely on this person not to make my job more difficult by careless work.	5	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	4	
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	2	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	2	
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	1	
8	I take time to listen to this person's problems and worries.	1	
9	I help this person with difficult assignments even when assistance is not directly requested.	4	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	3	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	3	
	Current Trust Index	**3**	**ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES**

Figure 29: Case Study B - Completed Stage 1 for Trustee #2

Updated State		
Updated Trust Index (Today's Date)		
Tuesday, April 30, 2013		**Implementation Comments/Notes**
Strongly Disagree (1) ➡ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	5	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	5	
3	I can rely on this person not to make my job more difficult by careless work.	2	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	4	
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	3	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	4	
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	3	
8	I take time to listen to this person's problems and worries.	5	
9	I help this person with difficult assignments even when assistance is not directly requested.	5	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	4	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	4	

		Suggestions:
Updated Trust Index	4.00	Good Job! Your ability to effectively interact with this person seems to be increasing, take on another project with them and run this tool again!
Previous Trust Index	3.09	
Trust Index change (%)	23%	

Figure 30: Case Study B - Completed Stage 2 for Trustee #2

For this instance, Case Study B selected the trust-building method, "Communicate more than required or expected" for implementation with Trustee #2 and selected a completion date of May 25th, 2013. The intervention was completed as scheduled, and the trust index increased from 3.09 to 4.00, or 23%. Case Study B once again made a commitment to "continue to communicate more clearly/often" on May 31st, 2013.

Trustee #2 was the individual selected by Case Study B in response to my request that each case study test the tool with one person in whom they have a comparatively low level of trust. This is evident in the low baseline trust index. When asked, Case Study B mentioned that his initially low rating was based on two things: (1) a lack of history

159

with Trustee #2 and (2) a conversation they had early on that made him "wonder about him a little bit." When Case Study B used the tool with this person, he said that "once I got to know him and communicate more, I really began to understand who he is and his intentions," resulting in the comparatively large increase in trust index.

Figures 31 and 32 contain the trust indices, root cause analysis and comment portions from Stage 1 and Stage 2 of the completed tool for Case Study B's Trustee #3.

	Current State		
Step 1	Current Trust Index (Today's Date) Monday, April 29, 2013		Root Cause Analysis Why do you feel this way? Pay specific attention to extreme scores.
	Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:
1	This person approaches his/her job with professionalism and dedication.	6	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	6	
3	I can rely on this person not to make my job more difficult by careless work.	6	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	6	
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	4	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	4	
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	6	
8	I take time to listen to this person's problems and worries.	4	
9	I help this person with difficult assignments even when assistance is not directly requested.	5	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	6	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	6	
	Current Trust Index	5	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 31: Case Study B - Completed Stage 1 for Trustee #3

160

Updated State		
Updated Trust Index (Today's Date)	**Implementation Comments/Notes**	
Tuesday, April 30, 2013		
Strongly Disagree (1) ⟶ Strongly Agree (7)	Comments:	
1 This person approaches his/her job with professionalism and dedication.	7	
2 Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	7	
3 I can rely on this person not to make my job more difficult by careless work.	7	
4 Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	7	
5 We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	6	
6 I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	6	
7 We would both feel a sense of loss if one of us was transferred and we could no longer work together.	7	
8 I take time to listen to this person's problems and worries.	6	
9 I help this person with difficult assignments even when assistance is not directly requested.	7	
10 I find that his person is NOT the sort of co-worker I need to monitor closely.	7	
11 The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	7	
Updated Trust Index	6.73	Suggestions:
Previous Trust Index	5.36	Good Job! Your ability to effectively interact with this person seems to be increasing, take on another project with them and run this tool again!
Trust Index change (%)	20%	

Figure 32: Case Study B - Completed Stage 2 for Trustee #3

For the final Trustee, Case Study B selected the trust-building method, "Discuss the long-term benefits of your relationship" for implementation with Trustee #3 with a completion date of May 26th, 2013. The intervention was actually completed one day early, on May 25th, 2013. The trust index for Trustee #3 increased from 5.36 to 6.73, an increase of 20%. Case Study B also recorded two commitments regarding this relationship: (1) Continue to discuss current work, personal and career issues for completion on June 7th, 2013 and (2) Try to interact outside of a work environment to build trust on June 8th, 2013.

161

The following list includes some additional follow-up questions and the responses that I received from Case Study B:

- Question: Do you think this tool was useful or a waste of time (be honest)?

  - Answer: "I do not believe it was a waste of time. This tool made me think a little more critically about my interactions, communication, and intentions with those I work with. I had a project manager that always told me 'don't tell yourself a story' if I was ever frustrated or mad at a sub. This phrase always reminded me to look only at the facts and analyze everything (including myself). I found this tool helped do the same thing for me, just more formally."

- Question: Did you learn anything about these relationships as a result of using the tool that you wouldn't have otherwise known?

  - Answer: "I would probably say yes. Construction is a busy profession and we allow ourselves to get caught up in the hustle and bustle and toss relationships and trust out the door. I would like to think I focus more on building and sustaining relationships than the average contractor; however, this tool made me slow down and really get to know each of them outside of a business level."

- "I definitely think this could be more accessible as a smart phone app, but I know how research and funds go in grad school…"

Identification and discussion of patterns found:

Once again, we see the pattern of increasing trust indices across the board showing up in Case Study B's application of the tool. I specifically asked Case Study B if he believed that this increase in trust levels was actually the case or if it was a result of mistaken measurement (e.g., Hawthorne Effect). He responded, "I believe it was truly the case. Yes there is a part of your subconscious that remembers what you initially scored, but each of my experiences definitely led to an improved relationship with each person." This is an important finding for this study because it supports the purported value of a tool of this nature. Case Study B's application of the tool and his feedback show a pattern of the Trustor reaping the benefits of a formalized trust-building effort that quickens his ability to make connections and build relationships. The tool assists in accomplishing this by supporting and facilitating the Trustor's good intentions to build a strong relationship.

Another pattern evident in Case Study B is the large increase in trust index regarding a person with whom there was initially a lower level of trust. This seems to indicate that even though someone has done something that damages our trust in them, especially early in a relationship, if we will take the time to understand them and their situation better, we can quickly rebuild trust with that individual through concerted efforts in that direction.

4.1.5.2.3 Case Study C

Rationale for studying the case:

Case Study C was selected because of her upper level position within another national

general contracting firm. As a client executive for a large commercial contractor, Case

Study C interacts with diverse range of people similar to Case Study A, but from the

perspective of the General Contractor. She has worked with her employer for over 12

years and has been in the industry for 25 years. Her unique position allows for another

valuable set of data from a different angle than the other two case studies.

Detailed description of the facts related to the case:

Case Study C was initially contacted on April 22nd, 2013, in relation to participating in

this project. The project introduction, explanation and actual testing of the tool

commenced on May 14th, 2013. Due to the short timetable, Case Study C provided me

with an interim follow-up interview in between Stage 1 and Stage 2 to allow me to

document some of her feedback prior to the oral defense of this paper. After some

difficulty completing the second part of the data collection, we were able to do the final

follow-up interview on June 18th, 2013, via email.

Case Study C was only able to test the Trust-Builder Tool with two Trustees. The

positions/relationships of the Trustees to the Trustor were as follows:

1. Trustee #1 – Client

2. Trustee #2 – New direct report (employee)

Description of the data collected:

Like the other two case studies, data was collected via telephone interviews, emails, and through completion of the Excel spreadsheet that is version 3.0 of the Trust-Builder Tool. Figures 33 and 34 contain the trust indices, root cause analysis and comment portions from Stage 1 and Stage 2 of the completed tool for Case Study C's Trustee #1. The date for the Current Trust Index assessment appears to have been mistakenly completed as Monday, April 29th, 2013. The actual date of initial assessment is unknown.

	Current State	
	Current Trust Index (Today's Date)	**Root Cause Analysis**
Step 1	Monday, April 29, 2013	Why do you feel this way? Pay specific attention to extreme scores.
	Strongly Disagree (1) → Strongly Agree (7)	Comments:
1	This person approaches his/her job with professionalism and dedication. — 6	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job. — 5	Good construction general understanding, weak on business, insurance, contracts, process management
3	I can rely on this person not to make my job more difficult by careless work. — 4	No, often process hickups create rework for us, lost information, forgotten commitments
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker. — 5	Yes, because he is honest and straight forward, sometimes fails to follow up and has self-inflicted crisis which affects others.
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes. — 5	He is open and approachable, always.
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen. — 5	If it affects or is related to them as a client organization only.
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together. — 3	Would remember fondly, but not "attached in this way"
8	I take time to listen to this person's problems and worries. — 5	Yes, but he only shares if it is related to our firm's support of them as a client.
9	I help this person with difficult assignments even when assistance is not directly requested. — 5	Yes, but this has created internal friction. He is percieved as being too reliant on our support.
10	I find that his person is NOT the sort of co-worker I need to monitor closely. — 3	Must continue to monitor processes and commitments for him or it will be missed.
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring. — 3	All documents received will be insufficient, but fixable.
	Current Trust Index 4	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 33: Case Study C - Completed Stage 1 for Trustee #1

Updated State	
Updated Trust Index (Today's Date)	
Tuesday, April 30, 2013	**Implementation Comments/Notes**
Strongly Disagree (1) ⟶ Strongly Agree (7)	Comments:

Step 1

#	Statement	Score
1	This person approaches his/her job with professionalism and dedication.	6
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	5
3	I can rely on this person not to make my job more difficult by careless work.	6
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	5
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	5
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	5
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	5
8	I take time to listen to this person's problems and worries.	6
9	I help this person with difficult assignments even when assistance is not directly requested.	6
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	5
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	5

Comments:

Careless work is not a problem. The challenge is changing leadership in his organization which has created confusion in process. We agreed that together we can make this experience of rework is short duration. In our conversation about "pain points" our team creates for him, he was able to share that we have some redundant paperwork that causes frustration up and down his chain of command that is exasperated by the current shifting of leadership. We are making changes to have only "single touch" paperwork with this client (mostly change management).

Updated Trust Index	5.36
Previous Trust Index	4.45
Trust Index change (%)	17%

Suggestions:

Good Job! Your ability to effectively interact with this person seems to be increasing, take on another project with them and run this tool again!

Figure 34: Case Study C - Completed Stage 2 for Trustee #1

Case Study C was experiencing some problems with the drop-down menu box and so she input her own trust-building method: "Lunch to share challenges. Brainstorm ideas to stabilize process between firms. Ask about his 'pain items' that our team creates in his world. Internally work to resolve." She selected a completion date of May 31st, 2013, but the intervention was actually completed on May 25th, 2013.

Additionally, Case Study C recorded two commitments/expectations in relation to Trustee #1 along with associated completion dates. The first commitment was to invite Trustee #1 and an associate to a specific sporting event focused on welcoming interns that will be involved with this client's project. The other recorded commitment was to

166

send a thank you note for taking the time to visit with Case Study C. Both of these

commitments should act to strengthen the relationship between Case Study C and

Trustee #1.

Figures 35 and 36 contain the trust indices, root cause analysis and comment portions

from Stage 1 and Stage 2 of the completed tool for Case Study C's Trustee #2.

Current State			
Current Trust Index (Today's Date)		**Root Cause Analysis**	
Tuesday, May 30th, 2013		Why do you feel this way? Pay specific attention to extreme scores.	
Strongly Disagree (1) ⟶ Strongly Agree (7)		Comments:	
1	This person approaches his/her job with professionalism and dedication.	5	Person is very professional. Dedication if it fits within a normal work week?
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	6	Comes technically trained and prior performance indicates technically sound, schedule completion issues
3	I can rely on this person not to make my job more difficult by careless work.	2	No, he is meticulous to a fault and often misses deadlines because it is not right enough for him.
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	6	As a co-worker he is competent and resources, just not fast.
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	3	Not yet, good first step. He is not sure how much he can share with me.
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	5	Too soon to tell
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	3	Too soon to tell.
8	I take time to listen to this person's problems and worries.	5	Yes, but he has a filter in place. I hear the things he wants me to fix for him, but seems to filter out the rest. I have to inquire repeatedly.
9	I help this person with difficult assignments even when assistance is not directly requested.	4	Have only done so once, it was appreciated but left concern that I thought he couldn't handle it without help.
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	5	He does good work, only need to monitor time closely.
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	6	
	Current Trust Index	5	ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Figure 35: Case Study C - Completed Stage 1 for Trustee #2

167

Updated State		

Figure 36: Case Study C - Completed Stage 2 for Trustee #2

For this instance, Case Study C once again input her own trust-building method: "Jobsite visit with no agenda. Initiate a log of specific items and promised delivery. Verify if met. My perceptions could be skewed. Ask [Trustee #2] to record actual additional hours in timecard." Her selected completion date was once again June 7th, 2013. The date that the intervention was actually completed is unknown as the listed date was incorrect.

Case Study C again recorded two commitments/expectations in the tool regarding Trustee #2. The first commitment was to schedule another meeting for dinner or lunch with Trustee #2 to discuss whatever issues this individual is facing at that time. The second commitment was more of a realization based on something Case Study C learned

168

during this intervention. In the appropriate section of the tool, Case Study C made the

commitment to "manage the perception that I am too busy for [Trustee #2]." Apparently

she discovered that Trustee #2 was concerned about bothering her. This is a valuable

example of how the tool can encourage better trusting behaviors by facilitating learning

about the counterpart through planned interventions.

The following list includes additional concerns, questions, suggestions, and overall

feedback from Case Study C, in addition to a brief analysis:

- "To use the tool you created, I had to already be 'aware' of trust issues or at least

   trust potential issues. The user must already value trust in a business setting to

   even recognize that it is a factor. I am sold already so better than half the battle is

   won."

- "The tool helps add some discipline to a process/trust relationship and this is a

   real plus. To fill it out, you must take time to think through sources of trust

   breakdowns and that is very helpful."

     - **Analysis:** One of the great benefits of the Trust-Builder Tool is that it

        creates a formalized process for analyzing relationships and trust levels.

- "The tool is useless if you are not willing to extend 'unearned trust'. As I

   developed an action plan to improve my trust in these other folks, it became clear

   that it cannot be done if I am unwilling to change my trust levels. To 'reset' trust,

   you have to extend some measure of trust to them (even if it is not earned). To

   reverse the trust cycle, someone must extend trust first."

169

- **Analysis:** This comment supports extant literature and the proposed Virtuous Cycle of Trust-Building Model.

