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An analysis of the impact of information systems on the level of trust in the construction industry

Michael Wayne Jones
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Walden University

COLLEGE OF MANAGEMENT AND TECHNOLOGY

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Michael Jones

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2009

ABSTRACT

An Analysis of the Impact of Information Systems on the Level of Trust in the
Construction Industry

by

Michael Wayne Jones

M.S., Computer Information Systems, University of Phoenix, 2004
B.S., Applied Mathematics, Valdosta State University, 1999

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Applied Management and Decision Sciences

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ABSTRACT

Even though the current level of communication and information sharing is greater than it has ever been throughout the history of the construction industry, the problem under investigation stems from the results of current research that indicate that many major projects have difficulty in achieving client expectations, resulting in a negative image of the construction industry. The purpose of this study was to analyze the impact on the level of trust in the use of information systems between construction firms and their clients. The theoretical foundations of this research were based in interdependence and coordination theories. While information systems enable improved communication processes, coordination and interdependency are central to mutually successful completion of construction projects. However, there is a lack of a prescriptive view present in the literature regarding the role of trust in enhancing client satisfaction through the use of information systems. The research questions that underlay this study were based on discovering the extent and nature of mistrust between contractors and their clients. Through the use of a qualitative methodology, data were collected through responses from a semi-structured, open-ended questionnaire. By analyzing consistencies in the responses, the researcher used grounded theory to determine trends and consistencies. The results revealed that while contractors believed trust existed between contractors and clients, clients believed mutual trust was low despite the increased communication through emails and current information systems. By emphasizing the notion of mutual trust in the communication process, contractors can improve the image of the construction industry. The magnitude of social change could result in more successful and timely completion of projects saving millions of dollars.

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DEDICATION

This dissertation is dedicated to my lifelong friend and mentor, Mr. Michael E. Gayheart, who has over 30 years of construction and project management experience and who took the time and effort to mentor me and guide me toward understanding the industrial construction work environment for project controls in cost, quality, safety, and client satisfaction.

Mr. Michael E. Gayheart also exposed to information systems and technology used in industrial construction management which motivated me to learn about these information systems and to seek higher level degrees beyond just a bachelors. Before I met, Michael, I was just a “green” forklift operator with an applied mathematics degree with no true interest in computers. When he, exposed me to computers and how to apply them toward construction management, it gave me a pathway toward accomplishment that has lead me to where I am today completing my PhD and teaching as a college professor.

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Thank you again, Dr. Tony Lolas, Dr. Aqueil Ahmad, and Dr. Raghu Korrapati for helping me toward earning my Ph. D.

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CHAPTER 1: INTRODUCTION TO THE STUDY

Introduction

Although information systems technology has contributed significantly to the communication process through the use of email and project management software, construction projects continue to be challenged, and even fail, at an unacceptable rate which affects the relationship between the stakeholders. According to Chinyio and Boyd (2006), one of the greatest current problems in the construction industry is the conflict between firms and their clients. Consequently, the construction industry is known for distrust. This problem could be due to the difficulty or inability to identify hindrances to constructive relationships with clients, which often leads to a high level of mistrust. These issues that prevent positive working relationships need to be overcome and require much more emphasis by the industry. Methods to improve client trust should be a priority by construction firms to ensure the level of project success that achieves client satisfaction. However, there is little research on the impact of the use of information systems in contributing to the communication process that could lead to improved levels of trust between construction firms and their clientele. The emphasis on improving the level of trust could lead ultimately to the mutually acceptable completion of the project. The primary objective of this study was to gain a better understanding of the nature of trust between the construction firms and their clients through the eyes of those directly involved in the industry. By shedding new light on the issue of trust, it is expected that a social change in the relationships between contractors, subcontractors, and clients could lead to an increase in the successful completion of construction projects throughout the world.

One of the explanations for distrust between construction firms and clients may be a fault in the integrative approach necessitating complex communication systems in the generation and transfer of information required in construction projects. The problem often occurs when information is not shared, or misrepresented, and one of the many groups involved in a project is not aware of what is taking place in other areas (Rowlinson & Cheung, 2004). When this occurs, resulting mistakes lead to stakeholders looking for attributions for blame. Defense mechanisms in response contribute significantly to the deterioration of trust between construction firms and their clients.

The amount of information that needs to be shared between the firm and the client can be immense, depending on the complexity and expense of the project. This demand for communication is due to the frequently high levels of volatility and uncertainty. Industrial projects already make clients tense due to the high level of financial risk. This results in the need for a high degree of trust (Rowlingsom & Cheung, 2004).

Much research has indicated that the construction industry needs to establish a means to build trust between firms and clients. As Kadefors (2004) stated, "If trust is present, people can spontaneously engage in constructive interaction without pondering what hidden motives exchange partners might have, who is formally responsible for problems, or the risks of disclosing information" (p. 176). With the use of current technology, it is possible to use information systems to communicate about potential problems and concerns and maintain the involvement of shareholders in a project, which is vital for project success. Thus, organizational leaders in the construction industry need to have a strong foundation in information processing to effectively build trust.

Finding a way to improve trust between contractors, subcontractors, and clients

can result in large improvements to the industry. Consistent with this premise, Pinto, Slevin, and English (2009) stated, “The formation of trust is desirable since it reduces the transaction costs of monitoring and controlling, hence making the working relationship more efficient” (p. 639). A solution may be more involvement through an exchange of information before a problem arises.

Information systems are being used in all types of industries to keep clients informed and involved to ensure project success (Johnson & Palanque, 2004). If implemented correctly, the construction industry could derive the same results. The key, however, is that managers and leaders of construction firms must rethink and re-engineer how they manage projects and manage relationships to effectively use information systems (Tan, 2002).

Background of the Problem

Welppert and Kajewald (2002) conducted a 2-year study to determine the usefulness of digital information and communications systems among project workers for remote projects in Australia. The study was conducted on large projects, such as residential and commercial buildings or other public and private construction projects. The researchers wanted to determine factors that led to information flowing more freely and efficiently using information systems. They also wanted to understand the overall impact information and communications systems had on projects during the development and implementation phases.

Welppert and Kajewald (2002) found that for the information and communications systems to be used effectively, (a) the users of the system had to believe that the system would result in more reliable and efficient informational exchanges; (b) the systems must be designed specifically for the construction industry and the needs of

those who work in the industry; (c) the information exchanged within the system had to be accurate.

Finally, Welppert and Kajewald (2002) explained that an important factor in effectively applying an information system to a construction project was total commitment by the team members. One way to develop the necessary commitment was to have a team member motivate coworkers to use the information system for each project. This person would show that the information system could help reduce problems caused by a lack of communication or a lack of information sharing.

O'Connor (2004) conducted a study to determine the actual levels of success that can be achieved for construction projects once *information technology* (IT) was put into place. O'Connor investigated data from 200 different capital projects ranging from buildings to industrial projects and varying in size from \$5 million to more than \$100 million. Such a range of project sizes provided a fuller dimension to data on how information systems have affected different types of projects in previous research.

This study revealed that the use of technology resulted in substantial improvements to scheduling, and thus, project success. O'Connor (2004) also found that overhead was reduced due to higher levels of technology use for high-tech functions on the job sites. Overall, this study indicated that the use of information systems improved the execution of both small and large-scale projects.

To encourage construction firms and project leaders to utilize information systems, it is necessary to demonstrate that indications of success, such as reduced cost and precise scheduling, are more pronounced as a result of their use. Thomas, Lee, Spencer, Tucker, and Chapman (2004) conducted an analysis using data from 297

construction projects ranging in value from \$15 million to more than \$100 million in order to ascertain whether information systems can have the positive indications reported in other studies.

The findings indicated that the use of information systems on construction projects resulted in an average cost savings of 4%, or \$2 million (Thomas et al., 2004). More important, such positive outcomes could lead to further business and positive referrals from satisfied customers, both of which lead to long-term benefits. The findings also indicated that using information systems resulted in a greater amount of scheduling compression, which can result in the early completion of projects. Ultimately, the use of information systems can have real-world results for construction firms and for individual projects. However, the authors of this study indicated that there is a learning curve for information systems in the construction industry. Those firms that can overcome this learning curve quickly and maintain the use of information systems can garner the highest level of cost savings and scheduling compression.

Firms in the construction industry are known for demanding conclusive evidence of the benefits to cost and organizational infrastructure from the implementation of a new process or system. However, even with an information system in place, construction projects frequently result in project failure, or at the very least, significantly challenged.

This study was designed to shed new light on the nature of trust and the impact of information systems with the expectation that it could provide insight that would lead to an increase in the level of trust between construction firms and their clients. By focusing on the notion of trust, construction stakeholders might better work together through the use of information systems to provide a better communication process that could lead to

more successful project completions. The findings from this study are also important because the very nature of the research that was conducted is grounded in practical applications that the construction industry expects from theoretical studies. By analyzing the extent and nature of mistrust, the results of this research could lead to an enhanced use of information systems and improve the communication process in construction projects.

Statement of the Problem

Although the current level of technology is the highest it has ever been in the construction industry, there is general agreement that the level of success in major projects is well below expectations. A review of the construction industry and the interests of the stakeholders can assist in alleviating this problem, especially from the viewpoint of trust.

In developing an understanding of how trust between firms and clients can influence project success, the basic relationships within the construction industry was explored. A construction project environment has two main stakeholders, the contractor and the owner (Pinto et al., 2009). The main contractor, known as the *prime contractor*, is responsible for overseeing and paying the construction team. Contentions frequently occur between the prime contractor, the sub contractors, and the client. “When trust levels are low, it is likely that the well being of the owner/contractor working relationship is at risk and disputes between the owner and contractor will arise” (Pinto et al., p. 641).

As with most industries, the profit-driven nature of the construction industry is largely due to the interest of the prime contractors and sub contractors to minimize

overhead and maximize profit. However, the clients' interest is to minimize cost in achieving their required specifications. This apparently contradictory nature of the industry may lead to distrust among the stakeholders. As trust decreases, each participant will endeavor to minimize their risk at the expense of the other stakeholders. This situation leads to a zero sum mentality. The resulting lack of trust among the various stakeholders can lead to a conflict of interest which frequently results in client dissatisfaction.

An additional problem in the construction industry is the apparent lack of awareness of how advanced information systems technology interacts with communication processes in a way that can provide a higher quality of service without significantly affecting profits. Among those who have knowledge of information system technology, there may be a perception that the use of such technology is a waste of time, resulting in the current dearth of implementation data that could result in improved outcomes.

In summary, the construction industry is filled with individuals who value hands-on technical skills. They consider administrative tasking an expense that can easily outweigh its benefits. To make matters worse, each stakeholder attempts to maximize their profits, even at the expense of others. Consequently, a lack of trust often permeates all stakeholders involved in many construction projects, especially major projects (Pinto et al., 2009). To reach an outcome where all stakeholders mutually benefit from their participation in the construction project, it is necessary to overcome the notion of maximizing the individual gain, which has an adverse impact on the level of trust.

However, the exact nature and extent of mistrust in the construction industry, as well as the role that an improved information system and communication process might play in building trust, have not been effectively recognized and developed. The objective of this research was to shed new light on the problem by exploring the nature of building trust through information systems technology and an enhanced communication process.

Purpose of the Study

The purpose of this qualitative study was to (a) investigate the exact nature and extent of mistrust in the industry, (b) identify methods to improve communication to increase the level of trust, (c) determine whether the use of an enhanced information system would lead to changes in the communication process that will improve levels of trust, and (d) identify a better method in the implementation of an enhanced information system for improving communication among stakeholders.

The study was conducted using questionnaire-based surveys administered to a sample of contractors and clients who were actively engaged in major construction projects. By getting the candid opinions of those actively involved in the construction process, it was anticipated that they would shed new light on the problems within the industry. The results from investigating the interplay between trust, information, and communication in the construction industry might contribute to increased satisfaction among all stakeholders in future major construction projects.

Research Questions

Informed by the problem statement and purpose, this study explored the following research questions:

1. How do clients in the construction industry define the nature of mistrust between them and the firm?
2. What might the industry be already doing, if anything, to improve their communications system that would lead to a reduction in mistrust?
3. How could the use of modern information systems help improve communication that would lead to a reduction in mistrust?
4. What factors hinder the implementation of information systems that could lead to an improved level of trust?
5. Is there a difference of opinion between the construction firms and their clients on the above issues?

Conceptual Support for the Study

In a qualitative study, the conceptual framework correlates the research to the given study. The current study used a framework that considered theories, models, and notions concerning trust within business and construction project management to form the base of the study and to assist in the formulation of the research questions. The theoretical foundation of this research was based on notions from coordination theory and interdependence theory in the use of information systems as they applied in the construction industry processes. While information systems technology enables improved communication processes, coordination and interdependency are central to mutually acceptable successful completion of construction projects. However, there is a lack of a prescriptive view present in the literature as to the nature of unsuccessful projects

regarding trust in the construction industry even though the current level of technology is greater than it has ever been throughout the history of the industry.

According to Malone, Olson, and Smith (2001), coordination theory attempts to answer the question, “How will the widespread use of information technology change the way people work together?” (p. 8). Working toward common goals seems to be the foundation in getting people to work together in construction projects. However, according to David Johnson and Roger Johnson (2005), interdependence exists when the outcomes of individuals are affected by each other’s actions. They indicated that “there are two types of social interdependence: *positive*, when the actions of individuals promote the achievement of joint goals, and *negative*, when the actions of individuals obstruct the achievement of each other’s goals” (p. 287).

As long as the interdependence among the construction stakeholders is *positive*, there is mutual trust and cooperation in the progress toward common goals. However, when the different stakeholders work to maximize their individual interests at the expense of the others, the interdependence becomes *negative*.

It appears that coordination and positive interdependence among the stakeholders depend on establishing mutual trust through a mutually satisfactory communication process. Information systems can play a major role in developing a mutually acceptable means toward establishing and maintaining trust in achieving mutual satisfaction among the stakeholders in construction projects.

The conceptual framework also provided an understanding of how businesses seek to change and adapt to industry or customer demands and desires (Henderson, 2000). The literature indicated that the construction industry is going through a change in

terms of how customers want to receive information about their projects. In addition, the construction industry is facing major changes in the way in which information systems require the adaptation to new ways of doing work in construction projects as well as contributing to the communication process.

The conceptual framework also required an analysis of trust. Bennis and Nanus' (2007) research regarding leadership appeared to reveal that business leaders achieve success through the establishment and maintenance of trust (pp. 41-50). Likewise, McGrath and Zell (2009) indicated that business success rests on a solid network of individuals who were loyal, trustworthy, and who told the truth (pp. 77-78). Similarly, Miles (2007) indicated that business success grows from shared knowledge as a contributor to innovation and the creation and sustainment of trust (p. 195). From the research, the theoretical importance of establishing trust is clearly a stated foundation in the business environment.

To enhance the conceptual framework of the study, business process reengineering (BPR) was used as a method to analyze the importance of trust in implementing successful projects. BPR explains how organizations adapt and change according to demands in their industries. An analysis of BPR is appropriate for the current study because it is concerned with how businesses change and adjust their means of project completion with the available industry resources, including those that are not currently utilized by most firms, namely, informational technology (Galliers & Leidner, 2003).

BPR is defined as the creation of completely new processes for business operation (Robson & Ullah, 1996). It is important to understand that BPR is concerned with using a

variety of tools. BPR is a means to identify disparities in companies that affect their performance, and therefore can be used to indicate the implications of not applying and integrating information systems to their business processes. More important, BPR can help to identify the potential improvements that can be made as a result of information systems.

Robson and Ullah (1996) explained that one of the important ideas of BPR is that an organization must think about its systems and processes from the very beginning. This is due to the notion that BPR requires the consideration of entirely new ways of handling organizational processes. Therefore, organizations must step out of what has taken place for years or even decades previously, question the assumptions that have guided it to this point, and break dated habits (Robson & Ullah). For the construction industry, this would mean questioning such assumptions as what it means to have project success in the first place. This could also mean questioning the roles of the client and the firm as well as the level of input and the information sharing that takes place between the client and the construction firm.

Previous research showed that during the beginnings of the BPR movement, many organizations that tried using the concepts of business process reengineering had very high failure rates, some as high as 75% (Kock, 1999). BPR is not only applied in the interest of changing the processes that are used by an organization, but it is also concerned with changing the culture. Many believed that the reason for this was that BPR was simply too radical in its notions of changing processes as well as the culture in completely new ways. However, it was later discovered that much of the problem had to

do with the fact that an organization changed some of its processes, but not its way of thinking and acting on those processes (Kock, 1999).

To further the importance of understanding the significance of current methods in contributing to the theoretical framework of the study, it is the recognition that dated perspectives have definitely become a problem. For example, the construction industry is certainly an industry where very deep-rooted ideas and notions prevail. For a theoretical manager to state that the firm is going to use information systems to communicate more effectively with the client in an effort to build trust might seem like a good idea. However, if the attitudes of those in the construction firm are not adjusted and changed, then the implementation of the information systems is probably going to fail due to the inherent resistance to change. If the project managers and project leaders have the attitude that information sharing and working to build trust are not important or are even a waste of time and resources, then the implementation of information systems is not going to have any significant effect. These predetermined notions would inevitably hinder the implementation of information systems, and the efforts to integrate it would result in it being ineffectual in contributing to the organization's profit margin.

It is important to note that BPR may be relatively new, especially when compared to other frameworks involving business processes, but it is not without its own range of research. For example, previous studies have indicated the notion that radical changes create dramatic results for an organization (Cooper & Aouad, 2004). This notion could be applied to BPR because it results from a complete departure from previous approaches or processes rather than a minor change in that approach or process. It is not simply a process of making adjustments. Instead, it is truly about changing entire processes and

entire ways in which an organization thinks about the way it does business and interacts with others. Implementing BPR requires modifications to organizational cultures before the technical change is fully developed.

Ultimately, BPR is an excellent counterpart to the theoretical framework to draw from for this research due to its concentration on information systems. BPR was originally created with the idea that information systems would play an important role in the redesign and changes that would take place to processes within an organization. One of the key ideas is that information systems can be used to create processes that can reduce costs, improve performance, and provide an overall better product outcome from the organization (Cheng & Tsai, 2003).