- "My trust of them is related to my own trustworthiness. In other words, I think some of the action planning is to not only extend trust, but also to take steps to become more trust worthy. In the tool for my new direct report, I need to measure my responses to items he does share in a way that will build his confidence to share more. Trust is two ways, so that action plan needs to be two ways also."

    - **Analysis:** The dyadic nature of trust is referenced in this comment. It was my intention that Step 2 of Stage 2 of the tool would allow for management of this aspect. Ideally, this step would be used to record commitments that the Trustor made and expectations that were set so that they can make sure to fulfill their commitments, thus enhancing their own trustworthiness.

- "For folks that trust does not come easy to (and this is not me), I think that this tool would be even more critical. My tendency is to trust fully until someone loses a portion of that assumption. Others assume nothing and you have to earn trust. This basic bias might really affect the results of the tool and might be worth some investigation."

    - **Analysis:** Perhaps the tool could be prefaced by an internal trust review that factors into the trust indices to allow for a more accurate comparison between Trustors. As created, the tool focuses on the change in the trust

170

index for an individual so the bias is essentially negated by the repeated measures design.

- "Item 6 is not generally appropriate for a manager to a direct report. Reworded slightly, this might make more sense in all relationships."

    - **Analysis:** Similar feedback received from Case Study A.

Identification and discussion of patterns found:

Once again, we see the pattern of increasing trust indices with each Trustee in Case Study C's application of the tool. In both applications, there was an approximate increase in trust index of 17%. Although the tool's functionality was limited due to software compatibility issues, Case Study C's comments once again support the idea that attempting to complete the tool facilitated improved understanding of the Trustees.

Another pattern evident in Case Study C is the opportunity afforded to the Trustor to make specific commitments to continue to improve the relationship based on learnings from the implementation of the intervention. For example, Case Study C's commitment to manage Trustee #2's perception that she is too busy for him to bother indicates an awareness that might otherwise have been unnoticed. This kind of learning benefits the relationship in that it prevents the potential downward spiral resulting from unintentionally sending a signal that could be interpreted incorrectly.

4.1.5.2.4 Case Studies A-C: Synthesis and Generalizations

The case study data provides support to this project in two different areas: (1) support for the student data collected during Stage I, and (2) preliminary indicators and feedback on the future wider industry application of the Trust-Builder Tool. The synthesis and generalizations drawn from the case studies can be viewed from either perspective and are relevant in both directions. The following list includes the key points or patterns synthesized from the three case studies:

- *Increase in trust levels* – this pattern was consistent in all three case studies and is similarly reflected in the student data. It is arguable as to whether or not these increases are occurring as a result of the trust-building interventions or simply because of the regular interactions occurring between the pre- and post-tests. The student data indicates that this increase is happening at an increased rate for Trustors, and although there is no control comparison in the case study examples, their data shows the same trend.

- *Usefulness of the tool* – despite some difficulty finding the time to run the tool for Case Study B and C, the overall feedback from the industry participants suggested that they perceived some value to the exercises required by the Trust-Builder Tool. As mentioned in the assumptions, the magnitude of the usefulness of the tool is predicated on the Trustor's interest in building trust with the individuals in question.

- *Higher Effectiveness in Low-Trust Relationships* – it is interesting to note the consistent pattern evident in the case studies regarding the individuals selected

because of a perceived low level of trust. In the two case studies that were able

to accomplish this assignment (A and B), there was a substantial increase in trust

index with this individual, and commentary supporting the impact running the

tool had on that specific relationship. As with the student data, this may simply

be the result of there being more room to increase trust levels in these

relationships. Alternatively, I suggest that in most cases, our low-trust

relationships are generally based on an earlier misunderstanding or a

miscommunication with the other party. If these issues can be properly

approached, analyzed and resolved with the other party through a process like

that suggested by the tool, those relationships can benefit from substantial

increases in trust levels and accordingly in productivity and effectiveness.

- *Industry Application of the Tool* – While it is evident that the Trust-Builder Tool
  is not completely ready for wider application, the framework and conceptual
  basis seem capable of benefiting industry practitioners in their efforts to build
  strong relationships.

4.2 Theoretical Discussions

One of the key outcomes of an effective DSR project is a contribution to the theory on

the topic. The various stages of this research have provided substantial contributions to

the theory supporting trust-building in the construction project delivery process. Of

primary interest in this section is some analysis of extant definitions and modeling

associated with trust and trust-building, along with the introduction of a new model on

trust-building. These theoretical developments are supported by the findings from

Section 4.1.

4.2.1 Support for and Analysis of the Definition of Trust

Rousseau et al.'s definition of trust that has been adopted for this project can be broken

into four key points that provide for additional insight and analysis. Their definition,

again, is as follows:

> "Trust is a psychological state comprising the intention to accept
> vulnerability based upon positive expectations of the intentions or
> behaviors of another." (Rousseau et al. 1998, pg. 395)

As mentioned in Section 2.1.1, previous analysis was focused on two components of this

definition: (1) the willingness to be vulnerable, and (2) the expectation of favorable

treatment by the other party (Ferrin et al. 2008; McEvily and Tortoriello 2011). Table

32 includes an extended discussion of these two points in addition to the analysis of two

other key points that deserve inclusion in this discussion on trust theory.

Table 32: Analysis of Rousseau et al.'s Definition of Trust
(Rousseau et al. 1998)

Key Points from Definition (emphasis added)	Discussion
1 "*Psychological* state…"	Trust, in its most elemental form, is not a behavior. Trust is a psychological condition that causes and/or results from behaviors (Rousseau et al. 1998).
2 "comprising the *intention to accept*…"	Willingness to engage or act is a critical part of this definition because although trust is a psychological state, it is only meaningful when it manifests as a behavior (McEvily and Tortoriello 2011).

Table 32 Continued

Key Points from Definition (emphasis added)	Discussion
3 *"…vulnerability…"*	Without risk, there is no trust. Trust is not needed under circumstances of complete certainty (Lewis and Weigert 1985).
4 "…based upon *positive expectations* of the intentions or behaviors of another."	Trust requires interdependence between the person trusting and the Trustee. The interests of one party must depend upon the other (Rousseau et al. 1998).

One of the key theoretical foundations for this research, and paradigm shifts critical to expanding our understanding of trust, is to accept trust-building as a competency. In other words, trust-building must be approached as a skill, the capacity for which can be increased through practice and deliberate action (Solomon and Flores 2003). An improved understanding of the four key components of this definition will assist in approaching trust-building in an effective and lasting way. I believe that proactive attention to a relationship resulting in higher levels of interpersonal trust can be practiced and managed, even on a construction job site.

Trust is often viewed as a noun. From this viewpoint, people will claim that trust either exists or it does not. Covey argues that trust is better viewed as a verb, an action that results in trust as a noun (Covey and Merrill 2006). When compared to the definition of trust that has been adopted for this dissertation, an important reciprocal relationship between trust and action is evident. While trust is of itself a psychological state (noun), it is meaningless without the behaviors that stem from it (verb). The results of the

behavior either build support for higher levels of trust, or break down existing levels to lower levels of trust. However, as it relates to trust-building as a competency, this understanding implies that if deliberate action is taken to implement this cycle, higher levels of trust should occur. It logically follows then that if a person can become more competent at implementing the actions necessary to transverse this cycle, his or her competency in establishing, building, sustaining, and/or rebuilding trust should correspondingly increase.

4.2.2 A Model for Trust-Building

McKnight and Chervany stated that interpersonal trust levels are determined by a combination of three factors: (1) interactions, (2) disposition and (3) institution (McKnight and Chervany 2000). I would like to clarify the relationship between these factors in terms of how trust can actually be built. Conceptually, given the combination of these three factors, it would be possible to determine a "current state" snapshot, or a current trust index, for any given relationship despite trust's dynamic nature. In order to appropriately analyze these factors, it is necessary to divide factor 1, interactions, into two separate components: indirect interactions and direct interactions. Figure 37 provides a simplified model for conceptually analyzing the current trust index between a Trustor (the person extending trust) and a Trustee (the subject being trusted) at its inception.

176
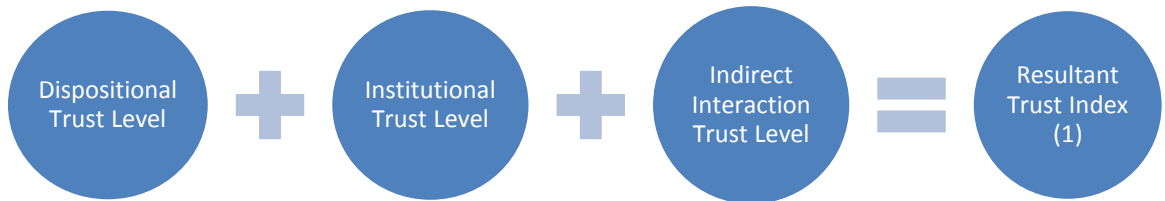
Figure 37: Model for Establishing a Trust Index in Interpersonal Relationships

McKnight and Chervany (2000) further analyze and detail the contributing factors but for the sake of this discussion, I will describe them as follows: (1) dispositional trust level is determined by a person's innate propensity to trust, (2) institutional trust level is determined based on a person's assessment of the relative situation or system within which a relationship exists, and (3) indirect interaction trust level is based on a person's perception of their Trustee's reputation. As described in Figure 37, the combination of these three factors leads to the resultant trust index, or the level of interpersonal trust that exists prior to a direct interaction with the Trustee.

Figure 38 extends this model to include subsequent direct interactions, or what Chow (2012) calls "moments of trust", which allow for the determination of resultant trust indices.
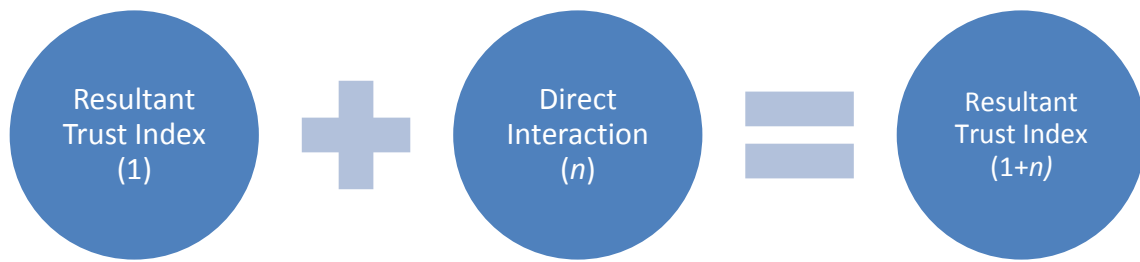
Figure 38: Model for Impacting a Trust Index in Interpersonal Relationships

As mentioned, this is a simplified model as it fails to take into account the impact of extra-relational interactions and other factors that can affect dispositional or institutional trust on a continual basis, thus possibly impacting the overall resultant interpersonal trust index. This is one of the difficulties in dealing with trust. One's disposition to trust can be affected by any of our numerous interactions, whether they are with the specific relationship in question or not. It can also be affected by events in society at large which could impact our level of institutional trust. This intensely dynamic nature of trust makes for a moving target that is admittedly difficult to anticipate and subject to a number of potentially confounding variables. These variables must be accounted for as effectively as possible in the methodology of a project attempting to measure trust.

As an extension to this discussion, and in relation to the models of trust discussed in Section 2.3.1, I would like to offer a new model of trust. My model emphasizes the iterative and reciprocal nature of trust in relationships, like Vangen and Huxham's

(2003) and Mayer et al.'s (1995). There are two key concepts included in my model that are missing in the previously discussed trust models:

1) The *directional* impact of behaviors on resultant trust indices.

2) The reciprocal nature of trusting behaviors in interpersonal relationships between the Trustor and the Trustee.

The authors of the previous models discuss some of these points in their work but I believe the model needs to represent these key components of the process.

I submit Figure 39 as a new model for trust-building. This model combines the concepts from Figures 4, 5 and 6 with Figures 37 and 38 to create the Virtuous Cycle of Trust-Building Model. This model was created as a result of this project's findings and forms the theoretical basis for future research into trust-building in the construction project delivery process. As additional support, Figure 40 is also included to detail potential consequences of the trust-building model.

Figure 39: Virtuous Cycle of Trust-Building Model

180

Key points for discussion from the model include:

- *Duality of trust-building* = trust-building necessarily includes a Trustor and Trustee, and the way these counterparts' actions are perceived by each other determines resultant trust levels and therefore the manner in which future interactions between the dyad can be conducted.

- *Trust Index (1)* = the foundation of the trust index rests on the pedestal created in accordance with Figure 37.

- *Reciprocal Behaviors (solid arrows)* = as the Trustor's positive expectations of the Trustee are reciprocated with trustworthy behaviors, trust is built, and the willingness to extend additional trust is increased. These arrows represent behavioral decisions made by both parties.

- *Departure Arrows (dotted arrows)* = at any point in this process, the Trustor may decide to terminate the relationship with the Trustee. This may be the result of external influences or what the Trustor perceives to be poor behavior by the Trustee.

- *Trust is evidenced by behavior* = trust is primarily valuable as an expressed behavior which requires some form of action.

- *External Influences* = trust levels are continuously influenced by the surrounding environment which includes extra-relational interactions and events on a macro-societal level.

- *Proactive approach to trust-building* = by design, my model begins with the trustor showing a willingness to enter into the initial risk stage of a

181

relationship. This is a critical component of my theory and indicates a desire on the Trustor's part to extend opportunities to gain trust to her counterpart.

In conjunction with this model, I am including a supporting figure to describe the potential consequences of increasing and/or decreasing trust levels. Figure 40 can be used to support the benefits of trust-building efforts.

High Risk Capacity	Excellent Group Performance	High Trustee Predictability	Low Transactional Costs	High Speed (flexible and responsive)	High Personal Well-Being

Low Risk Capacity	Poor Group Performance	Low Trustee Predictability	High Transactional Costs	Low Speed (inflexible and unresponsive)	Low Personal Well-Being

NOTES:
- Risk Capacity = The ability of the relationship to handle risk. Higher trust levels typically allow for new opportunities that might otherwise be unavailable (Vangen and Huxham 2003).
- Group Performance = Groups can obtain a competitive advantage from high-trust relationships (Zaheer et al. 1998).
- Trustee Predictability = The Trustor's ability to anticipate the Trustee's behaviors.
- Transactional Costs = The costs associated with exchange relationships (e.g., redundant efforts, bureaucracy, turnover, etc.) (Covey and Merrill 2006)
- Speed = The flexibility and responsiveness with which a relationship can handle exchanges or interactions, specifically change (Covey and Merrill 2006).
- Personal Well-Being = An individual's self-esteem and sense of security (Baier 1994).