The use of BPR as an adjunct to the theoretical framework that guided this research was practical in that it deals with both the optimization of business processes within an industry and the introduction of information systems in an environment where the need to change processes and the use of computerized systems are foreign concepts to many construction firms. In summary, for the business managers of construction firms to acknowledge the need for improvement through reacting to the disparities in trust between clientele and firms by incorporating information systems, it requires a practical approach to the theoretical framework. Currently, BPR appears to be a very important practical adjunct to the theoretical framework upon which to base this study.

Assumptions

This study was conducted under the assumption that trust can be improved by a combination of the use of an enhanced information systems and a more efficient and effective communication process among the stakeholders. There is sufficient evidence based on previous research to support this assumption (Jarvenpaa & Leidner, 1999).

To support this notion, it was assumed that the relationship between clients and firms in the construction industry is similar to relationships between companies and consumers in most other service industries. This applies to a series of subordinate assumptions that are generally accepted about service industries. These include that the most inexpensive means to achieve the expected level of quality will be pursued by both clients and firms, that trust by both parties is essential to facilitate functional communication necessary to successfully complete a project, and that the three most important aspects of a project are costs, scheduling, and quality.

Another primary assumption of this study is that trust levels can be improved upon by using more efficient and effective communication between the parties (Jarvenpaa & Leidner, 1999). The communication process that emphasizes the notion of building trust involves the transmission of information that is necessary to achieve project success.

Additionally, it is assumed in this study that clientele either directly or indirectly desires to work with companies that utilize information systems to enhance the communication process. This assumption applies directly to those who are familiar with the benefits of information systems to an organization, and thus have developed a preference to work with organizations that retain those benefits. It applies indirectly to

those who desire to work with companies who exhibit the benefits of using information systems without specifically acknowledging the source of these benefits.

Limitations of the Study

The foremost limitation of this study is the perceptions of a relatively small sample from both firms and clientele.

This study did not conduct a comparison between varying types and sizes of construction firms. Instead, only elements of trust, communication, and the use of information systems as they relate to construction firms and their clients were considered. In essence, the scope of this study is limited to these aspects, ignoring other variables that may apply to construction firms.

Although there may be multiple influences by extraneous variables that impact on the relationships between stakeholders, this study focused only on these primary three variables. Although project management crosses multiple industries, the focus was limited to only the construction industry.

Scope and Delimitations of the Study

Studies are bounded by the actual amount of time and resources that are available for data collection. A study of this nature is not going to have the resources to understand the construction industry on a global scale, except in terms of previous research literature. Collecting information from construction firms and clients in countries around the world is well beyond the scope of this research.

By investigating the opinions of only 53 construction and client personnel, the scope of the study may be subject to individual bias. Since construction project management differs from other types, the study's generalizability to other sectors of the service industry may be limited. Furthermore, individual perceptions of information systems exist between construction firms. Consequently, there may be issues that arise during the integration of information systems that can be attributed to an unwillingness to accept the changes that the implementation of information systems requires.

Considering there are existing issues of trust in relation to construction firms, clients may be unwilling to recognize changes in a company as a result of the application of information systems, or may believe that such an implementation may not be enough to satisfy their dissatisfaction. Indeed, those who seek firms in the industrial construction sector may have very different notions about project success and trust issues regarding large projects than smaller clients would have in their expectations for smaller construction companies.

To overcome these negative concerns, the sampling methodology included the utilization of senior construction management for the selection of individual employees from different functional roles in the industry as well as the clients of large construction firms. The limitation on this research was that the participants were primarily a convenience sample rather than a large-scale and representative sample of firms and clients. This does not necessarily make the findings any less significant. However, it does make the ability to infer these findings to a nationwide or even worldwide context as long as it is used with caution.

Research Design

This research was conducted using a qualitative methodology to gain insights from those directly involved in construction projects. Questionnaire-based surveys were given to a sample of construction stakeholders and the results were analyzed. Rather than simply taking a numerical or scale-based survey of managers of construction firms and their clients, this research sought to understand the broad spectrum of issues surrounding trust and communication in the industry. The idea behind this methodology is that key findings might be left out or overlooked if participants are not free to discuss their opinions openly.

The nature of the different types of information systems and the variety of applications make it difficult to assess complex issues through the use of a numerical or a scale based survey. Furthermore, many stakeholders in the construction industry are not likely to be computer literate or information system users. To further complicate the issue, some of the people who use information systems in their roles in the construction industry may be doing so only because they have been trained to use a specific system or a specific set of methods without understanding the theoretical output of the data that has been entered. This is where the qualitative research method can help to better understand the nature of information systems in contributing to the communication process in the construction industry. Interviews allow participants to better explain the state of trust in their industry along with adding explanations for the methods and technologies utilized for communicative purposes.

By including a sample from both construction firms and their clientele, the researcher gained an understanding of how information systems are used or might be

used to identify the factors that could increase the level of trust between clients and firms. The use of contractors and clients in this study provided insight from both sides of the issue.

The important issue that was ever present was that scientific principles and proper research ethics were used for the collection of the data from the interviews of the participants. This must be the foremost concern of any researcher, regardless of whether the participants are known, or are even seen, by the person conducting the research efforts. The ethical collection of data and the ethical explanation of the findings are areas that cannot be compromised in any way.

The sample chosen was actively engaged in major construction projects. Selecting currently active participants can provide the most germane data. In addition, they have recent experiences from which to draw upon when taking part in the study, increasing the likelihood of an accurate report.

Definition of Terms

Before any discussion can begin on the topic of using information systems to build trust and ensure project success in the construction industry, it is important to define what is meant by these terms. For the research that is being proposed here, nine terms have been identified: business process reengineering, challenged project, construction industry, contractors, clients, failed project, information systems, successful project, and trust.

Business process reengineering: Laplante (2001) defined business process reengineering as “business-focused, integrated, and radical approach to redesigning a

business system” (p. 58).

Challenged project: A project that has not met goals in regards to cost, schedule, and/or performance (Chan et al., 2002).

Failed project: A project that is abandoned completely due to exceeding budget, time, scope, and project specifications by at least 10% (Chan et al., 2002).

Information Systems: Burnie (2001) defines information systems as the use of information technology quite simply as “the storage, processing, and transmission of information by computers or computerized systems” (p. 256). From this definition, sending or receiving information, such as blueprints or scheduling details about a construction project, would involve information systems because one computer is being used to store and send the information and another computer is being used to receive the information.

Successful project: One of the words used in developing a succinct definition of success is customer satisfaction. Chan, Scott, and Lam (2002) explained that the actual definition of success can vary from one project to the next. However, in general terms, success for this research is defined as the level to which the goals and expectations for a project are met. These expectations do not necessarily mean, for example, that a building is completed. Instead, success can be achieved or not achieved from a variety of standpoints. These standpoints can exist in terms of technical elements, financial elements, professional issues, or even social issues. A project is considered successful if it meets the customer’s expectations once the project parameters are completed.

Significance of the Study

A comprehensive understanding of the issues that may contribute to project success from those who are directly involved in construction projects grant significance to the study, in that the enhancement of these issues could produce more favorable outcomes for both stakeholders and firms. In pursuing this understanding, this study provided information that may be new for many basic construction firms, even those accustomed to dealing with large clients on a daily basis. Project managers and leaders in the construction industry should realize that the future of this industry lies on operating in a world where information sharing and the use of information systems to bring firms and clients together in a mutually satisfactory manner will be the norm. Although many leaders in construction firms have been resistant to information technology changes in the past, information sharing and communication are required elements in doing business.

This research was further significant because the results could lead to an improved relationship between the client and the vendor. Communication and trust should permeate all levels within construction projects. If a client needs information from the project manager or the supervisor regarding a specific area of a construction site, that individual has the opportunity to assist in the process of building trust, which should lead to improved project success. The findings of this research could also be used to train those working for construction management firms how to better connect with their clients and build a relationship of trust.

Information derived from this study can also help those in the construction industry who may be uncomfortable about using new information technology by disambiguating its use and implementation as well as outlining its virtues. Through this

delineation, evidence was provided that trust building, the understanding of success factors, and the use of information systems are important constructs for trainers of construction industry personnel. This is important because construction industry personnel respond better to research-based evidence that is grounded in practical application rather than to unsupported theoretical notions.

This can also be said for clients. They want to see that their projects are completed on time and within the cost and specification constraints. Clients are not receptive to excuses about the causes of delays and cost overruns. Simply put, the client wants the project completed on time, within the specifications, and within the budget, or even better, below budget. Client satisfaction, as well as profit expectation, should be the objective of the construction firm. Even with an unexpected cost or time overrun, if the need is communicated properly and the level of trust is high, client satisfaction may even grow. An application of the tenets presented in this research can lead to the overall improvement of both individual construction firms as well as the industry through a more functional means of communication leading to a healthier relationship between firms and clientele.

From the perspective of social change, this research presented the opportunity to change the way in which the average individual interacts with the construction industry. Most people, at some point in their lives, whether it is having a home built, having repairs made to a home or business, or being involved in larger construction projects, interact with members of the construction industry. Distrust of the construction industry is already present as many of these interactions begin. This research can help to provide the construction industry increased information that is needed to change its own public

image, as well as to improve the interactions between clients and firms. The end result for social change can be a shift in the way that the public views the construction industry and even lessen the amount of needless litigation and bad public relations that occur simply because one side or the other lacks complete information or has not taken the time to fully communicate what was needed or expected on a particular project.

Chapter Summary

The purpose of this research was to investigate the association between information sharing and trust with construction firms and their clients, and the way in which information systems can foster these ideas. The research was conducted from the framework of BPR, which is concerned with radically changing processes and attitudes within firms to improve performance and outcomes. This framework was critical to this research because BPR is an important factor in the implementation of information systems and technology as a means toward making processes more effective and productive.

This research progressed with the assumption that clients in the construction industry are concerned about having access to more information and building trust with the firms that they hire. The literature on technology in the construction industry also points to the need for a greater understanding of the ways in which information systems can improve processes and performance. Since many of these projects are typically large in scale and require a lot of resources, a greater understanding of the relationship can lead to significant cost savings for the client and enhanced future business for the construction firm.

It is even more significant since these projects typically involve clients who are operating in their own industries where information systems and information sharing is the norm. Consequently, these clients may demand more information to feel a sense of trust with the firm. Since many clients are currently using a communication process that involves the use of information systems, there is often a strain on the relationship between these clients and firms who do not fully utilize it before a project fully begins.

Chapter 2 provides an in-depth literature review involving information systems in the construction industry. The literature review also examines issues of client satisfaction, trust, and communication within the construction industry. Next, the research includes an examination of the history and ideas behind BPR in this context. It is anticipated that the discussion of BPR and how it has been used in various industries may contribute to defining a mechanism that will lead to improvement in the present construction industry framework.

In chapter 3, the methodology explains the data collection process and the analysis and results of the data. The results from the research proposal shed new light on the relationship between construction firms and clients, which could lead to improvements in the construction industry. Chapter 4 presents the results of the study, including the data and the analysis of the data. The paper concludes with chapter 5, in which conclusions are drawn and recommendations for future research are made.

CHAPTER 2: LITERATURE REVIEW

Description of the Literature Review

The literature involved four inter-related subject areas: the general culture of the construction industry, information systems and IT in construction, client-firm relationships, and BPR. The literature also dealt with some of the misconceptions about the issues and variables that are associated with client satisfaction and the ways in which to increase client satisfaction. In this way, the literature presents illustration of how information systems have impacted the construction industry. Additionally, this review provides focus in areas in which the current research suggests for participants to convey even more understanding of the construction industry and the way it is being affected, and can be affected, by using information systems and integrating it into the traditional construction process.

In contrast, it should also be mentioned that the literature review also contains information about what construction firms are currently doing that reduces client satisfaction. This is just as important as examining what firms are doing that positively improves client satisfaction. Improving client satisfaction is not just about finding new processes, but also about understanding and avoiding the current processes that are contributing to client dissatisfaction.

This review of related literature has indicated where further research is necessary. Additionally, the literature review provides information regarding lapses or misunderstandings that contributes to client dissatisfaction. By summarizing and emphasizing the positive approaches and suggesting ways to minimize the negative

activities, it is hoped that the results will lead to mutually beneficial results for both the client and the construction firm.

Culture of the Construction Industry

Ankrah and Langform (2005) defined organizational culture as the set of shared assumptions and beliefs that have been applied to solving problems and is taught to those who enter the organization. In the case of the construction industry, there is a very complex cultural context comprised of both a larger infrastructure as well as smaller, independent components.

Riley and Clare-Brown (2001) explained that in construction many small cultures could exist concurrently on the same job site. Each construction firm may have independently contrived perspectives and methodologies, which will manifest themselves independently through representatives of each respective firm. Furthermore, a large job site can have a primary construction company that manages many sets of contractors, subcontractors and employees, each with their respective cultures. This necessitates the difficult process of integrating different working ideas and cultures in order to establish cohesion.

Consistent with these concerns, Cheung, Yiu, and Chim (2006) noted that the construction industry is actually very fragmented. Each contractor, subcontractor, or even front-line employee sees themselves as individuals or part of a small group based on the job they are performing. There is very little view of each person as being part of the larger project. Instead, those who are on a job site to lay pipes will see themselves as

being pipe layers. Those who are on the job site to install drywall tend to only think of themselves as people who install drywall.

Ankrah and Langford (2005) identified some of the characteristics of the contractors who lead teams on job sites that also indicate fragmentation. They explained that contractors are very formal in their organization in the sense that they are on a job site to lead their team of sub-contractors and laborers. There is also very little room for ambiguity of jobs or duties in the minds of most contractors. In the end, the construction industry from the standpoint of those who perform the tasks associated with completing a project are much more individual in their thinking as well as in their performance of required tasks than many outside of the industry might realize.

This can be improved through the application of information systems, which can provide cohesion to an integrated team of independent workers. It the coexistence of various cultures can make it difficult for project stakeholders to share information between firms and clients, especially when cultural differences result in a lapse in communication between the subunits of a construction team. This can result in delays and other problems that exacerbate overhead, especially in large-scale construction project. A standardized approach to communication could bridge these gaps by nullifying differences and expediting the transfer of information. It is the intention of the researcher to shed new light on the development of the macro view of a project through the use of information systems that will lead to improved teamwork and client satisfaction.

Information Systems in Construction

Carrillo and Chinowsky (2006) indicated that knowledge management is important in the construction industry. Large-scale construction projects require the exchange of knowledge, including that which has been previously learned, between workers and managers to make current projects more efficient and ultimately more profitable. The authors conducted a study to examine the use of knowledge management systems by the construction industry in the United States through interviews with 19 people from six construction companies. The authors found that knowledge management systems were much more difficult to implement for large companies than for small construction firms. They indicated that the source of this difficulty is that large companies are spread out over a large distances and have a hard time keeping track of its knowledge. Although smaller companies are more compact, alleviating this problem, knowledge management systems may remain elusive for them due the additional expense, resources and time requirements.

Although the sample size of the study was not large, the information that can be gained from the study is still important. The study provided a basis for understanding the relationships among the participants in the construction industry. It was expected that the findings of this study might lead to suggestions for specific projects and in particular company environments.

Lu and Issa (2005) approached limitations in implementing information systems due to company size by creating a highly customizable model for integrating information systems and management based on the size of the construction firm. It required a

construction firm to identify the most important tasks and participants for the specified project. Information regarding the most important tasks, responsibilities, and timelines can then be assembled and applied. Computer applications and components can thus be purchased and used based on what is needed for the current project, minimizing extraneous spending while approaching the most exigent issues.

Even though there is evidence that using information systems in major construction projects can improve the communication process leading to positive outcomes of construction projects, the practice appears limited and, in many cases, it does little to enhance client satisfaction. This indicates that either the current body of literature has been unconvincing, or there has been little exposure to data on the mutually successful implementation of information systems to improve the construction process from the perspective of both the construction firms and their clients.

However, it must be remembered that the construction industry is considered by many to be a very rigid industry where firms of all sizes are not quick to change how things have been done for years or decades. In many industries, it is normal to have models that are based on being able to adjust or change depending on the needs of the clients of the current project. However, in the construction industry, maximizing individual profits by each of the subcontractors and the primary contractor seem to be more important than maximizing client satisfaction. This attitude frequently results in a conflicting and sometimes hostile environment.

This fundamental contradiction is the emphasis of this research. Thus, it is important to quantify the benefits of implementing information systems in construction

projects. Thomas et al. (2004) conducted a statistical analysis of 297 construction projects in the United States. As a result, a baseline for the performance of a company that used information systems was established, leading to a level of performance based on an assessment of performance determined by the baseline measure. The authors discovered that by increasing the use of IT, firms and project owners save up to 4% on project overhead.

By improving the processes applied to construction projects through implements like information systems, savings exceeding 4% at all levels of the implementation process may result once a thorough understanding of the system is established by the organization. It is anticipated that greater savings may be found by combining theoretical conclusions with the real-world knowledge to make the implementation of information systems more effective and efficient.

O'Connor and Yang (2004) examined data from 200 capital projects and found that overhead decreased proportionately to the use of technology. In addition, higher levels of technology use on construction projects were associated with higher levels of scheduling success. This study thus provided additional support for the conclusions that the effective use of information systems in construction projects can result in reduced overhead and improved performance for construction firms and project owners. Further research should therefore be applied to identifying how to implement effective information systems in the construction industry is the essence of future progress.

Gyampoh-Vidogah (2003) discussed problems frequently encountered when firms attempted to integrate an information system. The author considered several issues that

compromise the efficacy of information systems and information management. One of these problems was that very little information from the firm is initially digitized, resulting in a need to engage in large-scale manual data-entry, which can be both time-consuming and expensive. Gyampoh-Vidogah stated that only about 5% of information in the construction industry is online, and about 90% of the information is exclusively on paper. This makes information sharing time consuming and very inefficient.

Sg et al. (2001) examined the way subcontractors in Australia used information systems to identify hindrances to its implementation. The authors found that there was substantial advocacy by the government of Australia for the construction industry to use information systems. However, the subcontractors in the study relied very heavily on the traditional means of communicating information about construction projects. About 95% of the subcontractors in the study used a computer on a daily basis. However, more than 95% of those who were classified as small or medium sized firms did not have networked computers. Although 72% of all the subcontractors used email on a daily basis, the use of such technology for business purposes was very much lower.

Sig et al. (2001) noted that in many construction firms, different divisions or departments maintain their own records, resulting in little or no ability to share information with other departments and divisions. To overcome this, it is important to apply a management structure that includes explicit policies on information management and the use of information systems. Without such leadership, the implementation of information systems in construction firms is not likely to result in the greatest possible improvements to overall project success.

Another obstacle for many construction firms is the costs of investing in information systems. Ekstrom and Bjomsson (2005) examined whether it is possible to quantify the projected value of information systems investment. The authors explained that it is possible to create a model in which the present and future cost of information systems can be quantified. They explained that the model must take into account the initial costs, as well as the potential costs of success and failure in adapting to the information system in the organization.

Ekstrom and Bjomsson (2005) stated that actual decision makers within the organization must be involved in the process of integrating an information systems model. This does not imply that only top-level management should make decisions. Rather, it is necessary to include middle-level management in the successful quantification of the present and future costs of investment in information systems. This is due to the fact that middle-level management has the most exposure to the processes that would be affected by implementing the new information system.

Jung, Chin, and Kim (2004) created an index to measure the level of *informationization*, or the use of information systems, by construction firms. To determine viability of a significant index to measure informationization, the authors used data from general contractors in Korea. The index involved 31 items, including computer hardware, computer networks, databases, and standardization of equipment. They examined the utilization of the equipment through system integration, interorganizational use, intraorganizational use, user satisfaction, and how well equipment was being used to fit into the strategic nature of the organization. Finally, the authors also determined the

actual support involving the use of the information system such as management policy, planning and investment, as well as the education process within the organization.

By applying their model to general contractors in Korea, Jung et al. (2004) found that their model significantly related to real-world information, which led to accurate predictions of the level of informationization by the contractors. They explained that it is possible to assess the level of awareness of information systems by a construction firm. This model makes it possible for clients to assess how much or how little information systems were utilized by a firm before they signed a construction contract. This type of index might also encourage a general pursuit by the construction industry to integrate and use information systems to be competitive with firms who use such systems.

Of course, the use of information systems by a firm does not guarantee its efficient use. Consequently, Kandil and El-Rayes (2006) created an algorithm to provide construction firms with the most efficient manner to use and optimize information systems and related resources. The authors ran 183 different experiments on their algorithm and concluded that it was successful. They found that the use of information systems could provide information to the construction firm about ways to save time and resources, including the most efficient number of computers and equipment necessary without adversely affecting optimal efficiency.

These studies indicated that there are models and systems in existence that can contribute to making it possible for an efficient adaptation of information systems in the construction industry (Kandil & El-Rayes, 2006). However, it appears from the research that many construction firms still believe that information systems investment is

disproportionate to its benefit. For example, Miodonski (2006) found that only 48% of executive managers in the construction industry used a computer. Additionally, he found that only 47% of construction accounting staff used a computer and only 29% of construction superintendents used a computer on a regular basis (Miodonski). To overcome this predisposition, the use of these models can contribute to persuading contractors that information systems does not waste resources, but does result in measurable benefits, especially over time.

According to Miodonski (2006), the problems resulting in a dearth of information systems implementation could be the result of inadequate staffing to support an information system infrastructure. His study indicated that only 31% of specialty contractors reported having employees who can accommodate information systems usage, issues, and requirements. Additionally, only 17% reported having a *chief information officer*, only 13% reported having a *director of information systems*, and only 8% reported having a *webmaster*. The results of this study indicated that most construction firms have a long way to go before accepting the potential that information systems might have for the industry as a whole.

Regarding the actual application of information systems, Rischmoller, Alarcon and Koskela (2006) explored the use of computer advanced visualization tools (CAVT) in the design process of projects by construction firms. The authors thereby identified how the use of CAVT improved the design process and made for work that is more efficient once the project was underway. By interviewing and surveying 56 people working in 17 countries for the same construction firm, the authors concluded that CAVT

was especially helpful during the planning stage of a project. The CAVT allowed clients to visualize projects and make changes before the project began. This visual projection has the potential to reduce frustration that many clients have reported in previous projects. It can also improve the working relationship between the client and the firm through a greater initial understanding of the project in the planning stage.

Rischmoller, Alarcon and Koskela (2006) also concluded that the use of information systems provided clarity during the initial implementation stage of a project. The visualization of the project contributed to the establishment of a common ground between the firm and the contractor once an agreement was made as to how the project should result. The use of information systems in the communication process has the capability to make the initial tone friendly, cooperative and mutually informative which can establish a high level of initial trust among the stakeholders. By providing the initial visualization of the completed project, the use of information systems in conjunction with an agreed upon communication process can contribute to a positive working relationship for the remainder of the project.

Moving past the actual design phase of a construction project, Li and Chen (2003) examined the use of barcode technology to monitor and control the amount of waste on construction sites in Hong Kong. The authors studied companies that provided employees with incentives for the maximum reductions in waste. They concluded that the use of the barcode technology provided construction firms with an easier method to monitor and track the materials that are being used, as well as the materials that are rejected, thrown

away or wasted. This method can lead to the use of excess materials that can be applied to future projects, thus saving companies money and increasing the financial bottom-line.

The results of Li and Chen's (2003) study indicated that properly monitoring building materials while introducing incentive programs for workers, construction firms in Hong Kong could prevent waste and save money. The barcode technology provided a systematic information system method to track the actual flow of building materials so that everything was accurately accounted for and available throughout the project.

Conversely, Li and Chen (2003) also noted the concern that a focus on incentives for workers to save materials may become more important than the actual quality of the work. The authors stated that some companies in Hong Kong were concerned that workers would try to avoid using necessary amounts of building materials in order to reflect large-scale savings of materials in the interest of earning extra rewards. Li and Chen acknowledged that this is a significant threat that requires further examination.

Tserng, Dzung, Lin, and Lin (2005) also investigated the use of barcode technology and personal digital assistants (PDAs) in the information system process as a way to improve efficiency in supply chain management on mobile construction sites. The authors proposed a system through which supplies and materials were outfitted with barcodes to render communication much easier for clients and construction managers who may be hundreds or even thousands of miles away from the actual construction site. The authors explained that managers and others on the actual construction site can be provided with PDAs that have the ability to read the barcodes and upload the information to the Internet for instant use by all stakeholders.

Once information is obtained from the mobile construction site, managers of the construction firm and their clients can access the information online for updates regarding the use of materials and supplies, as well as tracking progress (Tserng et al., 2005). Additionally, PDAs can give engineers on the mobile construction site access to timely information regarding changes in blueprints or problems requiring immediate approval and action. This use of information systems can result in the more efficient completion of work with diminished costs. Furthermore, clients can be kept abreast of relevant information, resulting in further ease regarding their investments.

Tserng et al. (2005) considered a similar problem on construction sites: the management of documents. The authors explained that the management of construction documents is vital. However, the problem for many construction firms is that most of the documents that are used were created in a text format that can confound information sharing. The authors therefore considered information systems that made file sharing possible via the internet regardless of format.

To increase information sharing, Caldas, Soibelman, and Han (2002) explained that information systems are now available for construction firms to place all documents in a generic electronic text format to make them accessible to all stakeholders. More important, the authors stated that a great deal of knowledge and innovation could be derived from the experiences of each project. This knowledge and innovation can easily be lost or never utilized once the project is completed due to a lack of archived data. However, the use of an information system that could access past data to address similar circumstances on future projects should lead to improvements in productivity. In essence,

the construction process can be improved through the use of computerized document storage systems in that they make data sharing, archiving, and referencing easier, thus minimizing duplication.

The discussion of information system storage and retrieval by the authors is significant not only due to the importance of sharing information but also due to the particular trust problem within the construction industry. Construction firms also have the potential to improve themselves and their futures by keeping track of the vast amounts of information and knowledge gained during large-scale projects. Organizations that learn from past mistakes and successes can make improvements that have a high potential to increase productivity and profits. Furthermore, the advantages from the gains in the learning process add credence to the potential of increased profits from such use of information systems.

So much of the previous discussion has focused on the divide that exists between the actual value and the perceived value of information systems. However, Caldas, Loibelman, and Han (2002) showed that investments in information systems might be necessary to remain competitive and retain client satisfaction. For example, learning from internal successes and failures has the ability to propel a firm ahead of competitors, and a means to derive this knowledge is through effective use of information systems.

It is interesting to note that proponents of information systems who have interest in accumulating information on successful and unsuccessful ventures are not necessarily implying that significant information on construction projects is exclusively narrative. In fact, the proliferation of cheaper and more affordable digital cameras and other digital

imaging systems has rendered the management of digital images just as important as the management of documents. Brilakis, Soilbelman, and Shinagawa (2005) investigated the impact on information systems from the creation and advancement of digital image storage and retrieval systems. The authors explained that recent innovations in digital imaging systems could do more than just catalog image files for later retrieval. New digital imaging systems can also be used to identify the type of materials that are being used on a site and even how much of a material has been used.

Apparently, these new digital systems can compare signatures of materials from one photograph to the next. The benefit for a construction firm is that this system can identify the materials remaining on a site and which materials have been used and whether they have been used appropriately, thereby enhancing the ordering process for just in time usage, and minimizing waste. Even more, the future of such information systems technology might pave the way for enhanced computer technology to identify other changes that might be needed simply with the analysis of photographs over time.

The use of such technology would certainly prove vital for construction firms that have job sites located in remote areas throughout the world. Rather than relying on eyewitness reports, project managers could have a computer analyze successive photographs to pinpoint areas of need and identify discrepancies that need resolving. This capability could enhance the accuracy of reports by identifying correlations between what is reported and what has actually taken place. This is another example of where the initial cost of investing in information systems might be much less than the potential value of the system in enhancing future profits of the construction firm. Having a system in place

that can automatically identify discrepancies could prevent internal losses of materials as well as minimize the extraneous ordering of excessive supplies. Although the potential from digital imaging may be high, there is little information available from current studies that provides for an effective cost/benefit analysis that is significant enough to persuade managers to adopt its use.

However, digital imaging is not the only way in which construction firms can better monitor information regarding the flow of materials and progress throughout the project, especially in terms of billing clients more accurately and fairly. One experiment involved the use of global positioning system (GPS) equipment that transmitted information to a construction firm about the size of dirt piles on the construction site. The GPS equipment was outfitted with a laser measurement tool that accurately determined the size of the dirt and monitored its change in size over time. This information was transmitted automatically via the use of a wireless Ethernet card to the firm for processing.

An example of an application of this process might be in billing for dirt movement. The use of a dirt pile for a construction firm is billed to a client based on how much dirt is used. Rather than estimating how much is used with the potential for undercharging or raising disputes with clients the system can keep highly accurate measurements at all times. What is even more important about the system is the wireless functions allow for measurements to take place almost anywhere on the planet. Again, for a construction firm with project sites in many locations, this is another high-tech way that

information systems can contribute to more effective managing of materials and reducing costs (Hogan, 2002).

There are shortcomings to the use of such advanced processes and equipment. The use of radio frequency (RF) tags enables the easy tracking of materials such as pipes, hammers, and other equipment used on a job site, which often disappears from the construction site. If a material were moved from a specific location, the RF tag would alert the construction firm or project manager that a specific material or piece of equipment is located elsewhere. Furthermore, if certain equipment did not return to its intended location, the firm would be notified and hopefully have a better chance of retrieving the lost or stolen item.

The loss of equipment and materials like hammers and other small but high value tools is something that construction firms take very seriously. If there was an easy way to track such things without the frequent counting of items physically, then construction firms could save tens of thousands or even hundreds of thousands of dollars in preventing the losses from stolen equipment. On a larger scale, the prevention of theft or careless activity with larger equipment and materials could save construction firms literally millions of dollars a year in needless expense. This is yet another example of how information system technology can not only lessen project cost and improve efficiency for construction firms, but also enhance the relationship with the clients by sharing in the cost savings.

However, the use of information systems in the construction industry cannot universally take place without some planning and upper management support. Shohet and

Frydman (2003) examined the communication patterns between various managers involved in construction projects. The authors stated that the level and quality of communication between managers and clients and those working on the project are the keys in engaging a project that is efficient and successful. They also noted that the use of information systems is enhanced when a manager allows a sufficient amount of time devoted to its use in the planning process. The authors indicated that managers who have a pattern of success in the use of information systems on large job construction sites usually allow up to 50 to 60 days of planning time on developing information regarding blue prints, drawings, material and labor projections, and other areas of the project before it even begins. They also communicate the information and expectations to all the stakeholders about the project as well as the procurement of materials and supplies.

It is important to note that information systems alone are not enough for a more efficient construction project. If a construction manager is not committed and effective in encouraging the use of the information system in the planning and communication processes, then the benefits may not be apparent during the implementation phase.

For information systems to be used effectively, the training of the employees is another important consideration. Tse (2005) considered the use of information systems by construction firms in Hong Kong as a function related to the quality of training. The authors found that the firms seemed to realize the importance of information systems and its efficient use. However, the firms were concerned primarily about the ineffective use of information systems which could result in wasted expenditure. In this regard, the construction firms in Hong Kong wanted to train employees not only on how to use the

information systems, but also on how to use them effectively in enhancing the communication process with external partners and clients.

In addition, Tatum (2005) considered the need for technical support to facilitate the use of information systems by construction firms. What is important about the conclusions that were reached in this study was that generalized technical support mentality was not the most efficient use of resources for construction firms. Instead, Tatum concluded that firms must create technical support for employees based on the type of technology being used, and the application of its usage. Rather than just training employees for the current application, firms should focus on technical support as a means of providing training to employees for future projects by building on current knowledge. The importance of this study also contributed to the notion that investing in information systems is not just about the actual cost of the infrastructure or the equipment. Instead, investing in information systems was also about investing in the learning needs of employees. Just as the literature on information systems has shown, there can be an optimal investment for each firm based on its needs. This can also be true for employee training and support, which can result in wasted money with little real improvement in efficiency or client relationships, or organizational improvements now and in the future.

Finally, in the preceding discussions regarding the use of information systems and the benefits that can be derived, there should be at least a mention of the changes that have occurred that have been counter-productive. Miozzo and Ivory (2000) explained that the greater presence of information systems by construction firms has created the problem of making firms more adversarial against each other as a way to undercut bids

and cut costs to the very lowest level possible. In addition, the authors noted that the use of information systems has resulted in a greater amount of knowledge needed by those who work in the industry. The problem is that the information systems knowledge that is needed is often unable to be learned on the job. Instead, contractors need employees who are already skilled in these areas and can join the firm already prepared.

It is certainly important to note that this discussion is currently based more on theory and opinion than on actual facts. Miozzo and Ivory (2000) were quick to point out that much more research needs to be conducted regarding the negative results from the increased use of information systems. However, what is important in presenting the negative side is that there are those who are willing to look past the benefits that might come from the use of information systems in construction and they prefer to focus on how these systems are changing the industry in negative ways. Of course, there are always two sides of every discussion. However, most would claim that introducing more knowledge and requiring more education and skills in the use of information systems of those who work in the industry can provide positive outcomes to project owners as well as to construction firms.

It is interesting to note that the number of firms that have made IT an important and common activity is still a minority. Furthermore, the number of firms that have a staff infrastructure in place to support and manage information systems is meager. Employees in construction firms cannot be expected to effectively use information systems when managers and company leaders are not engaged in similar activities. To be effective in taking advantage of the benefits that can come from the use of information

systems technology, construction stakeholders must not only receive the proper training and support, but also be motivated to see how it contributes to the specific needs of both the firm and the clients. If this does not take place, then information systems could result in considerable inefficiency and loss of revenue.

To summarize the research presented thus far, the use of information systems technology and communication processes in the construction industry can produce greater cost savings and efficiency in construction projects. However, the problem is that many construction firms and employees appear to have a negative attitude about the cost effectiveness regarding the use of information systems on the construction site as well as in the coordination among all the stakeholders of the project.

Finally, the literature that has been reviewed assumed that having more access to information by all the stakeholders stems from increased communication among the stakeholders. However, the literature indicated that having increased access to something as relatively simple as cell phones, email and internet access on the construction site does not mean that they are being used effectively for client communication and information sharing, and clearly there is little emphasis on their impact on trust. The successful implementation of information systems and its positive impact on trust between the clients and firms need further study especially regarding the relationship between the client and the construction firm.

Client-Firm Relationships

Yahn (1999) noted that many in the construction industry forecast that the future of project management lay in the integration of e-mail and the Internet. In fact, many in

the industry have realized that project owners want to receive information as quickly and efficiently as possible to stay informed and make decisions without delay. However, the literature review was not clear on how the use of information systems and the communication process lead to increased client satisfaction.

Ahmed and Kangarl (1995) examined the factors that are considered most important by clients in the construction industry for overall satisfaction. The authors of this study used data collected from 101 clients in various sectors of the construction and engineering industry. They found that six factors were significantly related to client satisfaction, including time, cost, quality, client orientation, communication skills, and response to complaints.

This study indicated that communication skills and response to complaints were part of the factors that were significantly related to client satisfaction. This would appear to indicate that clients of construction firms expect to be kept abreast of problems and receive timely communication when issues arise. It is apparent from the results of this study that clients want to be part of the entire process rather than a remote purveyor of the project.

The current discussion about the factors in the relationship between construction firms and their clients is something that is gaining more focus in the industry. Recent surveys of construction firms indicated that customer satisfaction is the single most important factor for success. The importance of customer satisfaction as it relates to success over the long term may be more important than net income or profits on a single project.

This current focus on customer satisfaction indicates that construction firms are realizing that the key to success involves more than just obtaining contracts or reducing overhead. Instead, this focus indicates that continued success stems more from building relationships with customers than stressing profit maximization. What is perhaps even more important is the indication that construction many firms seem to understand the importance of establishing positive client relationships. Progressively more companies in the industry are making the building of client relationships as the most important part of their business or operating model.

To support this notion from the reverse, Haransky (1999) wrote that one of the top ten mistakes that construction firms can make is to approach problems on construction projects with the wrong attitude. The author explained that problems on a construction project often resulted in arguments between members of the construction firm and their subcontractors. He stated that clients do not have patience in observing negative attitudes on a project where potentially millions of dollars are being spent. Instead, clients want construction firms to work with others as a team and find solutions to problems as they arise.