Figure 40: Potential Consequences of Increasing/Decreasing Interpersonal Trust Levels

182

The Virtuous Cycle of Trust-Building Model is reminiscent of the "Tit-for-Tat" cycle of

aggression, or the "Incivility Spiral", as described by Andersson and Pearson (1999).

Figure 41 is Andersson and Pearson's model which diagrams how incivility in the

workplace can lead to a negative or vicious spiral between the two involved parties.

Actions that are perceived as uncivil will likely be reciprocated with uncivil behavior,

thus supporting the negative trending indicated in the model.
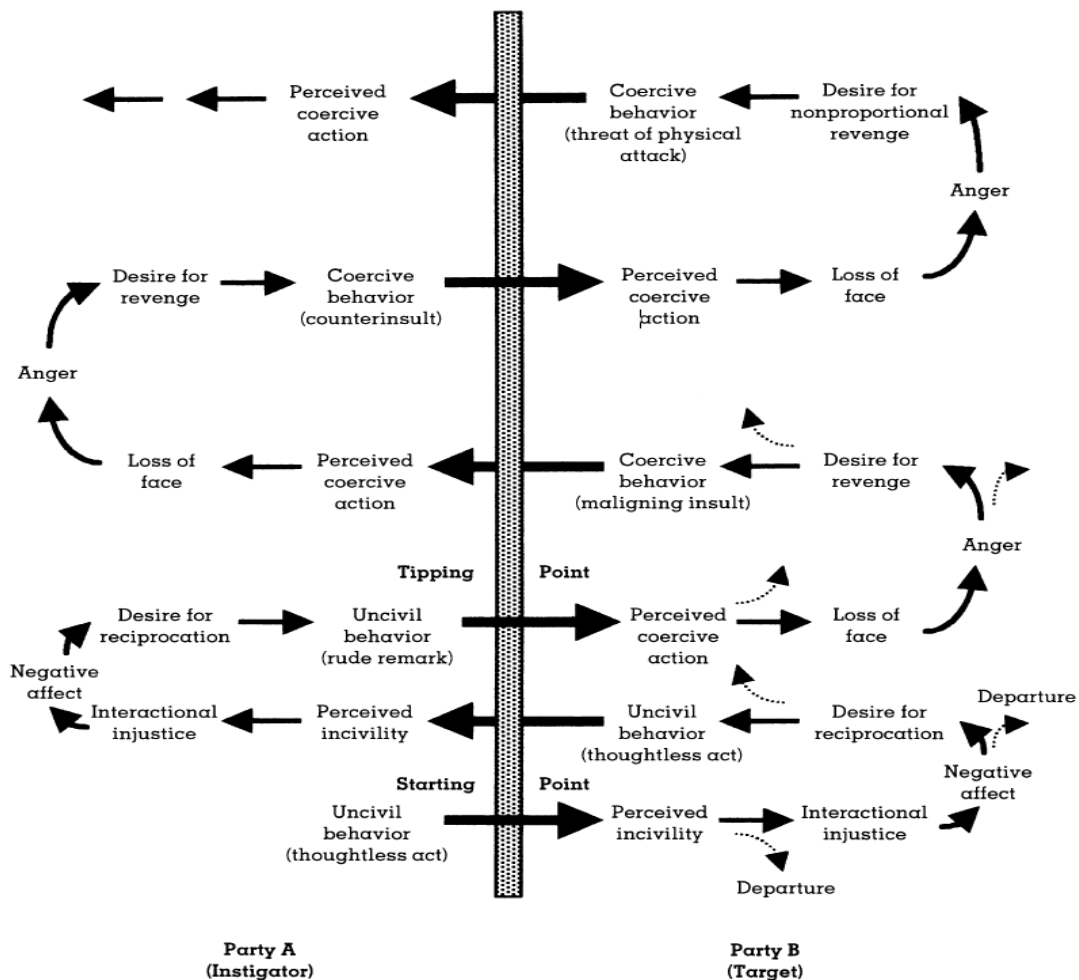
Figure 41: Incivility Spiral
(Andersson and Pearson 1999)

183

Particularly worth noting from Figure 41 is the increasing magnitude of aggressive

reciprocal behaviors as perceived actions, even though unintended, are returned to the

counterpart in the dyad, generally at an increased magnitude. For example, what begins

as a "thoughtless act" by one party is initially perceived by the other party as an

incivility. However, as the spiral progresses, that "thoughtless act" becomes a "rude

remark", then a "maligning insult", a "counterinsult", and ultimately transforms into a

"threat of physical attack". The increasing magnitude of these counteractions

exemplifies how "an ordinary conflict situation can suddenly develop into a crisis"

(Andersson and Pearson 1999, pg. 461). However, dotted arrows in the model indicate

potential departures Party B can make from the spiral to effectively end the relationship,

and the cycle. This pattern is also evident in the Virtuous Cycle of Trust-Building

Model as proposed.

It is also worth noting that Andersson and Pearson's "incivility spiral" suggests that

these consequences occur naturally in response to the initial act – and a vicious cycle is

born. Interestingly, similar behavior supporting the naturalness of this cycle has also

been observed in tree swallows (Lombardo 1985). Similarly, my model suggests what

previous research has also shown, that when an individual is treated as being

trustworthy, he or she naturally responds in accordance with that treatment – and a

virtuous cycle is born.

Recognition and understanding of this natural tendency is a key component to learning

how to build trust, but also how to stop a downward trending cycle. In reality, our

various interactions are likely a combination of both trust-building and trust-eroding

behaviors. As Covey (1997) described it, our actions are equivalent to deposits and

withdrawals into our personal emotional bank accounts. My model allows for visual

analysis and improved understanding of the impact of our various actions on trust levels.

Perhaps this discussion on Andersson and Pearson's work should have been included in

the literature review instead of in the results, but it seemed to tie so directly into my

model that I decided to incorporate it here as conceptual and theoretical support for the

Virtuous Cycle of Trust-Building Model.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Key Discoveries

Due to the incorporation of mixed methods into the Design Science Research framework, there were a number of discoveries or learnings made during the course of this project, starting during the exploratory phase. This section will highlight three key discoveries from this process. The discovery made during the exploratory phase led to the development and testing of the Trust-Builder Tool. The testing and development of the tool itself resulted in the second key discovery. The third discovery came as a result of the effectiveness of DSR in formalizing the approach to developing a tool of this nature.

5.1.1 Despite Perceived Importance, Trust is Not Actively Managed

The prevalence of trust and trust-related emphases in construction company mission statements was not surprising, but the lack of any deliberate attempt to manage it was. I am not aware of any formalized process by which interpersonal trust levels are managed within construction industry organizations, despite the apparent executive level importance of the topic. This somewhat two-faced approach to the issue was also evident during interviews and casual conversations. When asked, most people would champion the value of high-trust relationships while at the same time advocating policies and procedures that treat their industry counterparts as though they deserved little to no trust.

The data collected during the exploratory phases of this project suggests that according to industry practitioners, the biggest challenges faced on construction projects are *not* generally related to cost, schedule or quality, but to the relationships involved. It seems that our intense focus on things like budgets, scheduling software and punch-lists often overshadow issues of trust and relationships that may actually be the source of the problem. Most of the diagnostics and reports are geared towards dealing with time, cost and quality, perhaps because they are considered concrete and quantifiable. Relationships, on the other hand, seem to be given no more than an occasional in-house human resources review. Like a project schedule or budget, trust in relationships can and should be actively managed on the construction project.

5.1.2 Active Management of Interpersonal Trust Can Increase Trust Levels

The conscious, proactive and deliberate effort to focus on relationships through simple interventions can positively affect the interpersonal trust levels perceived by the one taking action, in this case the Trustor. These efforts, not surprisingly, seem to result in an improved understanding of other team members and generally speaking, lead to increasing trust levels. Admittedly, people informally do this regularly in business and personal relationships - some better than others - but this is the first time that the process has been formalized to my knowledge. This formalization allows for increased management and understanding of not only how others' behaviors impact our trust in them, but also how our own actions affect our relationships. The Trust-Builder Tool

increases awareness of these issues by requiring attention through the simple process of using the tool.

When guided by a formalized tool for building trust, individuals seem to make relational discoveries and connections that otherwise may not be made. In most cases it seems that these discoveries benefit the relationship and overall interpersonal trust level enjoyed by the Trustor. The question still remains as to the long-term impact of the Trust-Builder Tool on the Trustee and their trust levels with the Trustor. It is expected that reciprocal increasing trust levels would occur on the Trustee side of the equation. This fits with the Virtuous Cycle of Trust-Building Model as proposed in this research. Situations where trust levels decrease can also be viewed as a desirable outcome because it can potentially prevent future problems resulting from interactions with individuals who are not trustworthy. The student testing and case studies both showed some support for this finding. Additionally, some data suggests that a tool of this nature might be particularly effective in helping low-trust relationships.

5.1.3 Effectiveness of the DSR Framework for a Mixed Methods Approach

I found that DSR was able to effectively coordinate a mixed methods approach to a project that necessitated involvement and re-involvement in both the quantitative and qualitative sides of theory-building and data gathering. Early exploratory semi-structured interviews, questionnaires and observations fit naturally into the "awareness of the problem" phase of DSR, and the development of a solution for the perceived

188

problem followed the "development" and "evaluation" phases. The iterative design of DSR supported the necessary iterative testing and analysis of a tool attempting to change the current state of a situation.

5.2 Recommendation to Industry

I recommend that individuals and companies participating in the construction project delivery process who value trust focus on managing it. The iterative process supported by the Trust-Builder Tool of setting a baseline, attempting interventions and evaluating their impact corresponds with Deming's (2000) Plan-Do-Check-Act Cycle and appears to be an effective way to begin making trust a priority. However, even supporting an awareness of trust and trust issues will be conducive to incremental change in trusting and trustworthy behaviors.

5.3 Original Contributions

As with any scientific endeavor, this project is built on the work of others. Portions of this dissertation support and reinforce that previous work, but other portions provide original contributions to the general body of knowledge on the subjects of trust-building, specifically in the construction project delivery process as follows:

1. The primary original contribution of this research is the Trust-Builder Tool. This tool is a formalized *enabling* process for managing upcoming and current relationships in an effort to establish, build and sustain high levels of interpersonal trust. The Trust-Builder Tool still needs further development and

testing before it will be ready for wide-spread use, but it is the first of its kind

that I am aware of. The tool appears to contribute to users in two ways: (1)

increased levels of interpersonal trust and trusting behaviors on projects

theoretically resulting in improved performance and trustworthy behaviors, and

(2) improved ability to identify and avoid high risk relationships.

2. The Virtuous Cycle of Trust-Building Model (Figure 39) is the primary

theoretical contribution from this research. As discussed in the Section 4.2.2,

this model incorporates aspects of various earlier models combined with an

updated and improved graphical representation of the concepts. The Virtuous

Cycle of Trust-Building Model can be used to explain critical components of

interpersonal trust and its management.

3. Secondary contributions include (1) a model for potentially analyzing the

effectiveness of various trust-building methods suggested in the literature and (2)

a case study regarding the implementation and effectiveness of the relatively new

DSR methodology.

5.4 Study Limitations

This project and the data collected herein are limited by a number of constraints as

follows:

- As mentioned in Section 3.4 (Scope and Boundaries), testing the tool with

  student subjects limits the generalizability of that portion of this study.

- The time frame available for data collection with the samples was limited to a time period slightly shorter than one semester. This made it impossible to determine the long-term effect of the interventions from a statistical perspective. Follow-up interviews with Trustors and the follow-up survey administered to the student groups attempted to collect as much data as possible to determine the effect of the process on those involved.

- The size of the sample group for analysis during Stage I was limited by the number of classes that incorporate a semester-long group activity.

- Due to the inherent nature of trust measurement, "self-report" data representing individuals' perceived changes in trust levels was collected by the tool despite the fact that some researchers recommend alternative methods. In place of observing each group and relational dyad for trusting behaviors indicative of trust levels, the tool itself is designed to ask for behavioral and situational responses. It could also be argued that according to our definition, trust is actually a psychological state that can only truly be accurately measured as a "self-report". As a result, the primary statistical data collection portion of this study is limited by the accuracy and honesty with which respondents completed their surveys.

- Each Trustor and case study subject's implementation of the trust-building methods will be different depending on their personalities and circumstances. Additionally, as the Trustors were randomly selected from their groups, their respective motivation and desire to build trust and successfully work in their teams was likely variable. This may have limited the actual effectiveness of

interventions. The randomized controlled design of this quasi-experiment

necessitated this limitation so it was considered acceptable assuming the Trustors

made an effort to implement the majority of the interventions with their Trustees.

- The statistical portion of this work does not directly account for untrustworthy

   individuals within the groups. As designed, the comparison of overall change in

   trust indices penalizes recognition of untrustworthy individuals, whereas in

   reality, this recognition is actually a very valuable potential consequence of using

   the tool. In spite of this limitation, the randomized control design should still

   allow for a valid comparison and understanding of the differences between the

   various groups as untrustworthy individuals would have theoretically been

   equally distributed thereby cancelling each other out.

5.5 Opportunities and Direction for Future Research

Trust in the construction project delivery process needs more attention. As an industry

that suffers from a generally poor reputation in this respect, both internally and

externally, additional focus on the issue of trust will be a key component to changing

these perceptions. Covey (2012) claims that building trust requires talking and thinking

about it so that it can become a matter of conscious choice. From this viewpoint, I

believe that any work on trust in construction can benefit the industry. This section

includes a few specific ideas for future research that follow logically from this project,

and some that explore tangential issues to this one.

Perhaps the most readily connected opportunities include variations on the quasi-experiment conducted for this project. I would recommend that instead of presenting the project to the Trustors as a study on teamwork, that it be explained as what it is – a study on trust. This simple change *might* affect a drastic change in participant perceptions and thereby participant behaviors. One might argue that this change would only be the result of an increasingly impactful Hawthorne Effect; however, if it actually changed the perceived trust level between participants and their counterparts it would be worth exploring. In other words, if interpersonal trust levels are actually increasing as a result of the Hawthorne Effect or because of the tool, the benefits may be the same.

Alternatively, the survey portion of this project could be replaced with a different trust measurement technique. One option would be to use something similar to the Implicit Association Tests (IAT) originally developed by Greenwald et al. (1998). Utilization of an IAT might allow for more accurate determination of the various trust indices. Another option would be a different type of behavioral observation indicative of interpersonal trust levels between group members.

It would also be beneficial to be able to extend this study over a longer time frame. As mentioned in the limitations, this is difficult with a student population, but if there was a way to assess the longer term reciprocal feedback on the side of the Trustees it would strengthen the case for a tool like this. If the Virtuous Cycle of Trust-Building Model holds true, then it follows that the increased level of trust experienced by the Trustors in

193

this project would ultimately be reciprocated by the Trustees. If a situation where group

interactions extend beyond a semester is available, this could be attempted.

Wider industry application of the tool for further development and testing also follows

naturally from the current project. Some participant feedback from this project

suggested that application of the tool within an organization could benefit management

and allow for recognition of patterns and identification of effective or ineffective

employees. This could be difficult as an organizational implementation might put

pressure on the respondents to artificially enhance their trust levels in order to look good.

This variable could be managed by focusing only on Trustee responses, or by expanding

and/or complicating the questionnaire portion to improve validity of the trust indices.

Closely related to this idea is the use of the Trust-Builder Tool as a way to identify risky

relationships earlier on in the process. It seems that by the time someone realizes that

another individual should not be trusted it is too late to make an effective change. I

expect that the Trust-Builder Tool would be capable of supporting efforts to vet

relationships earlier allowing for more informed decision-making in the beginning of the

process. While it is yet to be fully developed, I have tentatively termed this process,

Relational Clash Detection.

The opportunities for new research projects tangential to this one are numerous. An

immediate connection can be made to research being conducted by the Lean

Construction community on Percent Planned Complete (PPC). The association between PPC and trust levels has yet to be measured but I hypothesize that as PPC levels increase, trust levels will correspondingly increase. The true value of PPC beyond its benefit as a scheduling technique and task management approach could be supported by combining these two ideas.

Expanding beyond the scope of individual trust indices, this research could lead to an improved method for analyzing trustworthiness of OAEC industry companies. Similar to the Experience Modification Rate utilized for determining how "safe" a company is, there could be a Company Trust Rating impacted by all the factors that relate to trustworthiness of a company. This would allow other parties of the OAEC to have an immediate snapshot understanding of how trustworthy a company is, as assessed by a third party. This would facilitate improved decisions regarding potential relationships, but perhaps more importantly, motivate improved decisions by companies overall. Admittedly, obtaining company trust ratings would be a difficult endeavor, but conceptually there is value. The Better Business Bureau provides a similar service to this but perhaps this could be more targeted and direct than what is currently being provided. Also, performance-based contracting attempts to capitalize on this idea by requesting information from project participants that is indicative of trustworthiness and reputation.

Another avenue worthy of attention involves how our higher education impacts proliferation of the low-trust environment prevalent in the OAEC industry. A comparison between undergraduate freshman and senior-level student perceptions and trust levels in the other parties to a construction contract could describe how big of an impact professors' stigmas are having on their students. Conceivably, these stigmas result in an unnecessarily low disposition to trust the people that graduating seniors must learn to work with, by virtue of nothing more than the degree their counterpart received or the field within which they operate.

REFERENCES

AGC (2011). *Project Delivery Systems for Construction*, 3rd Ed. Associated General Contractors of America.

AIA (2007). *Integrated Project Delivery: A Guide*, Version 1, AIA and AIA California Council.

AIA (2012a). Based on AIA "About AIA Contract Documents." <http://www.aia.org/contractdocs/about/index.htm> (November 19, 2012)

AIA (2012b). Based on AIA "History of AIA Contract Documents." <http://www.aia.org/contractdocs/AIAS076671> (November 19, 2012)

AIA (2013). Based on AIA "AIA Contract Document Families." <http://www.aia.org/contractdocs/AIAS076693> (June 11, 2013)

Adrian, J. J. (1988). *Construction claims: A quantitative approach*, Prentice-Hall, Englewood Cliffs, NJ.

Aken, J. E. (2004). "Management research based on the paradigm of the design sciences: the quest for field-tested and grounded technological rules." *Journal of Management Studies*, 41(2), 219-246.

Akintoye, A., Beck, M., and Hardcastle, C. (2003). *Public-private partnerships*. Blackwell Science, Hoboken, NJ.

Alarcon, L. F., and Ashley, D. (1999). "Playing games: Evaluating the impact of lean production strategies on project cost and schedule." *Proceedings of the 7th Annual Conference of the International Group for Lean Construction*, IGLC, Citeseer, 263-274.

Andersson, L. M., and Pearson, C. M. (1999). "Tit for tat? The spiraling effect of incivility in the workplace." *Academy of Management Review*, 452-471.

Arditi, D., and Pulket, T. (2005). "Predicting the outcome of construction litigation using boosted decision trees." *Journal of Computational Civil Engineering*, 19, 387.

Ashraf, N., Bohnet, I., and Piankov, N. E. (2003). "Is trust a bad investment?" KSG Working Paper No. RWP03-047.

Autodesk (2008) *Improving Building Industry Results through Integrated Project Delivery and Building Information Modeling*, Autodesk White Paper, Autodesk Building Solutions, San Rafael, CA.

Axelrod, R. (1981). "The emergence of cooperation among egoists." *The American Political Science Review*, 306-318.

Axelrod, R. (2006). "The evolution of cooperation." *Science*, 211(4489), 1390-1396.

Badurdeen, F., Marksberry, P., Hall, A., and Gregory, B. (2010). "Teaching Lean Manufacturing with Simulations and Games: A Survey and Future Directions." *Simulation & Gaming*, 41(4), 465-486.

Baier, A. (1994). "Trust and its vulnerabilities." *Moral Prejudices*, 130-151.

Ballard, G., and Howell, G. (1998). "Shielding production: essential step in production control." *Journal of Construction Engineering Management*, 124(1), 11-17.

Barnes, L. B. (1981). "Managing the paradox of organizational trust." *Harvard Business Review*.

Barney, J. B., and Hansen, M. H. (2006). "Trustworthiness as a source of competitive advantage." *Strategic Management Journal*, 15(S1), 175-190.

Barrows, H. S. (2006). "Problem-based learning in medicine and beyond: A brief overview." *New Directions for Teaching and Learning*, 1996(68), 3-12.

Becker, L. C. (1996). "Trust as noncognitive security about motives." *Ethics*, 43-61.

Berscheid, E., and Hatfield, E. (1969). *Interpersonal attraction*. Addison-Wesley Reading, MA

Beyer, J. M., and Trice, H. M. (1982). "The utilization process: A conceptual framework and synthesis of empirical findings." *Administrative Science Quarterly*, 591-622.

Black, C., Akintoye, A., and Fitzgerald, E. (2000). "An analysis of success factors and benefits of partnering in construction." *International Journal of Project Management*, 18(6), 423-434.

Bleeke, J., and Ernst, D. (1993). *Collaborating to compete: Using strategic alliances and acquisitions in the global marketplace*. John Wiley & Sons Inc., Hoboken, NJ.

198

Bloom, B. S., Engelhart, M., Furst, E. J., Hill, W. H., and Krathwohl, D. R. (1956). "Taxonomy of educational objectives: Handbook I: Cognitive domain." David McKay, New York, NY.

Bohnet, I., and Zeckhauser, R. (2004). "Trust, risk and betrayal." *Journal of Economic Behavior & Organization*, 55(4), 467-484.

Bonwell, C. C., and Eison, J. A. (1991). "Active Learning: Creating Excitement in the Classroom." *ASHE-ERIC Higher Education Reports*, George Washington University.

Boon, S. D., and Holmes, J. G. (1991). "The dynamics of interpersonal trust: Resolving uncertainty in the face of risk." *Cooperation and Prosocial Behavior*, 190-211.

Bresnen, M., and Marshall, N. (2000). "Partnering in construction: a critical review of issues, problems and dilemmas." *Construction Management & Economics*, 18(2), 229-237.

Bromiley, P., and Cummings, L. L. (1995). "Transactions costs in organizations with trust." *Research on Negotiation in Organizations*, 5 219-250.

Brown, J. S., and Duguid, P. (2002). *The social life of information*. Harvard Business Press, Boston, MA.

Bunge, M. (1967). *Scientific research*. Berlin and New York: Springer-Verlag.

Calder, B. J., Phillips, L. W., and Tybout, A. M. (1981). "Designing research for application." *Journal of Consumer Research*, 197-207.

Chickering, A. W., Gamson, Z. F., and Poulsen, S. J. (1987). "Seven principles for good practice in undergraduate education." 7.

Chow, P. T., Cheung, S. O., and Chan, K. Y. (2012). "Trust-building in construction contracting: Mechanism and expectation." *International Journal of Project Management*, 30(8), 927-937.

CII (1993). *Cost–Trust Relationship*. Construction Industry Institute, Publication 24–1, Bureau of Engineering Research, The University of Texas at Austin.

CII (1997). "Alignment during pre-project planning." *Implementation Resources, 113-3*, Austin, TX.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Routledge Academic, Florence, KY.

199

Cohen, J. (2010). "Integrated Project Delivery: Case Studies." The American Institute of Architects California Council, Sacramento, CA.

ConsensusDocs (2013). Based on ConsensusDocs "ConsensusDocs…Building A Better Way!" <https://www.consensusdocs.org/Catalog> (June 11, 2013)

CSB-SJU (College of Saint Benedict and Saint John's University) (2012) "The Red/Black Game." <http://www.cs.csbsju.edu/~lziegler/redblack.html> (March 15, 2013)

Covey, S. M. R. (2009). "Building trust." *Leadership Excellence*, 26(1), 15-15.

Covey, S. M. R., and Link, G. (2012). *Smart Trust: Creating Prosperity, Energy, and Joy in a Low-Trust World*. Free Press, New York, NY.

Covey, S. M. R., and Merrill, R. R. (2006). *The speed of trust: The one thing that changes everything*. Free Press, New York, NY.

Covey, S. R. (1991). *The 7 habits of highly effective people*. Covey Leadership Center.

Creed, W. E. D., Miles, R., Kramer, R., and Tyler, T. (1996). "Trust in organizations." Trust in Organizations: Frontiers of Theory and Research, 16-38.

Crookall, D. (1995). "A guide to the literature on simulation/gaming." *Simulation and Gaming Across Disciplines and Cultures: ISAGA at a Watershed*, 151-177.

Currall, S. C., and Epstein, M. J. (2003). "The fragility of organizational trust: Lessons from the rise and fall of Enron." *Organizational Dynamics*, 32(2), 193-206.

Currall, S. C., and Inkpen, A. C. (2002). "A multilevel approach to trust in joint ventures." *Journal of International Business Studies*, 33(3), 479-495.

Currall, S. C., and Judge, T. A. (1995). "Measuring trust between organizational boundary role persons." *Organizational Behavior Human Decision Process*, 64(2), 151-170.

Das, T. K., and Teng, B. S. (1998). "Between trust and control: Developing confidence in partner cooperation in alliances." *Academy of Management Review*, 491-512.

Deming, W. E. (2000). *Out of the Crisis*. MIT press, Boston, MA.

Denning, P. J. (1997). "A new social contract for research." *Communications, ACM*, 40(2), 132-134.

Dickson, W. J., and Roethlisberger, F. J. (1939). *Management and the worker*. Harvard School, Boston, MA.

Dirks, K. T. (1999). "The effects of interpersonal trust on work group performance." *Journal of Applied Psychology*, 84(3), 445.

Duke, R. D., and Geurts, J. (2004). *Policy games for strategic management*. Purdue University Press, Purdue, IL.

Dukovska-Popovska, I., Hove-Madsen, V., and Nielsen, K. B. (2008). "Teaching lean thinking through game: some challenges." *Proceedings of 36th European Society for Engineering Education (SEFI) on Quality Assessment, Employability & Innovation*. Sense Publishers.

Eden, D. (1993). "Leadership and expectations: Pygmalion effects and other self-fulfilling prophecies in organizations." *The Leadership Quarterly*, 3(4), 271-305.

Egan, J. (1998). "Rethinking construction." *DETR*, London.

Eisenhardt, K. M. (1991). "Better stories and better constructs: The case for rigor and comparative logic." *Academy of Management Review*, 16(3), 620-627.

Elangovan, A., and Shapiro, D. L. (1998). "Betrayal of trust in organizations." *Academy of Management Review*, 547-566.

Ferrin, D. L., Bligh, M. C., and Kohles, J. C. (2008). "It takes two to tango: An interdependence analysis of the spiraling of perceived trustworthiness and cooperation in interpersonal and intergroup relationships." *Organizational Behavior Human Decision Process*, 107(2), 161-178.

Fulbright & Jaworski LLP (2013), ''Fulbright's 9th Annual Litigation Trends Survey Report'', press release.

Fukuyama, F. (1996). *Trust: The social virtues and the creation of prosperity*. Free Press, New York, NY.

Garud, R., and Kumaraswamy, A. (2005). "Vicious and virtuous circles in the management of knowledge: The case of Infosys Technologies." *MIS Quarterly*, 9-33.

Gillespie, N. (2003). "Measuring trust in working relationships: the behavioral trust inventory." *Proceedings of the Academy of Management Conference*, August 2003.

Gosen, J., and Washbush, J. (2004). "A review of scholarship on assessing experiential learning effectiveness." *Simulation & Gaming*, 35(2), 270-293.

201

Goto, S. G. (1996). "To trust or not to trust: Situational and dispositional determinants." *Social Behavior and Personality: An International Journal*, 24(2), 119-131.

Granovetter, M. (1985). "Economic action and social structure: the problem of embeddedness." *American Journal of Sociology*, 481-510.

Greenwald, A. G., McGhee, D. E., and Schartz, J. L. (1998). "Measuring individual differences in implicit cognition: The implicit association test." *Journal of Personality and Social Psychology*, 74, 1464-1480.

Groat, L., and Wang, D. (2002). *Architectural research methods*. Springer, New York, NY.

Guba, E. G., and Lincoln, Y. S. (1985). *Naturalistic inquiry*. Sage Publications, Incorporated, Thousand Oaks, CA.

Gulati, R. (1998). "Alliances and networks." *Strategic Management Journal*, 19(4), 293-317.

Harback, H. F., Basham, D. L., and Buhts, R. E. (1994). "Partnering paradigm." *Journal of Management Engineering*, 10(1), 23-27.

Hattori, R. A., and Lapidus, T. (2004). "Collaboration, trust and innovative change." *Journal of Change Management*, 4(2), 97-104.

Heide, J. B., and Miner, A. S. (1992). "The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation." *Academy of Management Journal*, 265-291.

Hepworth, D. H., Rooney, R. H., Rooney, G. D., Strom-Gottfried, K., and Larsen, J. A. (2012). *Direct social work practice: Theory and skills*. Thomson Brooks/Cole.