This leads to another mistake that many construction firms tend to make: being slow to respond to questions and concerns from clients. Haransky (1999) explained that clients could have several ways that they pose concerns to a construction firm. The questions may be raised formally in writing or informally in conversation. In either case, construction firms must be quick to respond; otherwise, a very small concern can become a major problem that can ruin any type of working relationship.

The top 10 mistakes made by construction firms and contractors from Haransky's (1999) observations are listed below:

1. **Project Team Changes.** The author stated that frequent changes in personnel on the job site, especially among core personnel with whom clients have frequent contact, are very annoying and even worrisome.
2. **Multiple A/E Team Contacts.** Clients like to have a few specific points of contact to address problems or concerns. When clients have to address each concern with a different person, this becomes frustrating and leads to issues not being handled promptly.
3. **Schedule Delays and Missed Milestones.** Clients are not happy when projects fall behind schedule.
4. **Overdesigning.** A firm that tries to plan what it believes the client needs or wants without adequate communication can be just as upsetting as missed dates because these "extras" add cost that a client may not have wanted in the first place.
5. **Negative Approaches to Problems.** As discussed earlier, clients do not want to deal with negative attitudes, especially when the people with those attitudes are in charge of what may be a multimillion-dollar project.
6. **Low-Quality Product.** A large number of change orders because bids were not precise or were too low and based on inadequate materials are typically combined with schedule delays, which result in significant client dissatisfaction.

7. Slow Response to Construction Questions. Clients want to have questions answered promptly. Firms that are slow to answer questions generally find themselves dealing with hostile clients later on in the process.
8. Slow Review of Submittals. Construction firms and contractors must avoid receiving submittals from subcontractors and others that cause stress at future points in the project. The clients are not concerned that others did not submit information on time. They just want the project to move forward within the schedule.
9. Weak Leadership. Clients who see that project leaders are weak and not able to manage personnel or problems as they arise lose confidence very quickly in the larger project and its successful completion.
10. Absence at Final Completion. All stages of the construction project must come together and be completed at the time of the final completion determination. Otherwise, the client views the project as not being completed, and certainly not being completed on time. (pp. 29-30)

Many of the issues related to client satisfaction tend to focus on two particular issues: communication and information sharing. Clients want to be able to share their concerns and questions with specific people and build a relationship with those people. At the same time, clients want to know who will be answering questions and that the questions will be answered quickly. Finally, they also want to be made aware of problems as they arise, not after a minor problem has become a major problem by causing schedule delays and problems with budget constraints.

Hassan, McCaffer, and Thorpe (1999) also made the case that the entire relationship between contractors and clients is dramatically changing. They foresee that within the next decade, clients will demand even more accountability on the part of contractors for a lack of timely and effective information, attentiveness, and communication. Hassan, McCaffer, and Thorpe argued that the construction industry must understand what clients are beginning to require from contractors in order to satisfy client needs.

Allen, Becerik, Pollalis, and Schwegler (2005) further argued that there has clearly been an increase in the availability and use of information systems in the construction industry over the past decade. The problem, however, lies in the notion that there is very little confirmation that these information systems are resulting in greater collaboration between clients and firms. The authors note that simply using an information system and a communication process more frequently does not necessarily result in better outcomes. In fact, they pointed out there are still many barriers that must be overcome for true collaboration and information sharing to take place.

Another issue that must be raised is that the use of information systems and information sharing does not necessarily translate into greater client satisfaction. The relevant body of literature has consistently indicated that using technology to save money and complete projects more quickly can result into greater customer happiness and satisfaction, but this is an assumption that could be very troublesome. More research is required to test whether this assumption is valid.

Cheung, Yiu, and Suen (2004) examined client satisfaction ratings in the dispute negotiation process using an online collaboration system known as ConegO. This collaboration system allowed firms, partners, and project owners to negotiate parts of projects. This difference between this software and other options is that this system requires that all parties evaluate alternatives. The authors found that the satisfaction rate of those who used this system was 68%, compared to a satisfaction rate of 62% using the traditional method of negotiation.

The study by Cheung, Yiu, and Suen(2004), although compelling, may have flaws. Primarily, this study was conducted using one person as the firm and one person as the client. Both of these individuals had more than a decade of experience in contract negotiations in the construction industry. However, it is possible that people with more or less experience in contract negotiations could have considerably different rates of overall satisfaction. Although the findings from this study contributed to the understanding of how information systems can affect client satisfaction, much more research in this area is clearly needed.

El-Mashaleh, O'Brien, and Minchin (2006) also examined how the use of information systems by construction firms affected performance on the job and overall client satisfaction. The authors conducted this study using data from 74 construction firms. The authors found that an increase in the use of information systems resulted in a 2% increase in overall firm performance, 3% in cost savings, and 5% in scheduling efficiency. However, the authors also found that there was no relationship between the use of information systems and client satisfaction.

El-Mashaleh, O'Brien, and Minchin's (2006) study is important in that it contradicts the notion that many in the construction industry have about the relationship between the use of technology and client satisfaction. Implementing information systems does not necessarily translate into happier customers. Instead, creating happier customers may be more about how information is shared as well as in the way in which clients are brought into the overall framework of the project. Again, the results of this study reaffirms the notion that more research on information systems, project success, and client satisfaction is required.

Davey, Lowe, and Duff (2001) sought to understand the development of partnerships and working relationships with construction firms in the United Kingdom. They observed a sample of construction firms numbering in employees between 50 and 150. They found that clients want to work with construction firms who have processes in place to share information. Additionally, from their research, construction firms that endeavor to create active working relationships with clients and partners have better professional processes and outcomes than those firms that do not aggressively pursue the development of a partnership relationship with clients.

However, as with most theories, there is another purview. There can be some drawbacks to trying to ensure that a strong relationship is established and fostered between construction firms and clients. Ivory (2005) conducted case studies in 1997 on three different construction projects: a workplace and housing project, the construction of a building for a large university, and a framework agreement with a provider of retail and transportation facilities. The author found that one of the problems with building a strong

relationship between the construction firm and the client in these three cases was the loss or at least stifling of innovation on the project.

From studying the progress of these three projects, Ivory (2005) concluded that clients are often afraid to take on the risks that are associated with innovation in construction projects. Because of the extra financial investment in information systems, many clients are more concerned with the potential of increased risks associated with the innovation than they are of the possible benefits. Because of their concern about the magnitude of their investment, clients are likely to prioritize adhering to time constraints or remaining within budget over innovation or even experimentation that might ultimately make a project more successful in the long-term.

Ivory (2005) indicated that some clients could be quite adversarial to the entire notion of innovation in their construction projects. These clients who are adverse to increased risk may want to have the minimum implementation applied to the project in order to save money and time. Such clients may also be resistant to any technological innovation no matter how minor, such as the use of digital cameras and software applications for real-time information gathering and sharing. Instead, they may be more interested in the time-tested traditional methods of construction than they are in being involved with new processes. This can be one of the drawbacks of pursuing information systems to achieve the highest level of customer satisfaction between the construction firm and the client. Progressive construction firms like to enhance the use of innovation in their projects. In recognizing that clients are different with different agendas, construction firms who have an interest in creating and expanding upon innovations from

previous projects to produce even more innovative results may have to forgo the use of such innovation to achieve satisfaction in risk adverse clients. Regardless, the research indicated that to achieve successful completion of the project, the firm needs to maintain strong communication with the client and provide the information that is necessary to ensure that they are satisfied at every stage of the project.

In summary, the differences in the notions regarding the client-firm relationship underscores the complexity of the issues of project success and client satisfaction.. For many, project success is commonly based on the notion of completing the project on time, within budget, and within the specifications. As the previous research indicated, there is not a universally accepted definition of a successful project. Some clients might be satisfied with a project that is completed late and over budget and consider the project as a success because the specifications that were achieved are better than anticipated. Similarly, there is not a universally accepted definition of client satisfaction. In essence, to achieve client satisfaction, the research is consistent regarding the importance of construction firms to communicate trustworthy information in a timely process that leads to mutual satisfaction. However, there is limited research that addressed how to establish the level of trust necessary to achieve mutual satisfaction between the firms and their clients, especially considering the risk involved with the expenditure of i millions or even tens of millions of dollars on a project. The ability to achieve high levels of customer satisfaction can be beneficial for a construction firm in the long run. Customer satisfaction is more than reducing the instance of confrontations between the firm and the client. From a financial standpoint, being concerned about client satisfaction can translate

into financial success. Clients who are satisfied with a firm's quality, prices, and level of communication may recommend the firm to others for their large-scale construction projects. They may also be likely to use that firm in the future for other projects.

In reality, acknowledging the importance of spending the time and resources on customer communication and customer satisfaction can be quite stifling for a construction firm. A firm that is intent on producing innovative projects may be confronted with resistance from a client who simply wants to see a project completed as quickly as possible at the cheapest price. When this occurs, each firm must make a decision about what is more important to them: having happy customers or having innovative projects.

The preceding discussion is important because it showed that the issue of the relationship between customer satisfaction, information systems, and communication systems in the construction industry is complicated. Obtaining a high level of customer satisfaction in construction is much more detailed and much more in-depth than the focus on completing projects through the use of information systems and increased communication. To achieve a mutual level of successful project completion, construction firms need to bridge trustworthy communication and information sharing at the level needed and desired by the clients if they are to achieve a high level of customer satisfaction.

Finally, in relation to the current research, the literature that has been reviewed on client-firm relationships suggested that firms might need to do more than just provide open lines of communication. Customer satisfaction needs to be pursued with as little

project interference as possible. The literature suggests that client satisfaction is not achieved through a standard process. Rather, some clients may want a no-frills approach to construction, while others may feel that the use of innovative means of information sharing gets in the way of the main objective of the project. The question that arises that was addressed with the participants of this research is how they work with different clients who may have different opinions about technology usage and what is meant by client satisfaction to achieve mutually agreeable project success.

Business Process Reengineering

According to Gunasekaran and Kobu (2002), Business Process Reengineering (BPR) can be defined as the redesign and changing of a business process in an organization to achieve large-scale results such as improvements in performance, cost, or customer satisfaction. The significance of BPR hinges on its systematic approach and focuses on changing the orientation of the entire organization. Even more, business processes reengineering requires that an organization collect data and information for the purpose of making positive changes. This methodology for change is not simply for the purpose of change, but rather for a need based on data that is systematically collected that leads to a means of achieving the best outcome for the firm and its clients (Fitzgerald & Murphy, 1996). For construction firms to become more cognizant of the relationship between information systems, communication processes, client satisfaction, and project success, an analysis of BPR is an important method to achieve organizational change. Because of its significance to the construct industry, BPR, including its strengths and weaknesses, is the focus of this section.

BPR has gained a great deal of attention since the early 1980s (Earl, Sampler, & Short, 1995). The process of using business reengineering has been described as a four-step model (Fitzgerald & Murphy, 1996). The first step is the creation of a vision and a plan for the future. An example of this might be a construction firm that desires to improve client satisfaction through information sharing and enhanced communication. Once this is established, then the organization proceeds to outline the current business processes that are in place. This involves identifying and analyzing both positive and negative aspects of the process in regards to client satisfaction. For the construction firm, this might mean developing an understanding of the past and current level of communication and information sharing. Frequently, communication increases only in response to major problems that arise, which has an adverse impact on the level of trust. It might also mean a new approach to addressing client complaints which usually indicates that overall customer satisfaction may be low. Identifying the sources of client dissatisfaction and understanding the factors of client satisfaction are necessary before a firm can develop a plan for improvement which will require organizational change.

The firm then moves on to the third stage of the process, which requires the creation of a plan for the reengineering of the business process. At this stage, the hypothetical construction management firm determines how it is going to move from its current situation with unhappy clients which could be the result primarily from a lack of sharing of information to being a firm in which information is shared easily and efficiently, which should result in satisfied clients. This then leads to the fourth stage of the business reengineering process during which the plan is implemented (Fitzgerald &

Murphy, 1996). Plans of this kind require frequent interaction with the clients to improve customer satisfaction to a high level.

Fincham (1995) added to the research by addressing passing fads that tend to arise in the construction industry. There were many passing fads in the 1980s including the emphasis on improvements to efficiency in many business sectors, including the construction industry. However, the gains from many fads were enjoyed only temporarily and faded with time and the emphasis ceased without explanation. However, the author explained that BPR is not just another passing fad to be forgotten in a few years when the next theory is brought to the forefront. The reason for this is that BPR has become a specialized area of management that requires its own set of knowledge and qualifications. Since BPR is now presented in a professional and dynamic way, the concept will continue to evolve and react to the changes in the industry. The label may change with time, but the concept will endure.

According to Fincham (1995), BPR has made an incredible mark on the business environment where so many organizations have institutionalized processes and recommendations and made them part of their working model. Unlike other passing fads and theories that were popular in the 1980s, BPR has been given a special place in many organizations. The concepts of BPR are being adopted throughout the global environment by many organizations in many different industries.

To further develop the concepts of BPR, Keeble (1995) reiterated the very important aspect of BPR that stresses the involvement and training of all levels of employees within an organization. Too often, the BPR focus is on the upper level

executives in adopting the system. To be effective, BPR must involve all levels of human resources in the organization. BPR emphasizes the importance for upper management to understand that reengineering processes is really about making major changes in how employees and managers operate on a daily basis. Such employee modification rarely takes place by managers who simply tell employees that they need to change.

Effective and successful reengineering of business processes entails explaining to employees why changes are necessary, and then identifying the benefits over the long-term. In reality, BPR is as much about a cultural change in the organization as it is about functional change in processes and activities. All levels of the organization, from executives to employees, need to change how they think about the organization and their place within the organization before implementing the required changes. Instituting a cultural change in an organization is not easy. This is the major reason why all levels of managers and employees need to be included in the process.

Gunasekaran and Kobu (2002) continued with the idea that BPR is more than simply creating a plan to change the way in which an organization works. From their perspective, this process also requires that an organization change its internal structure and culture. Employees are a major part of BPR. Consequently, employees must be convinced about the importance of changing the way that they have performed their jobs and interacted with customers before they can make the changes that are necessary that will be effective for the duration of their careers. Once the need for change has been identified, managers must ensure that employees are given the necessary tools and

flexibility to achieve the objectives that were defined at the start of the reengineering process.

Grover et al. (1995) indicated that the human and technological issues of BPR are most important. To improve the way in which an organization serves its customers, employees must directly commit themselves to achieving set goals in improving customer service. If they are not given the tools to work more efficiently, then the entire goal of the process reengineering may not be achieved. Information systems are often a vital component of BPR. To be viable, organizations must be willing to invest in new technology and ensure that employees are trained to use the new technologies in this highly competitive environment.

In a related fashion, Rees (2003) noted that BPR requires that organizations see themselves as centralized units rather than a group of dispersed departments and sectors that are not strategically linked. This is certainly important in the construction industry where job sites can be dispersed over hundreds of miles and employees can be moved between work sites on a daily or weekly basis. To be effective, there must be a sense of personal responsibility and control at the individual unit level so that those who have direct impact can respond to changing conditions and make decisions quickly. Of course, it is important to note that responsibility for those decisions at the individual unit level should be built into the larger process.

Previous research has indicated that the role of information systems can be an important element in the BPR effort. However, Dixon et al. (1994) explained that information systems must be viewed with a proper level of importance in the larger

picture of BPR. The authors further explained that many organizations think that the role of information systems is the most important part of the BPR effort. In reality, however, it is only one part of the total organizational effort.

Another important part of BPR effort requires managers to be committed to the work that must be performed in implementing these plans. Managers must be committed to the need for changes throughout the entire process. This requires more effort than the normal duties in routine work. When a manager is not committed to the effort, the entire process may not move forward as expected because employees may not receive the motivation and incentives they need to participate in a cultural change in the organization.

Another reason that managers must be committed to BPR efforts stems from the importance of the information system and the communication process. For BPR to achieve greater acceptance, employees should receive the necessary information as well as proper communication for what is expected and what is taking place. When lower level employees do not receive the necessary information and feedback, then it is highly likely that they may not make and changes or they will revert to the ways in which they worked previously. If this takes place, then the work that has been performed to that point may be ineffective.

At this point in the discussion, it may seem that the BPR process is focused heavily on information sharing, the communication process, and human motivation. It is important to re-emphasize that employees at all levels of an organization can impact the level of success or failure of the reengineering processes. Motivated employees who are

properly informed and directed can create more effective outcomes for an organization and its customers in the change process.

In another study, Olalla (2000) also emphasized that technology can provide organizations with ways to save money and improve efficiency and accuracy on the job for the benefit of the firm and the customer. Even more, she explained that technology can provide firms with better tools to coordinate activities and perform several tasks at once. To emphasize this point, Olalla (2000) emphasized that firms should understand that technology can be seen in terms of the flow of information and the sharing or collaboration of information. In this regard, management's understanding of how technology and information should be shared for the most efficient processes to take place can help firms. Even more, Olalla (2000) stressed that firms must be prepared to take advantage of the technologies that are available if they intend to maximize their efficiency through the effective sharing of information.

To emphasize this notion, it may be enough for the firm and its clients to be able to track the progress on particular projects through a simple shared database. On the other hand, a large firm might need an entire internet infrastructure to allow people inside and outside of the firm to log-in remotely from locations around the world to check blueprints, resources, and budgeting and cost issues, as well as to provide information and feedback regarding the progress. The key is to understand what is needed based on the size and dispersal of the firm and the types of jobs that are being implemented.

Orman (1998) further extended the importance of adopting information systems. He proposed an actual decision model for the use of information systems as part of the

larger BPR efforts. He explained that this proposed model can take into account such decisions as the types of tasks that must be carried out and even how those tasks can add or take away from overall efficiency. However, this model of prediction for BPR does not address adequately the important aspects of human resources, employee training, and incentives, as well as the very important issue of the resistance to organizational change (Orman, 1998).

The literature that has been reviewed has indicated the importance of the human resource element of customer satisfaction in the BPR effort. Any model that attempts to predict the outcomes of business process engineering without looking at the human side of the processes is definitely a model that is leaving out a major factor in the entire process. The other problem with the model proposed by Orman (1995) is that it seemed more concerned about such things as cost reduction and efficiency in workload and ignored the impact of the people issues. Although cost reduction and efficiency are important issues, it takes coordinated effort by the stakeholders to achieve the objectives of the BPR.

With the issue of the integration of human resources in mind, Hill and Collins (1999) examined the use of BPR along with total quality management efforts, such as ISO 9000 and Six Sigma, at a telecommunications company in Northern Ireland. The company had gone through the initial stages of determining how it needed to improve. Company leaders found that the organization was very inefficient by virtue of having too many employees for the tasks that needed to be performed. This resulted not only in inefficiency, but also in significant financial waste. To change this situation, the company

instituted not only BPR, but also ISO 9000 as a means to increase the benefits from effective quality management.

In their study, Hill and Collins (1999) found that the use of both BPR and total quality management worked quite well together. Both programs brought together their own strengths in terms of examining organizational culture, as well as the needs of employees. The authors believed that this case study showed that BPR should not be implemented in a vacuum. Instead, both BPR and total quality management initiatives should work together if maximum benefits are to be obtained from their implementation throughout the organization.

Along those same lines, Kettinger, Teng, and Guha (1996) examined the connection between BPR and information architecture within an organization. The authors stated that both BPR and information architecture are focused on the actual operating aspects of an organization. Furthermore, they explained that so much of BPR is about the use of information systems to improve efficiency in the organization. Consequently, it really should be considered that information architecture and BPR can and do go hand in hand.

To support this notion, Kettinger, Teng and Guha (1996) indicated that information architecture and BPR, with the correct planning and collaboration can produce several positive outcomes for an organization. The first of these outcomes is the identification of the important business processes within the organization. Next, the collaboration of information architecture and BPR can produce a prioritization of the business processes into a strategic order of relevance. Finally, this would then be

followed by the development of an actual working model. This model would include the performance measures that are necessary to determine the best processes in developing the sets of information systems and architecture for the best outcomes for the organization and its clients.

Despite the complexity in combining BPR with quality initiatives and information systems, the benefits to the organization can be significant. The key is to recognize that BPR is really one part of the entire effort to improve efficiency and outcomes for the company. The literature that has been identified thus far supports the notion that BPR encompasses many smaller functions within the organization. Since many of these functions may be developing initiatives to continuously improve their efficiency and productivity, BPR can enhance the outcomes from a coordinated effort.

To further develop this notion of synergy, Lee, Pena-Mora, and Park (2006) suggested that using BPR and information systems to produce new models of workflow can create a buffer against some of the negative aspects of other quality control methods. The authors used the method of *just in time* (JIT) manufacturing as an example. Just-in-time manufacturing is based on the idea that a plant has readily available only the amount of materials needed for the selected time frame during the production process. By using JIT processes, a manufacturing plant improves operational productivity by minimizing the cost of maintaining an excessive inventory that can go to waste if not used.

The authors further proposed using BPR to create a model where the negative aspects of just in time manufacturing, such as a very rigid work structure or rigid controls on workflow, can be lessened. This means those employees do not experience such rigid

processes that result in increasing problems during conditions that require a degree of flexibility. In summary, the authors indicated that using BPR to create buffering could indeed overcome some of the negative aspects of just-in-time manufacturing and create better overall working conditions.

On a larger scale, what may be most important about this research, as well as the previous studies that have attempted to combine BPR with other models, is that they highlight the notion that BPR is not a passing fad. As with all models for improvement in efficiency, there are always positive and negative aspects with their implementation. They may require very rigid standards or take control away from employees in order to ensure that tight schedules and deadlines are followed. However, BPR is designed to avoid extreme rigidity in following the processes. Instead, BPR focuses on determining the significant needs of all levels of an organization to create the most efficient processes, which result in the best outcomes for clients. The emphasis on client satisfaction requires flexibility as each client may have a different need. Although process controls may be important to ensure a level of internal performance, shifting control to frontline employees who are in direct contact with clients requires a degree of flexibility to react the changing needs of clients in the external environment.

Gunasekaran and Kobu (2002) also commented on the introduction of models to help predict future outcomes from BPR. They explained that any model or set of models that are used must be flexible and easy to understand. They emphasized that BPR should focus on the organization's mission, goal, and specific objectives in developing improved processes. However, in today's global environment, BPR's emphasis on flexibility

provides an organization with the best chance of success in responding rapidly to the ever-changing competitive climate.

In addition to flexibility, the authors further emphasized that any model that is used must be easily understood. The problem with many models is that they are difficult to use in a practical environment. They can involve very complicated sets of algorithms and calculations that make understanding them a challenge, especially for those who are not well versed in mathematics or model creation. The use of models that are too complicated may impede the efforts to improve processes and outcomes, regardless of how well the models may be in theory for predicting future situations. It is the people involved in the process reengineering who must be able to understand the information contained in the models. If they cannot understand the information or application directives, then the probability that the model will be implemented successfully is low.

Thus far in this research, the emphasis has been on implementing models within the firm. There is the issue also of working with external partners, such as other companies and clients. They also are part of the entire business reengineering process. If they cannot figure out their roles in the models, or even what the models are attempting to do for the organization, then it is likely that the objectives behind the process changes may not materialize at the expected level. All those who have a stake or role in the process must understand any process that involves different levels of people. Otherwise, the objective of improving efficiency may result in just the opposite and cause even greater work inefficiency from the lack of understanding among those involved in the process.

As with any model, BPR also has some detractors. There are those who feel that BPR may cause greater issues for employees and for clients depending on the reasons calling for a change within the organization. For example, Loosemore (2000) indicated that several high profile companies have used BPR to cut jobs and make those employees who are left do more work that is less efficient. He used the example of Xerox that used BPR to spend more than \$700 million to cut more than 10,000 jobs from its workforce. He also indicated that Fortune 500 companies in the United States have cut 3.2 million jobs under the guise of BPR. Consequently, BPR has gained a negative reputation among many because of its association with downsizing.

Loosemore emphasized that the notion of BPR is to make things better. However, when it is used to justify cutting expenses and reducing the number of employees, it runs counter to the notion of making things better, which is not the primary goal of BPR. When BPR is used in this negative manner, it has the potential to make firms less responsive to customer needs because there are fewer employees who can respond to the needs of clients in a timely manner. The significance of this discussion is similar to the discussions about implementing information systems and enhanced communication processes in construction firms. The way in which BPR is implemented and the reasons why it is implemented can have a significant impact, either positive or negative, on the outcome,

Jaafari (2000) also addressed the issue of using BPR to justify cutting costs. He reiterated the point that the construction industry is becoming much more competitive. However, with the increase in competition, construction firms must be focused on

creating quality products and services, not just cutting costs in hopes that the business will be better able to compete and outperform other construction companies. Instead, he explained that the use of BPR in construction firms must focus on bringing together all of the processes in the organization to create a competitive strategic vision for the organization. Jaafari emphasized that the changes to the organization must have a purpose and they must be geared toward building a sustainable business. Strategizing about cutting costs is not ensuring that a business is sustainable for the future.

Instead, Jaafari (2000) stated very clearly that having a viable long-term vision required having an approach to employee relations and training that is also long-term in nature. This also necessitates that an organization be customer-focused rather than simply focused on its own current needs. In summarizing, the author stressed that BPR must be used for its intended purpose. It should not be used by an organization that sees this model as a quick fix to cut costs and increase revenues without thinking about its core mission and goals over the long term.

To emphasize the above notion in a different way, Wray-Bliss (2003) equated the so-called quick fix that many organizations see from using BPR with the promises that many think will come from using illegal drugs like ecstasy. This association to drugs might seem very bizarre on the surface. However, the explanation of this equation has validity. For example, the reason that people are attracted to illegal drugs such as ecstasy is because of the promise that these drugs will take away any pain that the user might feel. Some illegal drugs come with the promise of increased energy or an altered state of

viewing the world or one's personal problems. Even more, some drugs come with a promise to remove fear and make a person appear more secure and happier around others.

The problem with this analogy stems from the recognition that the use of illegal drugs in taking away the pain, or in feeling good, is very short-term in nature. Once the effect of the drugs is over, the person returns to his or her original state of mind. A person who is scared or feels pain before using the drugs returns to those same feelings only a few hours, or even a few minutes, after the drugs have run their course through the mind and body. Even worse, the use of these drugs may also come with negative side effects that were not present before the drugs were used. These side effects can include dependency on something that becomes very expensive and results in more pain and more troubles over time. Even worse, some drugs can damage the brain and result in increased physical and mental pain.

Wray-Bliss (2003) also noted that the use of BPR for the wrong reasons can result in similar effects in a business environment. An organization facing great pains from the fear of moving forward or from a lack of financial resources may view BPR as a way to cut costs and quickly increase revenues. The problem occurs when the initial quick fix in using BPR that is instituted for the wrong reasons wears off. The organization finds itself in a financial state that is no better than when it instituted the changes. In reality, it is quite possible that the financial resources that were used for corporate restructuring because of BPR may hurt the company even more by making the financial situation even worse.

Like many persons who begin using illegal drugs like marijuana or ecstasy in the hope of experiencing some great positive change in behavior easily and quickly, many organizations involve themselves with the idea of using BPR for the same reasons. However, what should be clear from the literature that has been reviewed thus far on the subject is that this notion in using BPR requires more than the short-term view. Likewise, it is not something that is directly concerned with the internal desires of the organization. Instead, BPR is focused on the long-term goals and missions of the organization in meeting the needs of its clients.

Most businesses usually have a mission and goals that involve creating a distinguishing product or service for the benefit of a set of customers. BPR begins with understanding an organization's goals and missions in meeting the needs of its clients. By virtue of this, BPR has focus on the customers of the organization and what can be improved for their benefit. Just like the incorrect perceptions of illegal drug use for improved personal feelings, the incorrect use of BPR is wrongly concerned with the improved feelings of a company.

Even in organizations where BPR is implemented with the right reasons in mind, other internal considerations are important. One of these internal considerations is about whom in the organization will be responsible for the implementation of the reengineered processes. Motwani, Kumar, and Jiang (1996) indicated the need for further research regarding who should be responsible for the implementation of BPR for the best possible results. The focus should be on whether the implementation of BPR might best be

accomplished by making it the responsibility of the board of directors, the CEO, the CIO, or even an outside consultant.

To perform these duties, one might conclude that the head of the firm or organization should be responsible for implementing and overseeing BPR activities. However, as the combined research has shown, there are a lot of efforts that go into the reengineering processes. First, information systems and the communication process are very important in identifying the elements and planning and implementing the changes required in the BPR process. Because of the significance of the information systems and the communication system technology, the CIO of an organization should be in charge of the changes that are directly related to information systems and the communication system infrastructure. If an organization does not have a CIO, however, then it might be necessary to bring in an outside information systems consultant who has experience in overseeing these kinds of changes in other organizations.

The preceding discussion regarding the role of information systems applies to the delicate nature of the decision making and implementation processes, especially as it applies to the construction industry where the role of information systems is considered by many to be a distant second to the construction process. . This is certainly typical in an environment where different sized firms have different levels of management and organizational structure. Research available provides very little information regarding construction management oversight through the use of information systems. Future research is necessary to examine the issue of how to structure the oversight of the BPR effort.

The preceding discussion regarding BPR focused primarily on changing processes that are currently in place. However, Jerva (2001) explained that the goals and concepts of BPR can also be used when developing and initiating a new process. The example that the author gave for this was the creation of an information systems department for an organization that did not see the need for one previously. This is an important concept for the construction industry where many large firms still do not have a dedicated information systems department even though there are examples of the positive contribution that information systems provide for the increased sharing of information, enhanced communication, an improved level of trust and customer satisfaction.

The author further explained that the objectives of BPR could be used to integrate the new department into the existing processes as well as the culture of the organization. These objectives for improving processes to benefit the overall goals and objectives of the company can be important specifications for the development of a dedicated information systems department.

There is a lack of research regarding identifying the practical ways in which information systems may be used in the construction industry to improve the level of trust in the communication process. The ultimate objective in improving the level of trust should lead to an increase customer satisfaction and project success.

Chapter Summary

The available literature on the subject of the relationship between construction firms and clients has concentrated on systems optimization and operations management. The construction industry is comprised of unique subcultures within the broader culture.

For example, electricians, carpenters, brick layers, concrete finishers are all different in their orientation. Consequently, the sharing of information and the communication process are vital to project success. Despite the many studies during the review that demonstrated the benefits of using information systems in the construction process, many companies are hesitant to implement such tools and techniques. Some of the hesitancy is due to cost concerns as well as leadership concerns and the training that would be necessary to implement new systems effectively. Apparently, they are not convinced that the benefits outweigh the costs. However, the literature suggests that project success may be increased through the use of information systems, which may lead to an increase in customer satisfaction, and customer satisfaction is very important in relation to project success.

The objective of this literature review was to gain a better understanding of what is being done to increase customer satisfaction in the construction industry and how information systems can contribute to the communication process to enhance mutual trust. In addition, it is apparent that there is a level of mistrust between many contractors and their clients as each may be oriented to maximize their own benefits, even at the expense of other stakeholders. However, there has been little research in the construction industry that connects the use of information systems and communication processes toward increasing the level of trust that will lead to an enhanced level of mutual satisfaction between the client and firm. The objective of the current study was to shed new light on the process that will ultimately lead to an elevated level of construction project success.

In the next chapter, the qualitative methodology that was applied to this study will be delineated. The study attempted to identify further means to improve client and firm relationships that would ultimately lead to an increase in construction project success. The selected population, the implementation of the design, and the research questions will be identified. This will be followed by limitations of the study, and closed with a means for data analysis and a summary.

CHAPTER 3: RESEARCH METHOD

Description of the Research Method

This qualitative study was based on the notion that those directly involved with the construction process would be in the best position to shed new light on the use of information systems to enhance the level of trust between the firms and their clients. Consequently, the use of *grounded theory* was chosen as a method to elicit the subjective comments and opinions from a selected sample of construction firms and their clients. Grounded theory is a way of conducting qualitative research in which theories and concepts are formulated from the data and are based, or grounded, on the actual data that is collected (Rockwood & Gauthier, 2005). This framework for conducting social research lies in the notion that narrative and evidence-based data are used to understand what is taking place in the context of the research and to build theories and ideas about what the data show (Glaser & Strauss, 1967).

Selection of Grounded Theory Methodology *Over* Alternative Methods

Grounded theory methodology can be better than operating from a previously constructed theory. The reason for this notion is that the information that is available regarding the efforts of construction firms to improve client trust and satisfaction with the use of information systems has many specific details that may not have been previously studied or that are not fully understood. The use of a specific theory with a rigid set of methods for scientific investigation could severely limit the current research. The use of

grounded theory resulted in the collection of data that would yield more open and less rigid interpretation and understanding (Lincoln & Denzin, 2000).

Grounded theory by its very nature is used in the interest of making discoveries to expand upon other research and their findings as opposed to developing novel ideas from the introduction of new data. The use of qualitative research allows for more in-depth discoveries of information through narrative intimations derived from those who have experiences in or produce a given phenomenon. Quantitative research, on the other hand, is more often interested in proving or disproving a problem or showing cause and effect (Creswell, 2003).

The study utilized the four-step process for data analysis in grounded theory designs as presented by Glaser and Strauss (1967). The first stage of the grounded theory process involves developing the codes to be used in the analysis, which allowed the researcher to collate the type of data or information required to answer the research questions of the study. The second stage of the process required the collection of the different concepts that were determined by the codes used in the first stage of the process. This stage in the process allowed the researcher to group together the codes that had similar content (Glaser & Strauss, 1967).

The third stage of the grounded theory process involved the categorization of the concepts that were grouped in the previous step, providing the determination of the different aspects of the role of information systems in construction. Subsequently, the final stage in the grounded theory process was to define the theory that was determined. Once the theory was established, the researcher was able to explain the role of

information systems in the construction field as perceived by both the client group and construction firm group. The current research was conducted with the intent to develop a paradigm by adding to the existing knowledge regarding the use of information systems as a means of improving communication between construction firms and clients that would lead to increased trust and mutual satisfaction. A qualitative methodology based on grounded theory was most appropriate as a guiding force for the current investigation in that the phenomenon in question, the lack of trust of construction firms by clientele, is largely based on perceptions rather than numerical data.

Population and Sample

Construction firm employees and their clients completed open-ended questionnaires and these served as the data for this study. Specifically, there were 53 participants, 25 of whom were construction firm employees while the remaining 28 were clients of the construction firms. The two groups completed different questionnaires, and each of which was specifically designed to capture the thoughts and opinions of the participants with regard to topics specific to the objectives of this study.

The sample participants were selected through direct contact with the senior management of four large organizations. The client firms included industry areas of paper production and pharmaceuticals. The construction firms included two contacts, as did the client firms. These four contacts provided access to the participants as well as assisted in the distribution of questionnaires to gain access to project engineers, project managers, site managers, and control managers.

It is important to recognize that any type of sampling that is performed has its advantages and drawbacks. Furthermore, while there is a great deal of research regarding various aspects of the construction industry, gaining access is frequently difficult. The majority of the studies that were reviewed in this study involved very small samples of construction firms or firms from small regions of the country or the world. This indicates that there is a dearth of information on organizations that possess attributes specific to their region due to cultural, economic, or political influences. It appears difficult to gain access to an industry where the priority is on completing the client's project and making as much profit as possible from each client.

The role of the researcher in this study was more of a casual observer. The researcher's position objectively assesses a phenomenon irreverent to personal perceptions. Instead, the role of the researcher was to record information, ensure proper research methods, ask questions and motivate participants to express their opinions related to the research questions.

Instrumentation

Data collection used a questionnaire that was sent to the participants, which was comprised of open-ended questions in order to derive a greater amount of data. These questions avoided the simple *yes* or *no* responses, and were structured in such a way as to encourage the participants to open up and relate their feelings as well as to express ideas about the industry. With respect to the clients, the questionnaire was structured to get them to provide their thoughts and perceptions regarding their experiences with the construction firm providers.

The questionnaire began with instructions for the participants regarding the nature of the questions and how to answer them. This may seem unnecessary considering that the questions were open-ended and are asked about the industry in which the participants are either employed or hired to handle large construction projects. However, Fink (2005) noted that respondents to questionnaires need to know certain basic information such as whether they are to answer all the questions or only those questions that apply to them and their individual backgrounds. In the current study, providing instructions such as to only answer those questions that apply to the individual respondents is vital. The questions in this study were provided to both managers and construction personnel, as well as to the customers of construction firms. To avoid confusion and inaccuracy in the responses, the instructions had to be clear to prevent construction firm employees from answering questions intended for clients or vice versa. Additionally, the instructions helped respondents feel more comfortable about the questionnaire process and allowed them to focus on the specific questions that pertained to their particular situations.