Hevner, A. R., March, S. T., Park, J., and Ram, S. (2004). "Design science in information systems research." *MIS Quarterly*, 28(1), 75-105.

Hinze, J. (1993). *Construction contracts*. McGraw-Hill, New York, NY.

Holmström, J., Ala-Risku, T., Auramo, J., Collin, J., Eloranta, E., and Salminen, A. (2010). "Demand-supply chain representation: a tool for economic organizing of industrial services." *Journal of Manufacturing Technology Management*, 21(3), 376-387.

Holt, C. A., and Capra, M. (2000). "Classroom games: A prisoner's dilemma." *The Journal of Economic Education*, 31(3), 229-236.

Hopp, W. J., and Spearman, M. L. (1996). *Factory physics: foundation of manufacturing management*. McGraw Hill/Irwin, New York, NY.

Howlett, A. (2002). "International construction developments—what comes after partnering." Jones, Day, Reavis & Pogue. Posted on the Internet at: Http://Wwwl.Jonesday.Com/Practices/pulLdetail.Asp (February 2012)

Husted, B. W. (1989). "Trust in business relations: Directions for empirical research." *Business & Professional Ethics Journal*, 23-40.

Jackson, B. J. (2010). *Construction Management Jumpstart: The Best First Step Toward a Career in Construction Management*. Sybex, Hoboken, NJ.

James, H. S. (2002). "The trust paradox: a survey of economic inquiries into the nature of trust and trustworthiness." *Journal of Economic Behavior & Organization*, 47(3), 291-307.

Jeffries, F. L., and Reed, R. (2000). "Trust and adaptation in relational contracting." *Academy of Management Review*, 873-882.

John, G. (1984). "An empirical investigation of some antecedents of opportunism in a marketing channel." *Journal of Market Research*, 278-289.

Kadefors, A. (2004). "Trust in project relationships--inside the black box." *International Journal of Project Management*, 22(3), 175-182.

Kaplan, R. S., and Johnson, H. T. (1987). "Relevance Lost: The rise and fall of management accounting." *Harvard Business School*, Boston, MA.

Kasanen, E., and Lukka, K. (1993). "The constructive approach in management accounting research." *Journal of Management Accounting Research*, (5), 243-264.

Khalfan, M. M. A., McDermott, P., and Swan, W. (2007). "Building trust in construction projects." *Supply Chain Management: An International Journal*, 12(6), 385-391.

Kirgis, P. F. (2012). "Hard Bargaining in the Classroom: Realistic Simulated Negotiations and Student Values." *Negotiation Journal*, 28(1), 93-115.

Kline, P. (2000). *The handbook of psychological testing.* Psychology Press, Florence, KY.

Krishnan, R., Martin, X., and Noorderhaven, N. G. (2006). "When does trust matter to alliance performance?" *The Academy of Management Journal*, 49(5), 894-917.

Lahdenperä, P. (2012). "Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery." *Construction Management and Economics*, 30(1), 57-79.

Larson, E., and Drexler, J. (1997). "Barriers to project partnering: report from the firing line." *Project Management Journal*, 28 46-52.

Latham, M. (1994). *Constructing the team*. HM Stationery Office, London.

Lazar, F. D. (2000). "Project Partnering: Improving the Likelihood of Win∕Win Outcomes." *Journal of Management Engineering*, 16, 71.

LCI (2012). "The Last Planner", <http://www.leanconstruction.org/training/the-last-planner/ > (May 31ˢᵗ, 2013)

Leedy, P. D., and Ormrod, J. E. (2005). *Practical research*. Prentice Hall, Upper Saddle River, NJ.

Leifer, R., and Mills, P. K. (1996). "An information processing approach for deciding upon control strategies and reducing control loss in emerging organizations." *Journal of Management*, 22(1), 113-137.

Lewicki, R. J., McAllister, D. J., and Bies, R. J. (1998). "Trust and distrust: New relationships and realities." *Academy of Management Review*, 438-458.

Lewis, J. D., and Weigert, A. (1985). "Trust as a social reality." *Social Forces*, 63(4), 967-985.

Lichtig, W. A. (2006). "Integrated Agreement for Lean Project Delivery." *Construction Law*, 26, 25.

Liker, J. (2004). *The Toyota Way: 14 management principles from the world's greatest manufacturer*. McGraw-Hill, New York.

Lombardo, M. P. (1985). "Mutual restraint in tree swallows: a test of the Tit for Tat model of reciprocity." *Science*, 227(4692), 1363-1365.

Luhmann, N. (2000). "Familiarity, confidence, trust: Problems and alternatives." *Trust: Making and Breaking Cooperative Relations*, 6 94-107.

Luhmann, N. (1979). "Trust and power." Wiley & Sons, New York, NY.

Lukka, K. (2003). "The constructive research approach." *Case Study Research in Logistics, Publications of the Turku School of Economics and Business Administration*, Series B, 1(2003), 83-101.

Lynch, J. G. (1982). "On the external validity of experiments in consumer research." *Journal of Consumer Research*, 225-239.

MacLeod, L., and Cadieux, A. (1980). "Wife battering in Canada: The vicious circle." *Canadian Advisory Council on the Status of Women,* Ottawa, Ontario.

March, J. G., and Simon, H. A. (1958). "Organizations." *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.

March, S. T., and Smith, G. F. (1995). "Design and natural science research on information technology." *Decision Support System*, 15(4), 251-266.

Markus, M. L., Majchrzak, A., and Gasser, L. (2002). "A design theory for systems that support emergent knowledge processes." *MIS Quarterly*, 179-212.

Maruyama, M. (1963). "The second cybernetics: Deviation-amplifying mutual causal processes." *Am. Sci.*, 164-179.

Masuch, M. (1985). "Vicious circles in organizations." *Administrative Sciences Quarterly*, 14-33.

Matthews, O., and Howell, G. A. (2005). "Integrated project delivery: an example of relational contracting." *Lean Construction Journal*, 2(1), 46-61.

Mayer, R. C., Davis, J. H., and Schoorman, F. D. (1995). "An integrative model of organizational trust." *Academy of Management Review*, 709-734.

McAllister, D. J. (1995). "Affect-and cognition-based trust as foundations for interpersonal cooperation in organizations." *Academy of Management Journal*, 24-59.

McDermott, D., Linebaugh, K., and Solomon, J. (1998). "Indonesia close to IMF pact to speed reform." *Wall Street Journal*, January, 15 A15.

McEvily, B., and Tortoriello, M. (2011). "Measuring trust in organizational research: Review and recommendations." *Journal of Trust Research*, 1(1), 23-63.

McKnight, D. H., and Chervany, N. L. (2000). "What is trust? A conceptual analysis and an interdisciplinary model." *Proceedings from the AMCIS Conference.*

McKnight, D. H., and Chervany, N. L. (2001). "Trust and distrust definitions: One bite at a time." *Trust in Cyber-Societies*, 27-54.

Meredith, J. R., Raturi, A., Amoako-Gyampah, K., and Kaplan, B. (1989). "Alternative research paradigms in operations." *Journal of Operational Management,* 8(4), 297-326.

Merton, R. K. (1948). "The self-fulfilling prophecy." *The Antioch Review*, 8(2), 193-210.

Misztal, B. A. (1996). "Trust in modern societies. The search for the bases of social order." Vol. 1, Pollity Press, Cambridge.

Mitropoulos, P., and Tatum, C. (2000). "Forces driving adoption of new information technologies." *Journal of Construction Engineering and Management*, 126, 340.

Morgan, R. M., and Hunt, S. D. (1994). "The commitment-trust theory of relationship marketing." *The Journal of Marketing*, 20-38.

Mosley, P., and Verschoor, A. (2005). "Risk attitudes and the 'vicious circle of poverty'." *The European Journal of Development Research*, 17(1), 59-88.

NASFA (2010). "Integrated Project Delivery for Public and Private Owners." <http://www.agc.org/galleries/projectd/IPD%20for%20Public%20and%20Private%20Owners.pdf> (April 11, 2012)

Nash, J. (1951). "Non-cooperative games." *Annals of Mathematics*, 54(2), 286-295.

Nassar, K. (2002). "Simulation gaming in construction: ER, the equipment replacement game." *Journal of Construction Education*, 7(1), 16-30.

Nicholson, J. (1991). "Rethinking the competitive bid." *Civil Engineering—ASCE*, 61(1), 66-68.

Nowak, M. A., and Sigmund, K. (2000). "Shrewd investments." *Science*, 288(5467), 819-820.

Parkhe, A. (1999). "Building trust in international alliances." *Journal of World Business*, 33(4), 417-437.

Pavlou, P. A., and Gefen, D. (2004). "Building effective online marketplaces with institution-based trust." *Information Systems Research*, 15(1), 37-59.

Pawson, R., and Tilley, N. (1997). *Realistic evaluation*. Sage Publications Limited, Thousand Oaks, CA.

Peterson, R. A. (2001). "On the use of college students in social science research: Insights from a second-order meta-analysis." *Journal of Consumer Research*, 28(3), 450-461.

Porter, L. W., and McKibbin, L. E. (1988). *Management Education and Development: Drift or Thrust into the 21st Century?* McGraw-Hill, Hightstown, NJ.

Pretty, J., and Ward, H. (2001). "Social capital and the environment." *World Development*, 29(2), 209-227.

Pyzdek, T. (2003). *The Six Sigma project planner: a step-by-step guide to leading a Six Sigma project through DMAIC*. McGraw-Hill, New York, NY.

Ring, P. S. (1997). "Processes facilitating reliance on trust in inter-organizational networks." *The Formation of Inter-Organizational Networks*, 113-145.

Rosenfeld, Y., Warszawski, A., and Laufer, A. (1991). "Quality circles in temporary organizations: lessons from construction projects." *International Journal of Project Management*, 9(1), 21-27.

Rosenthal, R., and Jacobson, L. (1968). "Pygmalion in the classroom." *The Urban Review*, 3(1), 16-20.

Rotter, J. B. (1967). "A new scale for the measurement of interpersonal trust1." *Journal of Personality*, 35(4), 651-665.

Rousseau, D. M., Sitkin, S. B., Burt, R. S., and Camerer, C. (1998). "Not so different after all: A cross-discipline view of trust." *Academy of Management Review*, 23(3), 393-404.

Russo, A. P. (2002). "The 'vicious circle' of tourism development in heritage cities." *Annals of Tourism Research*, 29(1), 165-182.

Rybkowski, Z. K., Munankami, M., Gottipati, U., Lavy, S., and Fernández-Solis, J. (2011). "Impact of cost constraints on aesthetic ranking following Target Value Design exercises," *Proceedings of the 19th Annual Conference of the International Group for Lean Construction*, Lima, Peru, July 13-15, 448-457.

Rybkowski, Z. K., Munankami, M., Smith, J., and Kulkarni, A. (2012) "Survey instrument to facilitate continuous improvement of lean teaching materials: A first run study." *Proceedings of 20th Annual Conference of the International Group for Lean Construction*, San Diego, CA, July 18-22.

Sabol, L. (2007). "Technology, Change, and the Building Industry." *Real Estate Review*, 36(3), 87.

Sacks, R., Esquenazi, A., and Goldin, M. (2007). "LEAPCON: Simulation of lean construction of high-rise apartment buildings." *Journal of Construction Engineering and Management*, 133(7), 529-539.

Sako, M. (1998). "Does trust improve business performance?" *Organizational Trust: A Reader*, Oxford University Press, Oxford, 267-291.

Sarkar, M., Aulakh, P. S., and Cavusgil, S. T. (1998). "The strategic role of relational bonding in interorganizational collaborations: An empirical study of the global construction industry." *Journal of International Management*, 4(2), 85-107.

Schön, D. A. (1999). *The reflective practitioner*. Basic books, Vol. 5126.

Schwegler, B. R., Fischer, M. A., O'Connell, M. J., Hänninen, R., and Laitinen, J. (2001). "Near-Medium-and Long-Term Benefits of Information Technology in Construction." *Proceedings of the International Conference on Construction*.

Sears, D.O. (1986). "College of sophomores in the laboratory: Influences of a narrow data base on social psychology's view of human nature." *Journal of Personality and Social Psychology*, 51(3), 515-530.

Shek-Pui Wong, P., and Cheung, S. O. (2004). "Trust in construction partnering: views from parties of the partnering dance." *International Journal of Project Management*, 22(6), 437-446.

Sherman, S. (1992). "Are strategic alliances working?" *Fortune*, September 21, 77-78.

Simon, H.A. (1996). *The sciences of the artificial*. MIT Press, Boston, MA.

Simons, T. L., and Peterson, R. S. (2000). "Task conflict and relationship conflict in top management teams: the pivotal role of intragroup trust." *Journal of Applied Psychology*, 85(1), 102.

Smale, S. (1980). "The prisoner's dilemma and dynamical systems associated to non-cooperative games." *Econometrica: Journal of the Econometric Society*, 1617-1634.

Smith, J. P., Miller, K., Christofferson, J., and Hutchings, M. (2011). "Best Practices for Dealing with Price Volatility in Utah's Residential Construction Market." *International Journal of Construction Education and Research*, 7(3), 210-225.

Smith, J. P., and Rybkowski, Z. K. (2012). "Literature Review on Trust and Current Construction Industry Trends." *20th Annual Conference of the International Group for Lean Construction*, San Diego, CA, 311-320.

Solomon, R. C., and Flores, F. (2003). *Building trust: In business, politics, relationships, and life*. Oxford University Press, New York, NY.

Spekman, R. E. (1988). "Strategic supplier selection: understanding long-term buyer relationships." *Business Horizons*, 31(4), 75-81.

Spicer, A., and Pyle, W. (2002). "Institutions and the vicious circle of distrust in the Russian household deposit market, 1992–1999." *Advances in Strategic Management,* 19, 373-398.

Stack, L.C. (1978). *Dimensions of personality – Trust.* Wiley, New York, NY, pg. 561-599.

Swan, W. (2002). *Trust in construction: achieving cultural change*. Centre for Construction Innovation, London.

Tommelein, I. D., Riley, D. R., and Howell, G. A. (1999). "Parade game: Impact of work flow variability on trade performance." *Journal of Construction Engineering and Management*, 125(5), 304-310.

Vaishnavi, V. K., and Kuechler Jr, W. (2007). Design science research methods and patterns: innovating information and communication technology. Auerbach Publications, Florence, KY.