It is also important to explain that the questions did not limit the participants from providing information in a particular way. In fact, the participants were encouraged to answer questions in the way that they thought was appropriate. The instructions instructed participants to answer the questions with as little or as much information as they felt were needed. They were told that there was no correct way to answer the questions. Instead, they should answer the questions with their thoughts and opinions and what they thought was important.

This is the very nature of the semi-structured questionnaire. The research questions provide a general direction for the conversation and responses. However, the structure is not so rigid that it prevents the participants from being able to provide their own opinions and insights. This open-ended process is important because it increases the amount of information and the depth of the information that potentially can be collected for this type of investigation.

What followed was a sample data collection and questionnaire form that was used. The questions were arranged as a way to get the participants to provide information about their experiences with construction firms from both inside the firms and from outward looking in. Following each of the questions listed in the questionnaire, a short description of why the question was asked was provided. Each question had a purpose in answering the research questions that were outlined in chapter 1.

Questionnaire

Questions for Construction Firms

1. As a participant in this questionnaire, how would you best describe your role in the construction management process? For example, please share your job title and job function as it relates to the construction management process.
2. What would you say is the current level of trust or mistrust between clients and construction firms? Please also describe the nature for your feelings in terms of the level of trust or mistrust between clients and construction firms.

The research in the literature review suggested that in recent years construction firms and clients have changed in how they view the issue of customer satisfaction. This question allowed the participants to express their views on these changes. It will allow for an examination if the issue is as important among the participants of this study as has been suggested in other studies.

3. How would you describe the communication between construction firms and clients? For example, what technologies do you use to communicate (i.e. computer system or email, collaboration software, open access to project documents etc.) and how often does that (those) communication (s) take place?

This question began the process of asking construction personnel and clients about the methods, such as information sharing, more in-depth meetings, and other processes to make customers feel more involved and informed about project status and conditions. Even more, the question also allowed for respondents to state if they cannot think of any methods that are being used to make clients feel more involved in the construction process.

4. What are your thoughts regarding the possible increase in the level of trust through increased communication? For example, do you believe that trust can be increased through improvements in information sharing technologies or the increased communication between construction firms and clients? If so, to what degree can trust be improved through communication and why?

5. What changes have you seen in the use of IT to improve communication between construction firms and clients? Have you or your firm upgraded communication technologies in the recent past?

This question was intended for both construction industry personnel and construction industry clients. The information provided in response to this question allowed for an examination of how the respondents within and out of the industry feel about the way in which IT is used in construction.

6. To what degree has the use of IT from your perspective changed in the construction industry overall?

This question allowed for some historical perspective from all respondents about the changes in how IT has been used in the industry, or even if changes have occurred at all.

7. How receptive are personnel in your firm to using IT?

This question allowed for an understanding of not only how the individual respondent is using IT, but his or her perceptions of how others in the organization feel about using IT. This was important considering the literature that has been reviewed suggesting that there is some resistance to IT among those working in the construction industry.

8. How receptive are clients toward using IT to increase communication?

This question was intended to determine the perceptions of construction personnel regarding how their clients feel about using IT. This was important to understanding if clients truly want to use IT for greater communications.

9. Where do you see the future of the use of IT in the construction industry?

This question was intended for all respondents. It was part of the questionnaire as a way to ask about how construction firms can improve in the future and the perceptions of what will take place.

10. What can the construction industry do better to build relationships with clients to improve sharing information and use of information systems to manage a construction project?

After asking about IT and client satisfaction, this question allows all of the respondents to provide additional insight and opinion about what can be done in the construction industry to improve relationships with clients.

Table 1 categorizes the construction firm interview items by study research questions. Please note that the numbering used for the interview schedule items differs from that used in the above text.

Table 1

Categorization of Construction Firm Interview Items by Study Research Question

Study research question	Interview schedule items	Percent of Total Items
Research question 1: what is nature of trust	2,3,8	30%
Research question 2: current use of communication systems	4,6,7	30%
Research question 3: will improving communication systems impact trust	5,9,10,11	40%

Questions for Construction Clients

1. As a client, how would you describe your experience working with the construction industry and what type of projects have you been involved in?

This question was simply intended to gather information about the level of experience of the client working with the construction industry.

2. What methods have you seen take place by construction firms and others involved in construction projects to make the clients feel more involved in the entire construction process through information sharing and use of information systems? Further, how would you rate the level of trust you possess for the construction firms with which you have worked?

This question was intended for both construction industry personnel and construction industry clients. The information provided in response to this question

allowed for an examination of how the respondents within and out of the industry feel about the way in which information systems is used in construction.

3. How has the construction firm that you have worked with used information systems or technology to communicate with you regarding your project? For instance, does the construction firm have email systems, collaboration software, or open access to project documents?

This question allowed for some historical perspective from all respondents about the changes in how information systems have been used in the industry, or even if changes have occurred at all.

4. As a client, how would you like to see construction firms communicate with you about problems or even successes on projects through information systems or other methods where better trust can be achieved?

This question was intended only for clients of the construction industry to allow for an examination of client perceptions of communications and whether they think communications could be improved through the use of technology or even just greater use of face-to-face meetings.

5. To what degree has the use of IT from your perspective changed in the construction industry in the recent past? Do you believe that an increased use in IT could change the level of trust you feel for the construction firm? If so, how and to what degree?

6. How would you describe the willingness of construction firms to use IT to communicate with you? Have you encountered any resistance in this area? If so, to what degree has that resistance been experienced?
7. Have you experienced any change in the level of trust for the construction firm with whom you work or have worked? Is this change in any way related to IT usage? If so, how?

This question was intended to get to the heart of the underlying focus of this research, which is building trust in the construction industry. This question allowed for information from the perspective of clients as to whether trust has changed and how it has or has not changed.

8. What can the construction industry do better to build relationships with clients to improve sharing information and use of information systems to manage a construction project?

Table 2 categorizes the construction client interview items by study research question. Please note that the numbering used for the interview schedule items differs from that used in the above text.

Table 2

Categorization of Construction Client Interview Items by Study Research Question

Study research question	Interview schedule items	Percent of Total Items
Research question 1: what is nature of trust	2,3,8	37.5%
Research question 2: current use of communication systems	4,6,7	37.5%
Research question 3: will improving communication systems impact trust	5,9	25%

These questions were asked because they allowed for an understanding of the factors involved in the client-firm relationship. These questions ranged from issues of using information systems on the part of the firm to how clients can best create a working relationship with managers in which information will be shared. These questions allowed for a full picture of information sharing and customer satisfaction in the construction industry. These questions linked back to the research question at hand because they will help to answer how research firms and contractors are adapting and changing to the use of information systems, how they feel about the integration of information systems, and how the clients feel about the job that construction firms and contractors are doing in this regard.

As was mentioned earlier, all of these questions provide for open-ended responses from the participants. None of the questions limited the respondents to simply answering questions on a scale or with responses such as *very likely* or *somewhat likely*. Even more,

Patton (2002) noted that open-ended questions should not try to direct respondents to any type of specific answer, such as providing a particular feeling. In the case of the questions that were asked for this study, the questions were specific in regards to asking about the use of information systems or areas of client satisfaction. However, they did not try to attempt to obtain specific answers from clients. They were broad enough that clients can explain answers from a variety of viewpoints. One example of this is the question asking construction personnel how greater use of information systems has changed the performance of individual firms. This question could be answered from the standpoint of financial performance, scheduling, or even workload on employees. It was up to the individual respondents and what they felt was important in how the question was answered.

From a methodological standpoint, this research was conducted to attempt to create a theoretical understanding of client satisfaction in the construction industry through information sharing and information systems. The use of open-ended questions allowed for more truthful answers because the respondents felt free to express their own ideas and opinions. Bernard (2005) noted that previous research has found that the use of open-ended questions typically results in greater response rates and respondents who are less threatened because they do not have to provide answers based on categories provided by the researcher.

Finally, the use of the open-ended questions is appropriate for research where the researcher is studying a diverse range of people or opinions (Community Culture and the Environment, 2003). The current research studied construction personnel and clients of

the construction industry. However, the various job functions of construction personnel and the range of clients means that there are likely to be a diversity of responses based on the diversity of the jobs and the needs of the respondents of the questionnaire. The use of the open-ended questions allowed for the range of participants in the study to provide responses based on individuals ideas and opinions.

Waclawski and Church (1998) also indicated that open-ended questions allow participants to simply blow off steam and have an outlet for opinions or ideas that they may not otherwise be able to express to others. The result was that more honest and even direct responses to the questions are possible from the participants. Having such responses can provide insight for the research that would not be obtained if other research methods, such as surveys, were used.

With all the benefits of open-ended questions that have been discussed, it is important to discuss some of the drawbacks and potential problems that exist from the use of an open-ended questionnaire for this research. First, open-ended questions are likely to result in responses from participants that are not expected and hard to code into particular categories (Panneerselvam, 2004). For the researcher, this does mean that more work must be done to analyze the data. With the use of a survey that has specific response categories or levels, such as the use of a likert-type scale, it is much easier to prepare for the range of responses that will be received and to interpret them.

Closed-ended questions tend to be easier for the researcher to analyze. There is also the concern that open-ended questions will result in responses from participants that are not really useful in allowing for the research questions of the study to be answered. It

is possible that respondents will have so much freedom in how they respond to open-ended questions that the responses will be almost useless in terms of the purpose of the study. Survey questions or close-ended questions ensure a greater level of control over responses for the researcher (Cargan, 2007).

In the end, a researcher must examine all issues of methodology in context with the nature of the research and the questions that are trying to be answered. In the case of the current study, the benefits of the use of the open-ended questionnaire format outweighed the potential problems and additional work required on the part of analyzing the data by the researcher. This study attempted to examine an area of the construction industry that has many inconsistencies and even completely unanswered questions from previous studies. Because of these inconsistencies or even the lack of specific information, the current study operated from an approach that collected data and used that data to formulate theory. What this means is that using open-ended questions appeared to be the best approach to conduct this study and obtain the information that was needed.

It is also very important to discuss the issue of reliability and validity of the data that was collected for this study. Establishing validity and reliability of data in a qualitative study can be difficult. However, there are ways to establish reliability and validity of the data. First, Silverman (2001) noted that one way that a researcher can establish reliability and validity without the help of others is to make it clear when actual information from the participant is presented and when the researcher's own opinions or analysis are presented. He explained that qualitative research should make it quite clear when the actual information obtained from the participants is presented. He stated that

this calls for having accurate transcripts of interviews and using actual quotes from those transcripts to show the reader exactly what was said.

What is being called for here is the use of quotations from the interview subjects that can stand-alone. Rather than using a lot of space to paraphrase participant answers, their actual words should be provided. This allows for the reader to understand exactly what was said in response to a question. It also allows the reader to make a judgment about the analysis given by the researcher and to determine if he or she agrees with that analysis.

Hardy and Bryman (2004) concurred with this idea that validity and reliability can be established with the use of the actual words of the interview subjects, and making it clear when the analysis or opinion of the researcher is being provided in contrast to the actual data that was collected. Even more, the authors explained that the very nature of grounded theory, which is the approach being used in this investigation, provides the means for establishing validity and reliability in a qualitative study. They stated that the foundations of grounded theory call for researchers to explain their procedures at each step of the data collection process. By explaining procedures in detail, the readers can understand the steps that were taken to collect the data and make their own decisions about the analysis and its overall reliability and validity. Based on all of this, if the procedures of grounded theory are used, and if it is made clear in the analysis where the words of the participants end and where the analysis of the researcher begins, then it should be possible to establish validity and reliability of the information collected.

Furthermore, this should allow also for other researchers to have the information they need should replication of this study be desired.

Another important issue that is related to the validity of the responses to the questionnaire has to do with the order in which the questions are asked. This might not seem like an important issue considering that all the questions were open-ended. However, the order in which the participants presented the questions for response can affect the answers that are provided. The questions that precede a specific question can affect future responses. For example, asking a question about a participant's organization before asking about the construction industry in general might cause a participant to think more about his or her own organization or to try and create an answer to the industry question that is different from the answer provided about the organization, even if both answers should be similar in nature (Houtkoop-Steenstra, 2000).

The questionnaire in the current study took the issue of question order into consideration by grouping questions of a similar nature, such as about information systems or client satisfaction together. Even more, within each group, the questions were first asked about the industry in general and then moved to the participant's specific industry or needs. In essence, moving the questions from one topic to the next and moving from a broad view of the issue being raised to the particular issues of the participant's firm or situation added to the validity of the results.

Bernard (2002) also stated that the first question of the questionnaire is vital to gain and keep the attention of the participant. He explained that the first question should have several traits. First, the question should be non-threatening in nature. The first

question should also be directly related to the topic of the questionnaire, and it should be easy for the participant to answer. In the questionnaire for the current study, the first question asked the participants about how the issue of client satisfaction and client relations has changed over the past five to ten years. This question is directly related to the nature of the research about improving client satisfaction in the construction industry. This question is also non-threatening in the fact that it is general in nature and not personally directed toward the participant or his or her specific situation. Finally, the first question is also relatively easy to answer.

By taking into account the need to draw participants into the questionnaire and gain their attention and willingness to continue with the questionnaire, the hope was that the participants in the current study was interested enough to complete all the questions that pertained to them. Even more, it was hoped that by using these cues to gain the attention of the participants, they maintained that attention and interest in the questions that were asked and have the desire to answer them fully and honestly. Otherwise, it was quite possible that the participants might simply rush through the questionnaire and provide less than honest or complete answers to simply finish a questionnaire that did not hold their interests. Even worse, it was likely that they would never finish answering all the questions or even have enough interest to return the questionnaire to the researcher for analysis.

Bernard (2002) also stated that questionnaires should be created so that any question that might be threatening to the participants, such as very personal questions or questions that might be perceived to question how they personally operate should occur

well into the questionnaire or not exist altogether. The questionnaire for this study has been developed so that personal questions occur once the participants have become interested in the questionnaire and have answered several questions. Questions that might be threatening in a personal way, such as about the specific organization or the way in which the participant does business, are dispersed throughout the questionnaire and do not occur together.

Finally, it is important to discuss how the questions are worded. Fink (2005) explained that one of the most important mistakes that a research can do in developing a questionnaire is to put more than one question together in a single questionnaire item. Placing more than one question together creates a problem for the participant because there may be a conflict of what is expected in terms of how to answer the combined questions. The participants may also focus on one of the combined questions and forget the other. The result would be that complete information for the questionnaire item would not be obtained.

Combining questions can also make it difficult for the research participant to stay focused because the questions become more difficult to answer because the questions are complicated. The outcome from confusing participants with questionnaire items or making it difficult to answer individual items is that the participant loses interest and may likely not even bother to finish the questionnaire at all. Because of this, Fink (2002) suggested placing only one question in each questionnaire item. In addition, he stated that questions on a questionnaire should never be abbreviated. Using lots of abbreviations or

assuming that a participant knows what abbreviations mean can add more confusion and the possibility that the questionnaire will not be completed at all.

Bernard (2005) added that questionnaires must be easy to read. This means that questions must be formatted in such a way that they are easy to follow from one question to the next. Standard English conventions, such as capitalizing the first word of a sentence and ending sentences with appropriate punctuation, as well as using punctuation within sentences, are important. Having questionnaire items that are not easy to read because of missing punctuation or no punctuation at all is just as bad as having questions that are difficult to understand on the part of the participant. If questions do not make sense simply because of misspellings and a lack of proper punctuation, respondents are not likely to try and decipher the questions for the sake of the researcher.

Overall, the important part of this in-depth discussion about the methodology that has been used to develop the questionnaire for this study is that a great deal of thought went into the creation of the questions, as well as their order and how they were presented. On the surface, the questions might appear to have little relation to each other. However, on closer inspection, and in the context of research on questionnaire methodology, it becomes clearer that the questions and how they were presented were done so with specific ideas in mind. They are grouped according to similar ideas and they are easy to read and understand. The questions ask one question and do not try to direct the respondents to provide specific answers.

What is also very important is that the questions that make up the questionnaire are related back to the research questions that have been stated for this research. The

questions asked about the changes that the construction industry has experienced and is experiencing currently because of information systems. The questionnaire also asked about the ways in which construction firms are using information systems and adapting their processes because of these changes. The questionnaire also asked about specific uses of information systems and how employees are handling these changes. Finally, the questionnaire posed questions to both clients of construction firms and to construction firm personnel regarding how clients are responding to these changes in information systems and issues related to client satisfaction.

Data Collection IRB 0315323

The actual collection of the data for this research consisted of collating the responses to the questions obtained from the participants. Once the data was collected, it was archived in such a manner as to protect the identities of the participants. The responses from the questionnaires were not identified by the name of the participant. Instead, a coding scheme, such as "FW" was used for participants working with construction firms, and "C" was used for participants working in the capacity of the customer or client that awards contracts to the constructions firms.. The actual coding sheet that connects the coding scheme to the names of the participants was destroyed after the full coding and transcription of the data took place.

Furthermore, to ensure the full confidentiality of the interview subjects, the data was kept private and only seen by the researcher. The questionnaire responses were kept in a locked file cabinet that was only accessible by the researcher. In addition, any coding schemes or notes taken by the researcher were kept on the researcher's computer in a

password-protected file. Finally, none of the actual questionnaire responses or notes were made available to anyone else for further analysis or research.

The issue of exactly how the data was collected is vital. One of the important aspects of the data collection process was how the questionnaires were sent to the participants and how the responses were received from the participants. The questionnaires were emailed to the participants in such a way that it was easy for the participants to type out their responses. Once the participants had typed out their responses, the participants were able to send their responses back to the research for archival and analysis.

The fact that all participants, whether they are employed in the construction industry or are clients of the construction industry, received the questionnaire in the same manner was an important aspect of standardization of research methods. Galtung (1967) noted that an important part of research is the standardization of research methods. This standardization includes providing questionnaires to all respondents in the same manner. Providing questionnaires to different participants in different manners can affect how they respond to the surveys and the questions that are asked. This is a variable that can be eliminated if all participants receive the questionnaire in the same way.