Van der Zee, D., and Slomp, J. (2005). "Simulation and gaming as a support tool for lean manufacturing systems: a case example from industry." *Proceedings of the 37th conference on Winter simulation, Winter Simulation Conference*, 2304-2313.

Van Strien, P. J. (1997). "Towards a Methodology of Psychological Practice The Regulative Cycle." *Theory & Psychology*, 7(5), 683-700.

Vangen, S., and Huxham, C. (2003). "Nurturing collaborative relations Building trust in interorganizational collaboration." *Journal of Applied Behavioral Science*, 39(1), 5-31.

Verma, A. K. (2003). "Simulation tools and training programs in lean manufacturing—current status: Final Report." *National Shipbuilding Research Program*, NSRP-ASE-0301-11, Old Dominion University, Norfolk, VA.

Von Neumann, J., and Morgenstern, O. (2007). *Theory of Games and Economic Behavior*, Princeton university press, Princeton, NJ.

Walker, D. (2003). "Implications of human capital issues." *Procurement Strategies: A Relationship Based Approach*, 258-295.

Weston, D. C., and Gibson, G. E. (1993). "Partnering-project performance in US Army Corps of Engineers." *Journal of Management Engineering*, 9(4), 410-425.

Whyte, W. F. E. (1991). *Participatory action research*. Sage Publications, Inc,, Thousand Oaks, CA.

Wicks, A. C., Berman, S. L., and Jones, T. M. (1999). "The structure of optimal trust: Moral and strategic implications." *Academy of Management Review*, 99-116.

Wilson, C., and Byrom, F. (1941). "The vicious circle in chronic Bright's disease. Experimental evidence from the hypertensive rat." *QJM*, 10(2), 65-93.

Wong, E., Then, D., and Skitmore, M. (2000). "Antecedents of trust in intra-organizational relationships within three Singapore public sector construction project management agencies." *Construction Management & Economics*, 18(7), 797-806.

Wong, P. S. P., Cheung, S. O., and Ho, P. K. M. (2005). "Contractor as Trust Initiator in Construction Partnering—Prisoner's Dilemma Perspective." *Journal of Construction Engineering*, 131 1045.

Wong, W. K., Cheung, S. O., Yiu, T. W., and Pang, H. Y. (2008). "A framework for trust in construction contracting." *International Journal of Project Management*, 26(8), 821-829.

Wood, G., and McDermott, P. (1999). "Building Trust: A Co-Operative Approach to construction Procurement." *Journal of Construction Procurement*, 7(2), 4-14.

Wrightsman, L. S. (1991). "Interpersonal trust and attitudes toward human nature." *Measures of Personality and Social Psychological Attitudes*, 1, 373-412.

Yin, R. K. (2008). *Case study research: Design and methods*. Sage Publications, Inc., Thousand Oaks, CA.

Zaheer, A., McEvily, B., and Perrone, V. (1998). "Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance." *Organization Science*, 141-159.

Zak, P. J., and Knack, S. (2001). "Trust and growth." *The Economic Journal*, 111(470), 295-321.

Zand, D. E. (1972). "Trust and managerial problem solving." *Administrative Science Quarterly*, 229-239.

APPENDIX A MAROON-WHITE GAME

NOTE: A slightly adjusted version of this paper was accepted for publishing by editors Carlos Formoso and Patricia Tzortzopoulos in the Proceedings of the 2013 International Group for Lean Construction Conference, Fortaleza, Brazil, July 31-Aug 2, page numbers yet to be determined.

A.1 Description

A.1.1 Introduction

Trainers and educators use games and simulations in an effort to teach new concepts and encourage new ways of thinking within their respective organizations (Crookall 1995). Research has shown that this kind of "active learning" is not only generally preferred by the student, but is also more effective at promoting development of critical thinking skills (Bonwell and Eison 1991; Chickering et al. 1987; Gosen and Washbush 2004). Games and simulations introduce a problem to provide an opportunity for the student to learn based on a *need* for information, where alternatively one might be prone to ignore or dismiss the information being shared (Brown and Duguid 2002). Additionally, research suggests that gaming and simulations are particularly useful for learning regarding social interactions and complicated, multi-person problems with conflicting objectives (Duke and Geurts 2004). This makes games and simulations a valuable vehicle for training and teaching in the construction industry. This approach has also been explored by researchers studying "problem-based learning" (PBL).

Games and simulations fall under the umbrella of a pedagogy known as "problem-based learning" (PBL). PBL focuses on "providing an experience that gives participants a sense that they are engaging in a real problem; learning then becomes a natural by-product of their engagement in and motivation to solve the problem" (Badurdeen et al. 2010, pg. 466). Badurdeen suggests that PBL is a particularly effective method for teaching and learning the concepts promoted by lean manufacturing theory "because it accords with lean's emphasis on teams and on a culture of problem solving, on learning what to pay attention to, on the value of failure, and on the importance of learning in human development" (Badurdeen et al. 2010, pg. 466). Other research has also shown that the continued propagation of lean theory, especially as it relates to the construction industry, has benefited greatly from various games and simulations (Alarcon and Ashley 1999; Nassar 2002; Rybkowski et al. ; Tommelein et al. 1999; van der Zee and Slomp 2005). One reason that PBL techniques have proven so effective in teaching lean principles is the set of challenges that lean construction proponents generally face in sharing their information. Someone who is attempting to teach lean construction must typically overcome scepticism and the students' experience in traditional approaches in order to effectively convey the lean message. To do this, the facilitator must be able to create an experience and an environment so that students can imagine and understand not only why lean philosophy is relevant and important to them personally, but also *how* it can be applied to their individual contexts (Dukovska-Popovska et al. 2008).

The purpose of this appendix is to describe the Maroon-White Game—a simulation designed to help students recognize how natural competitive tendencies can often result in sub-optimization and long-term losses (Smith and Rybkowski 2012). There is a similar game that has been used in lean training entitled "Win As Much as You Can" (Kirgis 2012), but we have found that the complexity of the game has prevented participants from understanding the key learning objectives. The Maroon-White Game is a simple, alternative version that seems to effectively teach the same concepts. Additionally, this appendix will demonstrate how to facilitate the game and it will highlight key learning objectives that support successful lean implementation.

A.1.2 Setting the Theoretical Stage for the Game

The Maroon-White Game attempts to capitalize on the lessons learned from a simulation called the Red-Black Game. The Red-Black Game was designed to demonstrate to players the advantages of systems thinking, as opposed to sub-optimization, during a live playing of the game. Although effective in illustrating the greater mathematic gains incurred from systems thinking to a community-at-large, the simulation might be criticized in that obtaining a larger group gain appears to require individual diminishment—a practice that may not be as easily embraced in capitalistic societies or in societies that cherish individualism over collectivism.

The Maroon-White Game emphasizes the impact of trust—both earned and broken—on total point-based gains and losses returned not only to the community-at-large, but also

to individuals, over time. The game and its facilitation are supported by theory and

research from three primary areas: lean construction, PBL, and game theory.

A.1.2.1 Lean Theory – Hard vs. Soft Skills

The Maroon-White Game was developed in response to a perceived need to teach soft

skills to those wishing to learn about lean construction. It appears there are numerous

methods available for teaching the "hard skills" involved in lean construction, but less

support for the equally necessary "soft skills." This perception was later confirmed in the

literature. Badurdeen et al. (2010) determined that commonly practiced games and

simulations for teaching lean theory were heavily weighted towards production line

principles such as cell design and layout, line balancing, pull production and one-piece

flow, kanban, value stream mapping, visual control, etc. (Rybkowski et al. 2011;

Rybkowski et al. 2012; Sacks et al., 2007; Verma 2003). Only a few examples of games

or simulations attempting to educate the participant on the social/cultural aspects of the

process were found in a literature review. Badurdeen et al. suggested that to more

effectively teach lean theory, new simulations are needed to help participants develop

the soft skills required to implement lean successfully.

Additional theoretical support for the importance of soft skills in lean training is

confirmed by a focused review of Liker's "4 P Model of the Toyota Way" (Figure 42)

(Liker 2004, pg. 6). Soft skills are clearly evident in three of the four P's shown in the

model, and could arguably be included in the fourth. Of particular note is the base or

foundation of the pyramid: "Philosophy—Long-Term Thinking." The Maroon-White

Game aims to help participants grasp not only the value of long-term thinking, but also

how easily we revert to short-term thinking especially when placed in a competitive
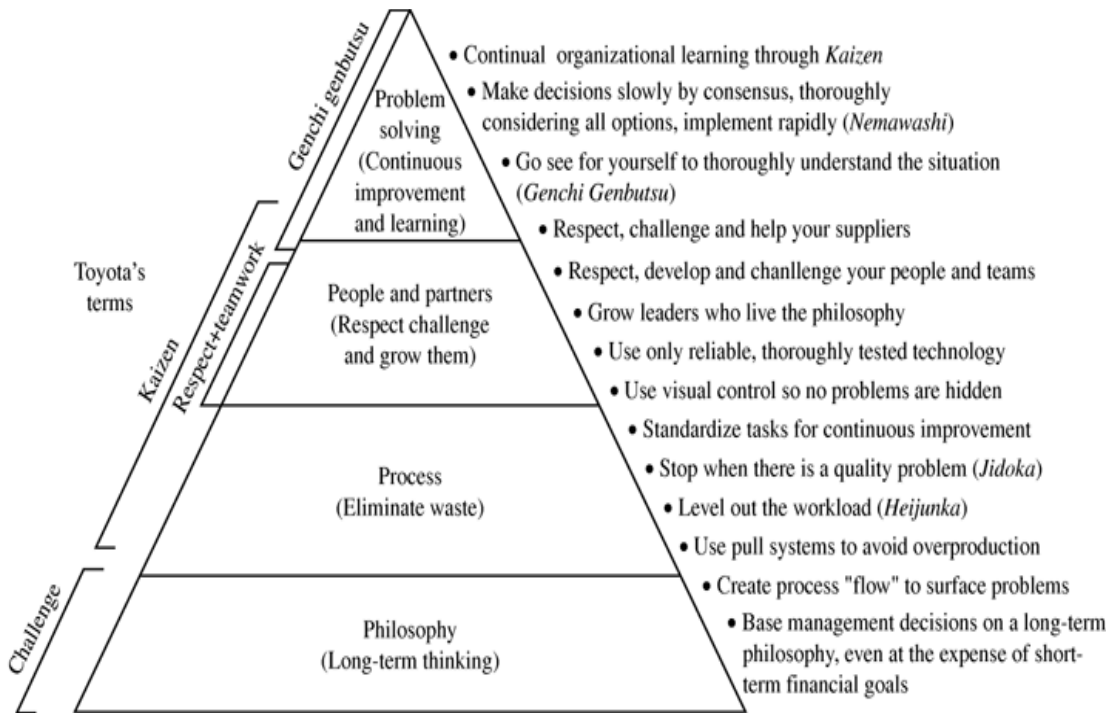
situation.

Figure 42: The 4P Model of the Toyota Way
Reprinted from Liker (2004)

It is evident in Figure 42 that in order for the hard skills and processes advocated by lean

theory to be as effective as possible, they must be built on the very soft skills of

understanding and internalizing the philosophy and culture exemplified by Toyota.

Liker suggests that leaders and teams must not only understand the work, but *live* the

philosophy and be capable of teaching it to others. This involves other soft skills and

216

concepts that are spread throughout the text of the *Toyota Way* such as trust, respect, and continuous learning.

A.1.2.2 Problem-Based Learning Theory

From a pedagogical perspective, the Maroon-White Game follows PBL theory. Barrows (2006) identified six characteristics of PBL:

1. Learning is Student-Centered

2. Learning Occurs in Small Student Groups

3. Teachers Are Facilitators or Guides

4. Problems Form the Organizing Focus and Stimulus for Learning

5. Problems Are a Vehicle for the Development of Clinical Problem-Solving Skills

6. New Information is Acquired Through Self-Directed Learning

Badurdeen et al. (2010) suggested that when these six characteristics are present in a learning environment the skills needed for problem solving are learned through direct experience and students are also able learn about themselves and each other. The PBL approach to these six characteristics is the opposite of Bloom's (1956) more traditional taxonomy of cognitive skills development. Bloom's Taxonomy is a framework for the classification of educational objectives and it is made up of three primary areas: (1) cognitive, (2) affective, and (3) psychomotor. Bloom's Taxomony begins with cognitive learning, or the introduction of knowledge and concepts in preparation for problem-solving. Badurdeen et al. suggested that for lean concepts, learning should begin by

217

attempting to solve a problem, experiencing initial failures and successes, and then introducing new concepts so their impact can be seen on the problem.

Also worth highlighting from the list of PBL characteristics is the necessary role of the facilitator in the process. In order for the learning objectives of the Maroon-White Game to be met, the facilitator must effectively enable students to come to their own conclusions and solutions. This requires a change from the traditional teacher-student educational structure and has shown to be an effective way to approach lean simulations in general (Badurdeen et al. 2010). In many lean simulations, the role of the teacher becomes focused on guiding the student through the learning process, allowing them to learn from their mistakes and successes. Students become actively engaged in the learning process because they are responsible for making decisions relating to the problem at hand. In this model, students are encouraged to go with their initial impulse to solve the problem which results in immediate feedback and self-directed changes to the approach based on the new information.

A.1.2.3 Game Theory – A Prisoner's Dilemma

The Maroon-White Game is a three-group non-zero sum game. A non-zero sum game describes a situation where one team scoring points does not *necessarily* mean that fewer points are available for the other teams (Von Neumann and Morgenstern 2007). This type of game is commonly used in situations where cooperation between teams is a possibility. Within the context of game theory, The Maroon-White Game falls under the

broad characterization of a *prisoner's dilemma*. A prisoner's dilemma explores the conflict between social incentives to compete versus those encouraging cooperation (Holt and Capra 2000). Many researchers have tested and built upon the initial work of the RAND Corporation and John von Neumann in relation to game theory (Von Neumann and Morgenstern 2007). Most of these experiments have shown that generally speaking, when given the option to cooperate with another party or look out for their own best interests, barring additional incentives, the selection of a cooperative move is unlikely (Axelrod 1981; James Jr 2002; Smale 1980). This tendency was confirmed during our various playings of the Maroon-White Game.

A.1.3 Playing the Game

The Maroon-White Game is derived from the Red-Black Game found on the College of St. Benedict website (CSB-SJU 2012). The objective of the game is to help participants develop an intuitive understanding of fundamental lean principles and soft skills such as trust, respect, and optimization of project over individual parts. Common takeaways include a better understanding of: (a) our natural tendency, generally speaking, to sub-optimize in a competitive group setting; and (b) the effects of sub-optimization on trust, relational sustainability, and long-term gains and losses.