Although this issue might not seem important for the current study, a lack of standardization of how the questionnaire was distributed could definitely present a problem. For example, if clients of the construction industry were given the questionnaires in person, they might feel obligated to answer them quickly and be able to return them to the researcher. On the other hand, if the construction industry personnel

were emailed the questionnaire and given an unspecified amount of time to answer the questions and return the questionnaire, the type of responses could be drastically different. These differences could even be greater if certain construction personnel were given the questionnaire in person and others received it via email.

Part of any scientific research is to eliminate unnecessary variables that might interfere with the variables that are being tested. In this case, standardizing the means of distributing the questionnaires is not just a way of making it easier for the researcher to get the questionnaires to the participants. Instead, it is a means of standardizing the way in which participants receive and respond to the questionnaires by holding this variable constant (Galtung, 1967).

Data Analysis

Because this research is qualitative in nature, the data analysis method required a great deal of involvement in the actual interviews and feedback questionnaires that were obtained from the participants. Unlike quantitative research, which focuses more heavily on statistical analysis of questionnaires, this research required the researcher to look for patterns in the information collected and the feedback provided. This was done by analyzing how various participants answered similar questions relating to customer satisfaction and the use of technology and information sharing in the construction industry.

Based on the research of germane literature, the subject matter of this study required scholarly exploration. Indeed, there is a breadth of evidence that there are problems surrounding the client relationships with construction firms, and the

improvements information systems can make to this situation. The current study can be a good foundation for future research where more time and financial resources are available to allow for even more understanding of this issue.

Leedy and Ormrod (2005) stated, “A grounded theory study uses a prescribed set of procedures for analyzing data and constructing a theoretical model from them” (p. 140). Glaser and Strauss (1967) outlined a four-step process for data analysis in grounded theory designs. The first stage of the grounded theory process involves developing the codes to be used in the analysis. This allows the researcher to collate the type of data or information required to answer the central research questions of the study. For instance, this would apply to the perceptions of the participants with regard to the role of information systems in the construction field.

The second stage of the process requires the collection of the different concepts that are determined by the codes used in the first stage of the process, which allows the researcher to group together the codes that had similar content (Glaser & Strauss, 1967). The third stage of the grounded theory process calls for the categorization of the concepts that were grouped in the previous step. This, in turn, allows the researcher to determine the different aspects of the role of technology in apprenticeship education. Subsequently, the final stage in the grounded theory process is to define the theory that was determined. Once the theory has been established, the researcher is able to explain the role of information systems in construction as perceived by both the clients and construction firm.

Following this procedure, the data analysis process began by looking for certain

key words or phrases in participant responses. Researchers in the field of qualitative analysis (Robin, 2002; Holstein & Gubrium, 2003) have stated that the first process of analyzing what can be hundreds of pages of interview transcripts is to look for important words and themes from the subjects. In the case of the current study, transcripts of interviews were analyzed for words such as client satisfaction, trust, mistrust, distrust, IT, and information sharing. This pinpointed where participants talked about the key ideas that were relevant to the current study and allowed for a presentation of quotes and an analysis of what was said. Patterns of responses were investigated across particular participants. For example, if all project managers of construction firms answered a particular question in the same manner, this was something important that was worth analysis. At the same time, if all clients who are interviewed answered a particular question in a certain way, then this was an indication of a pattern that was important to examine and analyze.

In addition, the research notes explained the mood of the participant, the way in which he or she spoke and answered questions, and the general feeling of the interview session. These notes were combined with the relevant quotes from the interview transcripts to examine responses and to look for patterns in responses within each interview session and across interview sessions for participants from construction firms and from construction firm clients.

Looking for important patterns and themes in the responses helps to determine ideas or information that was discussed across questionnaires with various participants. When several participants in response to a specific question raised the same idea or

theme, then this information became important. There is a reason that several respondents provided similar answers. These are the patterns that are important and that deserve further analysis.

Miles and Huberman (1994) also explained that looking for patterns upon initial examination and analysis of the data helps to focus the researcher in specific areas that deserve greater analysis and discussion in the final research report. Without some way of focusing the data analysis, a great deal of information might be discussed that is really not very important in the large scheme of the research. On the other hand, not having a focused view of the data that is being analyzed could result in missing important patterns in the data that could provide answers to research questions or information that would be useful for future studies.

Once the data was reduced and patterns were identified, the actual analysis of the data and what it said about the construction industry and issues of information sharing and client satisfaction were summarized. Reducing the data and finding those patterns in the data that were most important allowed for a more focused set of analyses and discussions about what the data mean in light of the information provided by the research participants (Reviere, 1996). The analysis of the findings took into account if only particular types of responses were given by those who worked in the construction industry or if only by clients of the construction industry.

Similarly, if construction industry personnel and construction clients raise similar issues or present similar responses to particular questions, clearly there was a pattern that was worth examining and analyzing further. For example, if both clients and construction

personnel stated that they have seen few or no changes in the use of information systems to improve communications between construction firms and clients; this was clearly an important finding. This pattern of responses to the question showed that, at least for the participants in this study, they have not seen in a change in client communication in the construction industry because of information systems. This was important because both personnel and clients would be showing general agreement on this issue.

The larger goal for this research was to provide some insight for construction firms to understand how better to increase trust through communication and eventually client satisfaction through the use of information systems to share information and data with clients and each other. While part of this research was to develop theory from the data that was obtained, the theory that was developed is intended for the use of construction firm executives and project managers. The research that was conducted in this study is intended to help managers and company leaders make better decisions.

As was stated earlier, part of creating validity and reliability in research that was based on grounded theory was to do more than simply provide an analysis of the data. Instead, actual quotations provided by the research participants were used so that readers of the research can derive their own conclusions as to the analyses provided by the researcher concerning validity and usefulness. This method also allowed for other researchers to expand upon limitations with the current study and conduct future research to provide even more answers to the issues surrounding trust, client satisfaction, and information sharing in the construction industry.

The final part of the actual data analysis for this research involved putting the

findings of this research into context with what previous studies have suggested in regards to client satisfaction and the use of information systems in the construction industry. At the same time, the limitations of the data that arose during the analysis process were explained. This will help other researchers to avoid problems that arose during this research and to improve upon these procedures in future studies. The goal in all of this was not only to provide information that other researchers can use, but also information that construction industry personnel can use to help how they communicate and share information with clients.

Chapter Summary

This study extracted comprehensive information from detailed, open-ended interviews with the purpose of identifying trends and themes that may lead to a greater understanding of the current disparity of trust between clients and construction firms. With the implementation of the qualitative methodology and a phenomenological design, perceptions will be drawn from both organizational leaders and clientele in order to establish a full dimension to the yielded data. In that quantitative study has been applied to the issue in the past, there was reason to believe that a qualitative design may garner information that will better add to the existing body of knowledge.

In the following chapter, the results will be discussed both numerically and through narrative. Analysis that was applied to the data will be delineated, with accompanying charts and graphs in order to fully illustrate the information. Emergent themes will be identified, followed by an integration of the data and the initial premise of

the study, that is, levels of trust between clients and construction firms and how information systems can improve any disparities.

CHAPTER 4: RESULTS

Data Collection Procedures

The purpose of this qualitative study was to (a) investigate the exact nature and extent of mistrust in the industry, (b) identify methods to improve communication to increase the level of trust, (c) determine whether the use of an enhanced information system would lead to changes in the communication process that will improve levels of trust, and (d) identify a better method in the implementation of an enhanced information system for improving communication among stakeholders.

In light of the purpose of this study, the following five research questions were formed to help guide research:

1. How do clients in the construction industry define the nature of mistrust between them and the firm?
2. What might the industry be already doing, if anything, to improve their communications system that would lead to a reduction in mistrust?
3. How could the use of modern information systems help improve communication that would lead to a reduction in mistrust?
4. What factors hinder the implementation of information systems that could lead to an improved level of trust?
5. Is there a difference of opinion between the construction firms and their clients on the above issues?

To address these research questions, this study examined a sample population consisting of 53 participants, 25 who worked directly for the four large construction firms

and 28 who were clients of these construction firms. The participants were selected through direct contact with senior management. The data for this study are the participants' responses collected through an open-ended questionnaire. Separate questionnaires were completed by the workers of the construction firms and the construction firm clients, and each were constructed to capture the thoughts and opinions of the participants with regard to topics specific to the objectives of this study.

Specifically, this framework for conducting social research lies in the notion that empirical data and evidence are used to understand what is taking place in the context of the research and to build theories and ideas about what the data show (Glaser & Strauss, 1967). The use of grounded theory allows for a greater interpretation of the data collected and will make for more open and less rigid interpretation and understanding (Lincoln & Denzin, 2000). The qualitative analysis methods allowed for in-depth discoveries regarding the construction firm and client relationship.

The researcher first examined the data to identify key words or phrases in the participants' questionnaire responses. Key words and phrases included trust, mistrust, distrust, IT, information systems (IS), and information sharing. After the occurrences of these words and phrases were identified, the researcher grouped the occurrences according to the context of the participants' response. The participants' particular responses of interest, or invariant constituents, were grouped, allowing emergent themes to be discovered and identified based on the frequency of the specific responses. Emergent themes were identified for both the construction firm group and the client group and are presented in this chapter.

Construction Firms: Emergent Themes

Qualitative analysis procedures based on grounded theory included thematic analysis of the data, which allowed for the development and discovery of emergent themes in the data. The emergent themes are presented and categorized according to the participant subgroup to which they belong. The themes found in the construction firm data is presented, followed by those in the client data. Each of the themes includes a table of the participant responses that contributed to the corresponding thematic label. These frequencies do not always equal 100% because of the open-ended nature of the questionnaires. Some participants may have provided multiple relevant ideas, whereas others provided none. Instead, the percentages correspond to the fraction of participants who answered a particular way and as a result, may sum less or more than 100%.

Construction Firms

Nine emergent themes were identified within the data collected from the questionnaire responses by the firms' participants. These nine themes are: (a) firms believe a good level of trust is maintained with their clients, (b) construction firms communicate with clients using electronic means, (c) construction firms feel they are upgrading their information technologies, (d) technology improves communication and information sharing between the firm and the clients, (e) reception of technology is based on age and training, (f) firm workers perceive clients as receptive to technology, (g) increased communications and information sharing would increase levels of trust, (h) real time data exchange will be used in the future, and (i) better communication and information sharing would improve firm/client relations.

Theme A: Firms Believe a Good Level of Trust is Maintained with their Clients

There were only three invariant constituents relevant to the first theme. The invariant constituents were (a) level of trust is good (14 participants, or 56%); (b) improvement possible (4 participants, 16%); and (c) level of trust is low (3 participants, 12%). Table 1 shows each of the invariant constituents and their frequency. This theme addressed research question three and five, in part, because the perception of the construction firm is generally that there is a good level of trust, which will be compared to the perceptions of the clients later in this analysis. In addition, the construction firm group demonstrated some perception to the fact that improvements can be made to increase the level of trust with the client.

FW₆ said, “[there is a] high level of trust, but [it] could be higher.” FW₁₆ felt, “the level is very high.” FW₁₆ shared the same experience and said, “The trust level with the client is very good.” Table 3 shows a breakdown of the invariant constituents and their frequencies.

Table 3

Firm Workers’ Perception of Trust Level

Invariant Constituents	Respondents
Level of trust is good	14 (56)
Improvement possible	4 (16)
Level of trust is low	3 (12)

Note. The percentages do not total 100% in this case, for reasons described earlier.

Theme B: Construction Firms Communicate With Clients Using Electronic Means

There were four invariant constituents relevant to the thematic label of the firms' methods of communication with client. Table 3 shows a breakdown of the invariant constituents and their frequencies. This theme addresses research questions two and three in that the construction firms seem to be utilizing electronic communication as a form of modern information systems, but still frequently use less modern methods such as meetings and written correspondence to maintain communication.

The invariant constituents mentioned by more than two participants were (a) electronic (20 participants, or 80%); (b) meetings (10 participants, 40%); and (c) written (3 participants, 12%). Table 4 shows a breakdown of the invariant constituents and their frequencies.

With regard to communication methods, FW₂ said, "Much of communication is electronic with a progression towards even more electronic communication." FW₄ added, "In today's world, the client and contractor are linked together electronically and there is full information available." FW₅ continued, "We use fax, e-mail, phone, face to face meetings." FW₉ spoke of the prominence of e-mail, "E-mail has become a big part of communication." FW₂₂ mentioned both electronic methods and meetings. FW₂₂ said, "E-mail is the most common system used by both parties...there are daily progress update meetings and weekly progress reports."

Table 4

Firms' Method of Communication with Client

Invariant Constituents	Respondents
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Invariant Constituents	Respondents
Electronic	20 (80)
Meetings	10 (40)
Written	3 (12)
No communication	1 (4)

Theme C: Construction Firms Upgrade Their Information System Technologies.

Most of the participants indicated that information technologies were upgraded regularly within their firm. Table 5 shows a breakdown of the invariant constituents and their frequencies. The invariant constituents relevant to this theme include specific upgrades and are (a) upgrade information systems (18 participants, 72%), (b) software development (8 participants, 32%), (c) e-mail or instant messaging (6 participants, 24%), (d) file sharing (4 participants, 16%), (e) do not upgrade information systems (3 participants, 12%), and (f) use of client systems (3 participants, 12%). These responses provide insight to answer research question two in terms of the use and continuous upgrades to information systems in the communication with clients. Some participants blatantly stated that their firm does upgrade, while others provided specific ways in which upgrades take place. It should be noted that only three participants said their company does not regularly upgrade.

With regard to information systems changes, FW₄ said, “Huge changes in IT. We currently have the best that money can buy.” FW₅ added, “Our Company is always reviewing the latest technology to find ways to improve the flow of business.” FW₁₄ simply said, “We update communications as needed.”

Table 5

Firm Workers' Perception of their Firms' Information Systems Technology upgrading

Invariant Constituents	Participants
Upgrade IS	18 (72)
Software development	8 (32)
Email/IM	6 (24)
File sharing	4 (16)
Do not upgrade IS	3 (12)
Use of client systems	3 (12)

*Theme D: Information System Technology Improves Communication and Information**Sharing Between the Firm and the Clients*

The invariant constituents relevant to the thematic label of the effects of technology implementation can be found in Table 6. The invariant constituents that were mentioned by more than two participants were (a) improved communication and information sharing (12 participants, or 48%), (b) reduced cost (6 participants, 24%), and (c) more comparative (3 participants, 12%). This theme helps to answer research question two in that the perceptions of the construction firm group indicated an acknowledgement that improved information systems can improve communication and information sharing both within the firm and with the clients, therefore implying that increased use of IS will result in better communication.

With regard to the effects of technology, FW₅ said “It helps the field staff stay in better, quicker communication with the office.” FW₉ said, “It’s easier and quicker to get

responses to critical items.” FW₂₁ added, “New software has allowed both parties to better communicate with each other.” FW₂₁ and FW₂₂ spoke of the cost benefits of technology implementation. FW₂₁ said, “Cost saving is probable [*sic*] the most noticeable,” and FW₂₂ said, “The savings of time, which equates to cost, is probable [*sic*] the most single rewarding change.” FW₁₄ spoke of the industry become more comparative through technology. FW₁₄ said, “I think it has made the industry more comparative among them.”

Table 6

Effects of Information System Technology

Invariant Constituents	Participants
Improved communication and information sharing	12 (48)
Reduced cost	6 (24)
More comparative	3 (12)
Brings closer to client	2 (8)
Improved transparency and productivity	1 (4)
Made contractor more accountable	1 (4)
More competitive	1 (4)

Theme E: Reception of Information System Technology is Based on Age and Training.

The sixth theme is related to the firm workers’ reception of technology implementations. The invariant constituents relevant to the thematic label of firm workers’ reception of technology and their frequencies can be found in Table 7. Invariant constituents that received mention from more than two participants were (a) very

receptive (9 participants, 36%), (b) younger workers more receptive (7 participants, 28%), and (c) receptivity comes with training (7 participants, 28%). This theme directly addresses research question 4, which seeks to determine the factors that may hinder implementation of information systems.

With regard to employees' reception of technology, FW₁ said, "The use of technology is directly related to the age of the group using it. The younger want more and most of the older use it because they have to." FW₁₆ added, "Our personnel have been receptive. I think the key to this issue is age. The younger the personnel the quicker they will adapt." FW₉ said, "Very [receptive] as long as training is provided." FW₂₀ added, "The key factor in using new informational technology is the training of the people. Once employees have the training, they want to use the technology."

Table 7

Firm Workers' Reception of Information System Technology

Invariant Constituents	Participants
Very receptive	9 (36)
Younger workers more receptive	7 (28)
Receptivity comes through training	7 (28)
Slow reception	1 (4)

Theme F: Firm Workers' Perceive Clients as Receptive to Information System Technology.

Only one invariant constituent relevant to the thematic label of how clients receive technology received mention by more than two participants. This invariant

constituent was (a) very receptive (10 participants, or 40%). A breakdown of the invariant constituents and their frequencies can be found in Table 8. This theme sheds light on the potential differences between perceptions of clients and those of the construction firms (research question 5). It also addresses research question three, demonstrating the potential for increased use of information systems to reduce mistrust by improved communication.

FW₅ said, “Most clients prefer the technology used because it gives them more avenues to get answers.” FW₆ said clients are “very receptive—they like being able to communicate on their terms.” FW₁₅ added, “The client seems to be very willing to use new technology.” FW₂₃ said simply, “They have been very receptive.”

Table 8

Clients’ Reception of Information System Technology

Invariant Constituents	Participants
Very receptive	10 (40)
Client views IT as easier communication/more efficient	2 (8)
Ordinary for them	2 (8)
Resist technology	2 (8)
Depends on own technology use	1 (4)

Theme G: Increased Communications and Information Sharing Would Increase Levels of Trust.

There were five invariant constituents relevant to the thematic label of firm workers’ perceived factors affecting trust levels. The only invariant constituent

mentioned by more than two participants was (a) increased communication and information sharing (18 participants, or 72%). A breakdown of the invariant constituents and their frequencies can be found in Table 9. This theme directly addresses research questions two and three in that the increased communication, particularly if resulting from information systems usage, would increase the levels of trust.

With regard to factors affecting trust levels, FW₅ said, “We have found if the communication is there and open the trust is there.” FW₆ said, “I think to a high degree communication builds to trust because the customer feels part of the building process and is kept up to date.” FW₁₉ mentioned information sharing, “By improving information sharing technologies between the client and the subcontractor this will improve trust.” FW₂₂ added, “I feel that the sharing of information will always increase the level of trust between tow [sic] parties.”