The game is played as follows:

1. *Write the following score chart (Table 33) on a chalkboard, flip chart, or dry-erase board for everyone to see (M = Maroon, W = White):*

Table 33: Maroon-White Game Scoring Chart

Team Choice	Point Distribution		
M – M – M	50	50	50
W – M – M	100	0	0
W – W – W (all other combinations)	0	0	0

2. *Divide the group into three teams*:

Each team should consist of a similar number of players. There is no maximum number of players but we have found that 3-5 per team provides for ideal participant involvement and overall better results. Each team should be allocated its own space to allow for private deliberations. This can be accomplished by having different rooms for each team, or by simply dividing the room so that each can have a discussion separate from the other teams.

3. *Explain the following guidelines for the game:*

a. Clearly and aloud, state the following: "The goal of the game is to score as many points as possible" (this direction to participants should be stated frequently throughout the game).

b. For each round, each team picks a color, either maroon or white, and then reports to the facilitator their selection when asked.

c. Scores are then distributed to each team based on the point distribution included above.

4. *The facilitator can manipulate the game if desired by adjusting or introducing any of the following aspects of the game:*

220

a. Order of decision reporting by the teams.

b. Whether a team can change its choice during reporting.

c. Number of rounds, although 4-7 is recommended (the facilitator can also decide whether or not to let participants know from the start of the game how many rounds they will be playing).

d. Level of interaction between the teams (i.e., pick a representative from each team to negotiate with the other team representatives). Allowing the teams to try to come up with ways to structure the reporting or the negotiating can also provide valuable insight.

e. Require decisions to be written down prior to reporting.

5. *Reflections between rounds:*

a. Literature suggests that students may learn better when they are given the chance to choose improvement methods for the next round as opposed to being told what to do (Dukovska-Popovska et al. 2008). The list of adjustments included in step 4 has been included as potential options.

6. *Keep score following each round on the white board/flip chart as shown in Table 2, basing tabulations on the score chart shown in Table 34.*

Table 34: Sample Scoring Table

| | Team 1 | | Team 2 | | Team 3 | |
	Color Choice	Points	Color Choice	Points	Color Choice	Points
Round 1						
Round 2						

Round 3	
Round n	
TOTAL	

7. *Reflections, discussion and analysis of results:*

Following the game, time should be taken by the facilitator to allow students to reflect on and process their experience. The following guiding questions and potential responses can be used to engage participants in discussion:

    a. The goal of the game was to score as many points as possible. How would we have scored as many points as possible?

        • Everyone pick Maroon every time (150 points a round)

    b. What can we learn from this game?

        • Optimal solutions often require long-term perspectives and rely on consistent, sustainable choices.

    c. What could we have done to reach the optimal solution [earlier]?

        • Early negotiation

        • Change of mind-set

        • Sign a contract during negotiations

    d. Once one team chooses white, how is the game affected?

        • Distrust is introduced

        • Other teams seek opportunities to repay the negative treatment

    e. How can this be applied to the construction industry?

- We need to step out of the silos our industry has built in order to optimize projects and sustain long-term relationships

A.2 Typical Results

The Maroon-White Game has been conducted in a variety of settings with only minor variations in the outcomes. As the game has not been documented sufficient times to merit statistical significance, this paper includes results from a few actual playings that are representative of generally observed results to date. These results are included to show how the game is capable of teaching some of the soft skills critical to lean implementation. It is interesting to note that the game has been conducted with a wide range of participants including students from various different departments, professionals from different fields with varying degrees of experience and groups with varying levels of previous interactions. Results have been surprisingly consistent regardless of the makeup of the groups. However, to date, the game has *not* been played in countries other than the United States, or exclusively with other cultures. It is likely that a different culture's orientation towards cooperation and competition would likely alter the results significantly. Figures 43 and 44 show examples of actual results:

Figure 43: Typical Results - Consequence of Choosing White

Typical results like those shown in Figure 43 include the following notable characteristics:

1. When placed in teams, participants inevitably seem to be driven by competition.

2. When given the opportunity, teams will often choose to sub-optimize at the expense of the other teams and the explicitly expressed goal of the game to "score as many points as possible." In other words, teams will choose white when given the opportunity to maximize their own points for a given round, without regard for the potential impact on future rounds.

3. Consequently, the other two teams will refuse to place themselves in a situation where they might be taken advantage of again (see Bohnet and Zeckhauser 2004 for relevant additional analysis of betrayal), ultimately reaching the point where all three teams select white every time and will even state their intentions of doing so indefinitely. In game theory, this is known as the Nash Equilibrium (Nash 1951).

4. Unwillingness to cooperate from the other two teams ultimately prevents the team that chose white from scoring *any* additional points long-term. So while they may have scored 100 points once or twice, their total possible earnings over the long-term would have been substantially higher had each team been willing to cooperate.

5. While it may seem that on the surface Team 1 was the "winner" of the game, Team 1 could have actually scored twice as many points as they did had each team cooperated. This analysis helps participants move beyond the fear of the seemingly socialistic approach to choosing maroon every time. What we see is that due to the seemingly inevitable reactions of the other teams to one team choosing white, the *only* sustainable choice that will produce long-term gains for the individual team is maroon.

Figure 44: Typical Results - Inability to Cooperate

Typical results like those shown in Figure 44 have included the following additional notable characteristics:

1. When given the opportunity to reflect and discuss between rounds, teams will often suggest alternative ways to play the game in order to score additional points. This often includes ideas such as having team representatives write down their color choices and submitting them to the facilitator, or having representatives from each team negotiate with one another and make commitments prior to reporting. Interestingly, despite these efforts, long-term results do not generally improve.

2. Inability to trust other teams prevents potential gains both in the short and long term. There seems to be a natural proclivity not to trust other teams in a competitive environment.

A.3 Real-world Application

While this game is admittedly not designed to be an exact simulation of construction project delivery or any of its specific processes, it *does* showcase actions and decision types that industry participants have likely either suffered from or been party to. Being betrayed by other teams in the game conjures familiar emotions to those experienced in the field when a similar situation is experienced. How that experience impacts future decisions and effectively limits our potential gains is also clear. Students and practitioners alike have been able to make the jump from the game to industry application without the need for coaching.

What the game does very effectively is help participants recognize how natural the tendency to sub-optimize is when placed in a competitive situation. It provides an opportunity for participants to analyze their decisions based on the simple concept of whether they are figuratively choosing maroon or white. Decisions that fall into this category are made most every day by those in the industry. For example, the decision of when to pay subcontractors, how to charge for a change order, or how to interact with an architect over design discrepancies can readily be viewed through the lens of this game.

Perhaps the most important lesson for industry from this game involves the recognition of how the sustainability of our business relationships depends on our ability to make decisions based on a broader perspective than one individual job. This in turn impacts our ability to continue to benefit from the relationships that we have built, whether with owners, architects, engineers, subcontractors, suppliers, or any other industry players. It would seem that our natural tendency, and in some cases even our accounting policies encourage us to approach projects and interactions as "one-offs." However, this game reminds us that sub-optimizing, especially as it relates to relationships, is ultimately unsustainable. As mentioned earlier, this kind of "Long-Term Thinking" is the foundational philosophy of the Toyota Production System.

A.4 Conclusion

This appendix supports the principle that successful lean implementation requires both hard and soft skills. We have discussed how games and simulations are an effective way

to teach lean concepts but how our current body of knowledge is lacking in ways to teach the soft skills.   The Maroon-White Game can be used to teach participants about their natural tendency to sub-optimize in competitive situations, and how that tendency can impact trust and long-term gains. Participants can see how in many situations, optimization of the whole can ultimately result in higher overall individual gains.

APPENDIX B QUESTIONNAIRE 1

QUESTIONNAIRE:

1. Think of a project that you participated in that you would consider to have been successful. If you had to pick the biggest contributing factor to this success, what would it be? Why?

2. What were the major differences between your experiences on lean vs. DBB/CSP projects? Was it worth it?

3. What do you think contributes most to a high-trust job environment? Why?

4. What do you think contributes most to a low-trust job environment? Why?

5. Do you think that the level of trust on a project influences the productivity and overall project success? In what ways?

PRE-CONFERENCE QUESTIONNAIRE

Please answer the following questions.
Question 1
Think of a project you participated in that you would consider to have been successful.
If you had to pick the top three primary contributing factors to this success, what would
they be?

1.   Why?

2.   Why?

3.   Why?

Question 2

    a. If you could pick a project delivery method (e.g., Design-Bid-Build, Design-Build, CM at Risk, Integrated Project Delivery, etc.) for your next project, what would it be?

    b. Why?

Please raise your hand for page 2 of the questionnaire!

Question 3

    a. What do you think contributes most to a *high-trust* project environment?

    b. Why?

Question 4

    a. What do you think contributes most to a *low-trust* project environment?

    b. Why?

Question 5

    a. Do you think that the level of trust on a project influences project productivity and overall project success? (please circle your response)

                 YES   NO

    b. In what ways?

Question 6

    a. What are some alternatives to "trust" that you see employed in your projects or workplace?

OPTIONAL

If you would be willing to discuss your responses with our research team please write your name here:

<div align="center">

Thank you!!

</div>

Version 1

TRUST BUILDER

Relational Lookahead

Upcoming Relational Interactions		Current State		
	Step 1	Beginning Trust Index: DATE _____	Explanation of Current Trust Index	Root Cause Analysis (if necessary)
1 Insert Name Here				
with Insert Org. Name Here		1 2 3 4 5 6 7 8 9 10		[lookup list of tools]
				[link to another tool]

	Proposed Solution	
Step 2	Decide on a Trust Building Method	Anticipated Implementation Date
	[lookup list of methods]	[insert expected date]

Step 3

DO IT!

	Results		
Step 4	Resulting Trust Index: DATE _____		Implementation Comments/Notes
	Actual Implementation Date		
	[insert date]	1 2 3 4 5 6 7 8 9 10	

		Future Commitments and Expectations	Scheduled Date
Step 5	1		
	2		
	3		
	4		
	5		

Version 2.0

TRUST BUILDER

+ Relational Lookahead +

Stage 1 - Analysis of Current State and a Plan to Improve

Upcoming Relational Interactions		Current State		

Step 1

1 Insert Name Here

with Insert Org. Name Here

Current Trust Index
[insert date]

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | # |
Low→ ——————→High

Not willing to engage in a relationship with this person

Explanation of Current Trust Index

Comment:

Root Cause Analysis - Why do you feel this way?

Comment:

[select/link to analysis tool]

Proposed Solution	

Step 2

Decide on a Trust Building Method

[lookup list of methods]

Anticipated Implementation Date

[insert expected date]

Step 3

DO IT!

TRUST BUILDER

Relational Lookahead

Stage 2 - Follow Up

Relational Interaction

1 [Name from Stage 1]

with [Name from Stage 1]

Updated State		
Trust Building Method Employed - How did you try to build trust in this relationhip?	**Updated Trust Index** - [insert date]	**Implementation Comments/Notes**
Actual Implementation Date [insert date]	1 2 3 4 5 6 7 8 9 10 Low ➤ High	Comments:
[Insert selected method from Stage 1 here]	Not willing to engage in a relationship with this perso	

Step 1

Expectations

Step 2

Future Commitments and Expectations - What are the next steps in building trust with this person?	Scheduled Date
1	
2	
3	
4	
5	

Feedback - Do you have any suggestions to improve the ability of this tool to assist you in building trust?

Step 3

Comments:

237

TEAMWORK SURVEY

Your Name:

Date:

Please complete the following survey for each person on your team. *Remember to be honest in your responses* to ensure that the collected data will be able to assist us in creating more effective construction teams. Your responses will not be shared with team members or professors.

Team Member Name — Strongly disagree ←→ Strongly agree — 1 2 3 4 5 6 7

1. This person approaches his/her job with professionalism and dedication.

2. Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.

3. I can rely on this person not to make my job more difficult by careless work.

4. Most people, even those who aren't close friends of this individual, trust and respect him/her at work.

5. Other work associates of mine who must interact with this individual consider him/her to be trustworthy.

6. If people knew more about this individual and his/her background, they would be more concerned and monitor his/her

7. We have a sharing relationship. We can both freely share our ideas, feelings, and hopes.

8. I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.

9. We would both feel a sense of loss if one of us was transferred and we could no longer work together.

#. If I shared my problems with this person, I know (s)he would respond constructively and caringly.

11. I would have to say that we have both made considerable emotional investments in our working relationship.

#. Please list 1-3 specific recent experiences that informed or influenced your responses above.

1
2
3

Please turn over for additional space if you have more than 4 people on your team.

Date Administered: 2.11.13

[Introduction]
You are being asked to participate in a research study regarding teamwork in the construction project delivery process. The purpose of this study is to improve our ability to create effective teams. You were selected as participants because you are students in Texas A&M's College of Architecture and you are participating in a semester-long group project. In order to ensure data validity and to make this exercise valuable, PLEASE BE HONEST IN YOUR RESPONSES!

[What will I be asked to do?]
If you agree to participate in this study, you will be asked to assess your group members about once a week for five weeks. You should respond to the questions in the context of the term project, and your actual relationships with team members. Your responses are *completely confidential* and will not be shared with your team members or your teachers in association with any personal identifiers at any time. Fulfillment of the requirements for this research will take less than 1 hour over the four week period, the majority of which will take place during class. Your responses will NOT affect your grade in this class.

[What are the risks involved in this study?]
The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in group interactions and daily life.

[What are the possible benefits of this study?]
The possible benefits of participation are a better understanding of the principles of effective teamwork in the construction project setting.

[Do I have to participate?]
You do NOT have to participate. Your participation is voluntary. You may decide not to participate or to withdraw at any time.

[Who will know about my participation in this research study?]
The records of this study will be kept completely private and confidential. *No identifiers linking you to this study will be included in any sort of report that might be published*. Research records will be stored securely and names of participants will not be shared or used for any other purposes than to analyze collected data.

[Whom do I contact with questions about the research?]
If you have questions regarding this study, you may contact James P. Smith by phone or email. This information is available on your class e-learning site for reference as needed.

[Whom do I contact about my rights as a research participant?]
This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at (979)458-4067 or irb@tamu.edu.

[Participation]

If you would like to be in the study, please complete the survey and return to your instructor now. *Participation is considered consent*. REMEMBER!! PLEASE HELP US IMPROVE OUR COLLECTIVE ABILITIES TO WORK IN TEAMS BY RESPONDING HONESTLY. ALL RESPONSES WILL BE KEPT COMPLETELY CONFIDENTIAL.

Your participation and honest responses are greatly appreciated!

APPENDIX H RESEARCH SCRIPT #2

Date Administered: 2.15.13

[Introduction]
Today is the next stage of the Teamwork Research Project that you started last Thursday. As a reminder, the purpose of this study is to improve our ability to create effective teams. PLEASE CONSIDER YOUR RELATIONSHIPS AS THEY CURRENTLY ARE AND RESPOND AS HONESTLY AS POSSIBLE! Responses will not be shared with your team members or Professors. Honest responses are of utmost importance to help us improve our collective abilities to work in teams.

[Participation]
Please complete the survey and return to your instructor now. Your participation and honest responses are greatly appreciated!

Date Administered: 2.22.13

[Introduction]
Today is the next stage of the Teamwork Research Project. PLEASE REMEMBER TO CONSIDER YOUR RELATIONSHIPS AS THEY CURRENTLY ARE AND RESPOND AS HONESTLY AS POSSIBLE!   We are trying to improve our ability to create effective teams in the construction process and your honest and thoughtful responses will help us do that. As always, responses will not be shared with your team members or Professors.

[Participation]
Please complete the survey and return to your instructor now. Thank you!

APPENDIX K RESEARCH SCRIPT #4

Date Administered: 3.1.13

[Introduction]
It is teamwork survey day again! As always, PLEASE REMEMBER TO CONSIDER YOUR RELATIONSHIPS AS THEY CURRENTLY ARE AND RESPOND AS HONESTLY AS POSSIBLE! We recognize that this may seem repetitious - which it is - but please take a moment, consider each question, and help us improve teamwork in construction.

[Participation]
Please complete the survey and return to your instructor now. Thank you!

Date Administered: 3.18.13

[Introduction]

This is the last teamwork survey! It is also perhaps the MOST IMPORTANT of the surveys that you have filled out.   PLEASE TAKE AN <u>EXTRA</u> MOMENT TODAY TO READ EACH QUESTION CAREFULLY, CONSIDER YOUR RELATIONSHIPS AS THEY CURRENTLY ARE, AND RESPOND AS HONESTLY AS POSSIBLE! Your efforts in assisting with this project have been extremely helpful.   Your ability to work in teams will be an important part of your future success. Best of luck in all that you do!

Thank you and Gig' em!

FOLLOW UP TEAMWORK SURVEY

Your Name:

Date:

Please complete the following survey for each person on your team. *Remember to be honest in your responses* to ensure that the collected data will be able to assist us in creating more effective construction teams. Your responses will not be shared with team members or professors.

Team Member Name

	Strongly disagree	1	2	3	4	5	6	Strongly agree 7
1 I would like to work with this person again on another group project.		o	o	o	o	o	o	o
2 I trust this person.		o	o	o	o	o	o	o

Team Member Name

	Strongly disagree	1	2	3	4	5	6	Strongly agree 7
1 I would like to work with this person again on another group project.		o	o	o	o	o	o	o
2 I trust this person.		o	o	o	o	o	o	o

Team Member Name

	Strongly disagree	1	2	3	4	5	6	Strongly agree 7
1 I would like to work with this person again on another group project.		o	o	o	o	o	o	o
2 I trust this person.		o	o	o	o	o	o	o

Please use this space if your team has more than four members.

Team Member Name

	Strongly disagree	1	2	3	4	5	6	Strongly agree 7
1 I would like to work with this person again on another group project.		o	o	o	o	o	o	o
2 I trust this person.		o	o	o	o	o	o	o

245

FINAL FOLLOW-UP
Date Administered: 4.22.13

[Introduction]
We have two follow-up questions for the teamwork research that you helped out with this
semester. PLEASE TAKE A MOMENT TO READ EACH QUESTION CAREFULLY, CONSIDER
YOUR RELATIONSHIPS AS THEY CURRENTLY ARE, AND RESPOND AS HONESTLY AS
POSSIBLE!

Once again, best of luck in your future careers!

TRUST BUILDER
↔ Relational Lookahead ↔

Version 3.0

Upcoming Relational Interaction

101 [Enter Trustee Name]

with [Enter Trustee Company Name]

Stage 1 - Analysis of Current State and a Plan to Improve

Current State

Current Trust Index (Today's Date)

Step 1

Strongly Disagree (1) ←——→ Strongly Agree (7)

1. This person approaches his/her job with professionalism and dedication.
2. Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.
3. I can rely on this person not to make my job more difficult by careless work.
4. Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.
5. We have a sharing relationship. We can both freely share our ideas, feelings and hopes.
6. I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.
7. We would both feel a sense of loss if one of us was transferred and we could no longer work together.
8. I take time to listen to this person's problems and worries.
9. I help this person with difficult assignments even when assistance is not directly requested.
10. I find that his person is NOT the sort of co-worker I need to monitor closely.
11. The quality of work I receive from this individual is NOT maintained by my diligent monitoring.

Current Trust Index

Root Cause Analysis

Why do you feel this way? Pay specific attention to extreme scores.

Comments:

ROOT CAUSE ANALYSIS - ADDITIONAL TECHNIQUES

Five Why's

Proposed Solution

Step 2

Based on Your Responses Above, Select a Trust-Building Method:

Specific suggestions based on your selected method:

Set a date:

Step 3

Do It! (and then come back and complete the next tab, Stage 2)

TRUST BUILDER

◆ Relational Lookahead ◆

Stage 2 - Follow Up

Upcoming Relational Interaction

101 [Enter Name of Trustee]

with [Enter Trustee's Company]

Previously Selected Trust Building Method:	Deliver Results
Originally Anticipated Date of Completion	Wednesday, May 08, 2013
Actual Date of Completion	Wednesday, April 24, 2013

Step 1

Updated State

Updated Trust Index (Today's Date)

Tuesday, April 30, 2013

Strongly Disagree (1) ◆——————◆ Strongly Agree (7)

1	This person approaches his/her job with professionalism and dedication.	
2	Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	
3	I can rely on this person not to make my job more difficult by careless work.	
4	Most people, even those who aren't close friends with this individual, trust and respect him/her as a co-worker.	
5	We have a sharing relationship. We can both freely share our ideas, feelings and hopes.	
6	I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	
7	We would both feel a sense of loss if one of us was transferred and we could no longer work together.	
8	I take time to listen to this person's problems and worries.	
9	I help this person with difficult assignments even when assistance is not directly requested.	
10	I find that his person is NOT the sort of co-worker I need to monitor closely.	
11	The quality of work I receive from this individual is NOT maintained by my diligent monitoring.	

Updated Trust Index	
Previous Trust Index	
Trust Index change (%)	

Implementation Comments/Notes

Comments:

Suggestions:

Current Expectations

Step 2 Commitments and Expectations - What are the next steps in building trust with this person?

	When will you do it?
1	
2	
3	

Step 3 Feedback - Do you have any suggestions to improve the ability of this tool to assist you in building trust?

(CII 1997)

Pre-Project Planning (PPP) Alignment Thermometer
(Five Steps to Greater Success)

Thermometer legend:
- → 100 — Comfortable Road to Success
- → 70 — Discomfort on the Road to Mediocrity
- → 40 — Stressful Road to Failure

Step 1. Circle the number in the column that best shows your "Level of Agreement" with each of the following statements: Legend: 1 = Strongly Disagree 5 = Strongly Agree

Project Name:	LEVEL OF AGREEMENT					
ALIGNMENT ISSUES	1	2	3	4	5	SCORE
1. Stakeholders are appropriately represented on the project team.	0	3	5	8	10	
2. Project leadership is defined, effective, and accountable.	0	3	5	8	10	
3. The priority between cost, schedule, and required project quality features is clear.	0	3	5	8	10	
4. Communication within the team and with stakeholders is open and effective.	0	3	5	8	10	
5. Team meetings are timely and productive.	0	3	5	8	10	
6. Our team culture fosters trust, honesty, and shared values.	0	3	5	8	10	
7. The PPP process includes sufficient funding, schedule, and scope to meet our objectives.	0	3	5	8	10	
8. Reward and recognition systems promote meeting project objectives.	0	3	5	8	10	
9. Teamwork and team building programs are effective.	0	3	5	8	10	
10. Planning tools (e.g., checklists, simulations, and work flow diagrams) are effectively used.	0	3	5	8	10	
					TOTAL SCORE	

Step 2. Place the circled number in the Score column. Add the column to obtain your total score.

Step 3. Plot your team's answers in the appropriate column and calculate the Average, Range (high score – low score) and Range ÷ Average.

TEAM SCORE	Respondent									
Issue	1	2	3	4	5	6	7	Calculated Average	Calculated Range	Range/ Average
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
							TOTAL			

Step 4. Plot the Average and Range for each question and the Total on the Thermometer.
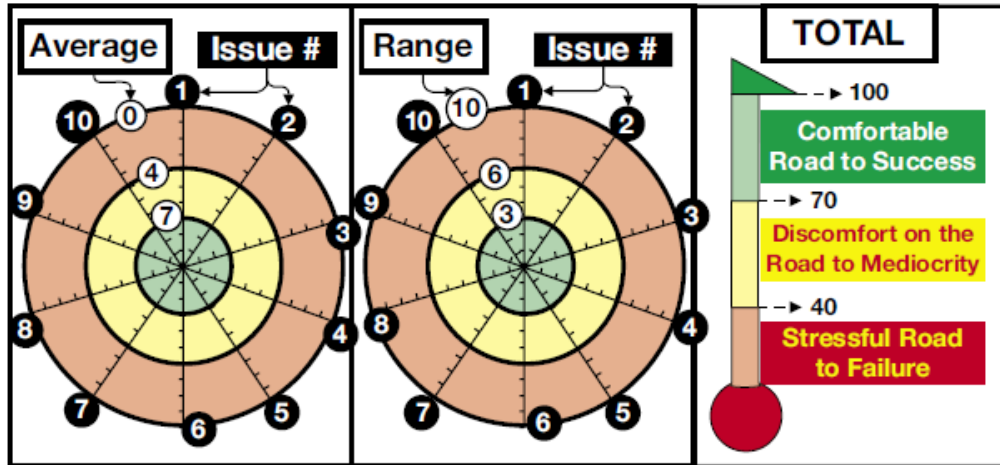
Step 5. All questions with results in the outer ring require discussion to either improve the situation or to determine why it is not an important issue for this project. A large Range ÷ Average likely indicates an issue for special concern.

Helpful Hints:
- Poll all appropriate stakeholders (including business and operations).
- Poll periodically and keep track of score (team meetings, monthly, quarterly).
- Identify issues for discussion and areas for remedial action.
- Use the results to facilitate/design team building activities.
- Modify questionnaire and substitute project specific issues as required.

250

INFORMATION SHEET
The Impact of Chosen Project Delivery Method on the levels of Trust that Exist
Between the Stakeholders to a Construction Contract

Introduction
The purpose of this form is to provide you (as a prospective research study participant) information that may affect your decision as to whether or not to participate in this research.

You have been asked to participate in a research study regarding the effects of trust perceptions in construction project delivery. The purpose of this study is to understand the effect of chosen project delivery method on team dynamics, specifically inter-organizational trust. You were selected as a possible participant because you work for, or are involved with, an owner, architect, engineer, or general contractor.

What will I be asked to do?
If you agree to participate in this study, you will be asked to complete a survey regarding a recent project you worked on. Your responses are completely confidential and will not be shared in association with any personal identifiers. Some follow-up questions may be asked to clarify participant responses, as necessary. Completion of this survey will take approximately 20 minutes of your time.

What are the risks involved in this study?
The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in daily life.

What are the possible benefits of this study?
The possible benefits of participation are an increased awareness of the effect of trust on productivity and waste in construction.

Do I have to participate?
No. Your participation is voluntary. You may decide not to participate or to withdraw at any time without your current or future relations with Texas A&M University or involved companies being affected.

Who will know about my participation in this research study?
The records of this study will be kept private. *No identifiers linking you to this study will be included in any sort of report that might be published*. Research records will be stored securely and names of participants will not be shared or used for any other purposes than to analyze collected data.

Whom do I contact with questions about the research?
If you have questions regarding this study, you may contact James P. Smith at (801) 885-0422, or by email at james.smith@tamu.edu

Whom do I contact about my rights as a research participant?
This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at (979)458-4067 or irb@tamu.edu.

Participation

Please be sure you have read the above information, asked questions and received answers to your satisfaction. If you would like to be in the study, either click the link to the survey found in the email and follow the instructions, or complete the attached survey and return to the sender. *Participation is considered consent*.

INFORMATION SHEET

[Introduction]
You are being asked to participate in a research study regarding teamwork in the construction project delivery process. The purpose of this study is to improve our ability to create effective teams. You were selected as participants because you are students in Texas A&M's Construction Science Department and you are participating in a semester-long group project. In order to ensure data validity and to make this exercise valuable, PLEASE BE HONEST IN YOUR RESPONSES!

[What will I be asked to do?]
If you agree to participate in this study, you will be asked to assess your group members once a week for four weeks. You should respond to the questions in the context of the term project, and your actual relationships with team members. Your responses are *completely confidential* and will not be shared with your team members or your teachers in association with any personal identifiers at any time. Fulfillment of the requirements for this research will take less than 1 hour over the four week period, the majority of which will take place during class. Your responses will NOT affect your grade in this class.

[What are the risks involved in this study?]
The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in group interactions and daily life.

[What are the possible benefits of this study?]
The possible benefits of participation are a better understanding of the principles of effective teamwork in the construction project setting.

[Do I have to participate?]
You do NOT have to participate. Your participation is voluntary. You may decide not to participate or to withdraw at any time.

[Who will know about my participation in this research study?]
The records of this study will be kept completely private and confidential. *No identifiers linking you to this study will be included in any sort of report that might be published*. Research records will be stored securely and names of participants will not be shared or used for any other purposes than to analyze collected data.

[Whom do I contact with questions about the research?]
If you have questions regarding this study, you may contact James P. Smith at (801) 885-0422, or by email at james.smith@tamu.edu

[Whom do I contact about my rights as a research participant?]
This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at (979)458-4067 or irb@tamu.edu.

[Participation]

If you would like to be in the study, please complete proceed with the applicable in-class instruction at the appropriate time. *Participation is considered consent.* REMEMBER!! PLEASE HELP US IMPROVE OUR COLLECTIVE ABILITIES TO WORK IN TEAMS BY RESPONDING HONESTLY. ALL RESPONSES WILL BE KEPT COMPLETELY CONFIDENTIAL.

Your participation and honest responses are greatly appreciated!