Table 9

Firm workers' Perceived Factors Affecting Trust Levels

Invariant Constituents	Participants
Communication/information sharing	18 (72)
Honesty	2 (8)
No room for improvement	2 (8)
Needs resolved on some higher level	2 (8)
Teamwork	1 (4)

Theme H: Real Time Data Exchange will be Used in the Future.

The participants offered eight invariant constituents regarding the future of technology in the construction industry. Only two of these—(a) real time data exchange (5 participants, or 20%), and (b) better information sharing (3 participants, 12%)—received mention by more than one participant. A breakdown of the invariant constituents and their frequencies can be found in Table 10. Findings from this theme can help to understand research question three in that real time data exchange would provide superior communication.

With regard to the role of technology in the future of the construction industry, FW₁₁ said, “Real time exchange of data, real time input, real time exchange with clients.” FW₁₉ succinctly said, “More real time data.” FW₂₂ added, “I see the sharing of date [*sic*] and real time information as the future.”

Table 10

Future Technology Use In the Construction Industry

Invariant Constituents	Participants
Real time data exchange	5 (20)
Better information sharing	3 (12)
More computers at jobsites	1 (4)
More accessibility to online documents	1 (4)
Increased profits	1 (4)
More stability	1 (4)
Reduced cost	1 (4)
Client and firm closer	1 (4)

Theme I: Better Communication and Information Sharing Would Improve Firm and Client Relations.

The invariant constituents relevant to this theme that received mention by more than two participants were (a) communication and information sharing (10 participants, 40%), and (b) more trust (3 participants, 12%). A breakdown of the invariant constituents and their frequencies can be found in Table 9. This is directly responding to research question two and demonstrating the perception that better communication and information sharing will improve relations between the firm and the clients. It has already been demonstrated that the firm group also perceived the use of technology and information systems to produce greater communication levels, and therefore increased use of information systems could provide for better relations between firm and clients.

With regard to improving relationships between firms and clients, FW₁₄ said, “We must talk to each other. This must start at the higher levels of management.” FW₁₃ said, “Management must become aligned with the client and share information.”

Table 9

Firm Workers’ Suggestions for Improving Relationships Between Clients

Invariant Constituents	Participants
Communication/information sharing	10 (40)
More trust	3 (12)
Training	1 (4)
Joint venture	1 (4)
Technology	1 (4)
Personal	1 (4)

Construction Clients: Emergent Themes

Five emergent themes were identified within the data from the clients' questionnaire responses. These five themes are: (a) Trust between construction firms and their clients is lacking; (b) Firms use e-mail to communicate with clients; (c) Clients desire real time information; (d) Technology alone does not improve levels of trust; and (e) Accurate information providing would enhance firm/client relations.

Theme A: Trust between Construction Firms and their Clients is Lacking

Clients perceived a lack of trust between them and the construction firms. Five invariant constituents relevant to the thematic label of the firm/client relationship were found. The invariant constituents receiving mention by more than two participants were (a) trust lacking (22 participants, or 79%), (b) don't feel involved (11 participants, 39%), (c) trust lacking because of lack of information (6 participants, 21%), and (d) lack of communication (3 participants, 11%). A breakdown of the invariant constituents and their frequencies can be found in Table 10. This theme relates to research question one and five in that the clients not only perceive a lack of trust between the firm and the clients, but also that the lack of trust is the result of lack of involvement and/or communication. With 79% of clients demonstrating a perception of lack of trust, this directly contrasts the construction firms' perceptions of a good level of trust.

With regard to this relationship, C₄ said, "We don't have a great deal of trust for construction firms." C₈ added, "I would rate the overall level of trust in the construction industry on a scale of 1 to 10 as a 2." C₁₃ said, "My trust in the industry is poor." C₂₆

mentioned the lack of feeling involved. C₂₆ said, “Trust generally does not exist between us and the construction firms. They do not make us feel involved in any way.”

Table 10

Clients’ Description of Firm/Client Relationship

Invariant Constituents	Participants
Trust lacking	22 (79)
Don't feel involved	11 (39)
Lacking because of lack of information	6 (21)
Lack of communication	3 (11)
Trust favorable	2 (7)

Theme B: Firms Use E-mail to Communicate with Clients

There were seven invariant constituents relevant to the thematic label of methods used by firms to communicate with clients. The invariant constituents receiving mention from more than two participants were (a) e-mail (21 participants, 75%), (b) software (10 participants, 36%), (c) no open access or lack of quality information (8 participants, 29%), (d) access to documents (3 participants, 11%), and (e) online database (3 participants 11%). A breakdown of the invariant constituents and their frequencies can be found in Table 11. This theme addresses research question two and three in that the firms already seem to be using email and other software to improve communication, but more can be done in the use of information systems to increase the level of communication and satisfaction with the clients.

With regard to communication methods, C₄ said, “The firms that we have worked with have only really used e-mail.” C₁₄ agreed, and said, “E-mail is really the technology that is relied on quite heavily.” C₁₇ said, “Most of the communication is through e-mail.” C₁₂ said that email and software are used, “The first muse collaboration software and e-mail.” C₂₃ had a similar response, “Mainly, the firms use e-mail. They also use Primavera and Project (software programs) in some situations.” C₁₁ said, “The firms that we currently work with use a lot of the major software in the industry.”

Table 11

Firms' Methods of Communication With Clients

Invariant Constituents	Participants
Email	21 (75)
Software	10 (36)
no open access/lack of quality information	8 (29)
access to documents	3 (11)
Online database	3 (11)
face to face/in person	2 (7)
Website	1 (4)

Theme C: Clients Desire Real-Time Information

There were only three invariant constituents relevant to the thematic label of clients' preferred method of information sharing. The invariant constituents receiving mention from more than two participants were (a) real time information sharing (9 participants, 32%), (b) honest information sharing (6 participants, 21%), and (c) e-mail

information sharing (4 participants, 14%). A breakdown of the invariant constituents and their frequencies can be found in Table 12. This theme can be used to help answer research question five as the clients want more real time information and increased use of information systems and the firms perceived increased use of information systems in the future, specifically, the use of real time information sharing.

C₇ suggested the use of real time information sharing. C₇ said, “I would love to see firms share information in real time using the Internet.” C₁₃ agreed, “I would love to see firms actually use their online databases the way that they were meant to be used with real time information.” C₁₀ said that honesty is important. C₇ said, “I think honesty is the key....Just being honest and communicating honestly would improve trust a lot.”

Table 12

Clients Preferred Method of Information Sharing

Invariant Constituents	Participants
Real-time	9 (32)
Honesty	6 (21)
Email	4 (14)

Theme D: Information System Technology Alone does not Improve Levels of Trust

There were only three invariant constituents relevant to the thematic label of changes in trust levels due to technology. The invariant constituents receiving mention from more than two participants were (a) no change (21 participants, 75%), (b) decrease in trust (4 participants, 14%), and (c) increase in trust (3 participants, 11%). A breakdown

of the invariant constituents and their frequencies can be found in Table 13. Participant responses regarding this topic were straightforward. Interestingly, the client group demonstrated a perception of no change of level of trust with the increased use of information systems, in direct contrast to the construction firm group, addressing research question five directly.

Table 13

Change in Trust Levels Due to Information System Technology

Invariant Constituents	Participants
no change	21 (75)
decrease in trust	4 (14)
Increase in trust	3 (11)

Theme E: Accurate Information Providing would Enhance Construction Firm/Client Relations

There were seven invariant constituents relevant to the thematic label of clients' suggestions for better firm/client relationships. The invariant constituents receiving mention from more than two participants were (a) provide accurate information (14 participants, 50%), (b) be considerate of clients (4 participants, 14%), and (c) open communication (4 participants, 14%). A breakdown of the invariant constituents and their frequencies can be found in Table 14. This theme can be used to address research question one and three to assess what construction firms can do to increase levels of trust, particularly as it relates to information systems.

C₂ said, “The construction industry can build better relationships with clients by providing them with the information they have.” C₁₅ said, “The companies need to cut out the negative attitudes and the lies and just make information available.” C₁₆ said, “Companies just need to communicate more easily with us. They need to supply accurate information.” C₂₂ said, “The use of information systems should focus on providing all the information in one place and in a timely manner.” C₂₃ said, “The industry needs to be more honest.”

Table 14

Clients’ Suggestions for Better Firm/Client Relationship

Invariant Constituents	Participants
Provide accurate information	14 (50)
Honesty	4 (14)
be considerate of clients	4 (14)
open communication	2 (7)
more efficient reporting	1 (4)
be more clear about choices	1 (4)
use new technologies	1 (4)

Summary

Overall, 14 emergent themes were found, nine from the firm employees’ data and five from the client employees’ data, which were then related to the research questions of the study. The themes indicated that the firms’ employees believed that a good level of trust was maintained between firms and clients, while the clients’ employees felt just the

opposite. This divergent issue was even more significant due to the intensity of the clients' use of such words as mistrust in their responses. Both groups agreed that e-mail was the most common means of communication between the groups, and similarly that more accurate information sharing would increase the levels of trust shared among them. Clients showed a desire for real time information and firms predicted a use of such in the future, indicating a possible cause of closure of the mistrust gap in the future.

From this information, it is clear that one of the prevailing problems that sustain a disparate relationship between clients and construction firms is a difference in perceptions of the relationship between the two parties. Whereas construction firms may be under the impression that there is room for improvement, or even no problem at all, clients almost ubiquitously felt as though there was a problem with trust and other aspects of functional professional relationships. Therefore, an immediate conclusion can be established that it is first necessary for firms to identify the problems they have in regards to their relationships with clients, followed by possible approaches to improvement, including the implementation of IT.

In the following chapter, these and other observations will be discussed as they relate to the relationship between firms in the construction industry and their clientele. Themes will be delineated, followed by their relevance to the observed problem and phenomena. Following this, conclusions will be drawn, and this study will come to a close with recommendations for further research in order to fully approach, understand, and find solutions to the problem at hand.

CHAPTER 5: SUMMARY, CONCLUSIONS, AND FURTHER RESEARCH

Even though the current level of modern technology is greater than it has ever been throughout the history of the construction industry, major projects continue to be unsuccessful, and even fail, at an alarming rate. Although there are a number of theories designed to improve the success rate of major projects, construction firms, prime contractors, and subcontractors in the industry place a strong emphasis on the practical application of theories toward the maximization of profits. Along the same vein, clientele of construction firms seek to minimize costs in the successful completion of their projects.

Not unlike projects in the information technology industry, the environment of a construction project promotes competing interests among the stakeholders at the expense of the client as well as the firm. The use of several subcontractors by the primary contractor is very often a major source of such competing interests. Because the various stakeholders of the construction firm seek to maximize individual profits and minimize expenditures, even at the expense of the other, the potential is very high for mistrust. This conflict has a progressive impact on the client of the construction firm as there is a common industry thread of the unintended increase in costs to the clients throughout the implementation of the majority of major construction projects. This conflict of interest has resulted in tension between the prime contractor, subcontractors, and the clients, as they tend to develop separate means to attain the goals which should be similar. As a result, this conflict often results in guarded communication, which normally leads to an increasing level of mistrust, which ultimately contributes to poor client satisfaction due to

a high percentage of construction projects being completed over budget with less quality than originally intended.

To shed new light from those directly involved in the construction process regarding the use of information systems and the impact on trust, this study focused on the comments made by construction firm employees and their clients. The participants completed open-ended questionnaires and these served as the data for this study. Specifically, there were 53 participants, 25 of whom were construction firm employees while the remaining 28 were clients of the construction firms. The two groups completed different questionnaires, and each of which was specifically designed to capture the thoughts and opinions of the participants with regard to topics specific to the objectives of this study.

The grounded theory design (Glaser & Strauss, 1967) was used for the data analysis, which was comprised of a four-step process. The first stage of the grounded theory process involved developing the codes to be used in the analysis, which allowed the researcher to collate the type of data or information required to answer the research questions of the study. The second stage of the process required the collection of the different concepts that were determined by the codes used in the first stage of the process, allowing the researcher to group together the codes that had similar content (Glaser & Strauss, 1967). The third stage involved the categorization of the concepts that were grouped in the second step, providing the determination of the different aspects of the role of information systems in construction. Lastly, the fourth stage in the grounded theory process was to define the theory that was determined, which once established, was

used to explain the role of information systems in the construction field as perceived by both the client group and construction firm group.

A main assumption of this study is that trust levels can be improved upon by using more efficient and effective communication between the parties (Jarvenpaa & Leidner, 1999). However, research is unclear regarding the extent of the mistrust and the exact role played by information systems on the communication process to improve the level of trust. Although it is understood that more productive communication can improve trust between parties, particularly between contractors, subcontractors, and clients, determining the extent of this mistrust and the impact of information systems in the communication process was the primary focus of this study.

The theoretical foundation of this research was based on notions from coordination theory and interdependence theory in the use of information systems technology as they apply in the construction industry processes. While information systems enable improved communication processes, coordination and interdependency are central to mutually acceptable successful completion of construction projects. The purpose of this research was to analyze the impact of information systems on trust between construction firms and their clients. The research questions that formed the foundation for this study were based on discovering the extent and nature of mistrust between contractors and their clients, the perceptions of this mistrust, the extent to which information systems are used, and whether an advanced communication process could improve the level of trust.

To address this notion, this study investigated (a) the exact nature and extent of the mistrust in the industry, (b) what the industry might already be doing to improve communication, (c) whether increased communication would improve industry-wide levels of trust, and (d) what might be the best method or use of information systems to improve communication among the stakeholders. This chapter highlights the important findings, practical implications, and recommendations for future research.

Interpretations of the Findings

The examination of the two sets of themes from both the construction firm's perspective and the client perspective can best be presented in an analysis of the responses to the research questions. These are presented below.

Research Question 1: How do clients in the construction industry define the nature of mistrust between them and the firm?

Based on the client responses and the emergent themes from the analysis, the clients felt strongly that there is a significant lack of trust between construction firms and their clients. The clients also perceived that technology alone does not and, surprisingly, will not improve the level of trust. According to the clients, accurate and timely information would enhance firm/client relations.

Research Question 2: What might the industry be already doing, if anything, to improve their communications that would lead to a reduction in mistrust?

The results from both the client and the construction firm groups can be used to answer research question two. According to the clients, the firms relied heavily on email for communication purposes and that an availability of real time information and accurate

information would improve communication and relations between the firm and the clients. According to their responses, construction firms communicated with clients using electronic means. Construction firms also felt they are upgrading their information technologies for improved communication as well as to enhance the flow of business. Additionally, the firms tended to believe that information systems improve communication and information sharing between the firm and the clients.

Research Question 3: How could the use of modern information systems help improve communication that would lead to a reduction in mistrust?

Research question three was addressed in the responses by both groups. The client group believed that accurate and real time information would improve the relations and therefore the level of trust between the construction firm and the clients. However, the clients also believed that technology alone does not and, surprisingly, will not increase the level of trust. The firms believed that information systems improve communication and information sharing between the firm and the clients, that better communication and information sharing would improve firm/client relations in general, and that increased communications and information sharing would increase the level of trust.

Research Question 4: What factors hinder the implementation of information systems that could lead to an improved level of trust?

This question was best answered by the responses and findings from the construction firm group. Of primary importance was the aspect of information system technology training for construction firm workers. If adequate training was provided, the workers were perceived to use the technology. Therefore, a lack of adequate training

within the firm could result in a barrier to the use of information systems. Another limiting factor to the use of information systems and new technology was the age of the employee. According to the construction firm group participants, younger employees use technology more freely and readily. To some, they felt that increasing the availability of adequate training would provide older employees with the understanding and comfort level to utilize the information systems more.

Research Question 5: Is there a difference of opinion between the construction firms and their clients on the above issues?

In summary, there seemed to be significant differences in opinion between the two groups with regard to the relationships between the client and the firm, as well as in the use of information systems to enhance relations. A major difference between the perceptions of the two groups was the basic perception of a lack of trust. The construction firm group perceived that there was a good level of trust between the firm and the clients. In direct contrast, the clients perceived that trust between the client and the firm was lacking significantly. In addition, the construction firm participants believed that information systems technology improves the communication and relations with the clients and therefore also increases trust between the two. However, although the client group believed that accurate and timely information would improve the relations between the groups, they also felt that technology alone does not and will not improve the levels of trust between the client and the firm.

Relationship of the Findings to the Conceptual Framework

This study was formulated on the foundation regarding the interactions of coordination theory and interdependence theory within the construction industry. Although it appeared that coordination and positive interdependence among the stakeholders depend on establishing mutual trust through a mutually satisfactory communication process, the industry has a long ways to go to develop this relationship. Even though information systems can play a major role in developing mutually acceptable means toward improving the communication process, establishing and maintaining trust in achieving mutual satisfaction among the stakeholders in construction projects, there was not general agreement on its use to achieve this objective.

Although the notion of increased coordination assumes increased communication regarding the sharing of information, the increase in communication may not lead to an increase in coordination if the information that was transmitted is inadequate, confusing, or worse, not trusted. Since the clients felt that information systems and communication systems technology alone do not lead to increased project success and client satisfaction, it challenges the notions from both the theory of coordination as well as the theory of interdependence.

As a result, the quality of the information is much more important than the volume of communication and information sharing through information systems. The level of the quality of this information must be established that meets the needs of all the stakeholders including the contractors, subcontractors, and clients.

1. *The exact nature and extent of the mistrust in the industry.* High levels of trust are not present in the construction firm/client relationship. Clients made it clear that the level of trust between them and the firms was lacking, but construction firm workers said they believed a good level of trust is maintained. If either side of a relationship says trust is lacking, then it can be concluded that trust is indeed in jeopardy. Clients believed that trust was lacking primarily due to inconsistent information. In essence, it was maintained that the initially reported time frame and costs were rarely accurate, and this was due to an omission of pertinent information. Firms agreed with this premise, but claimed that this was due to incomplete information furnished by the client, resulting in later costs and time expenditure unforeseen by either party. Firm employees otherwise believed there was trust and did not cite with any specific examples of trust, while clients were rather definitive in claiming trust levels were low. On the other hand, firm employees were ambivalent about trust among one another. Whereas some workers felt that trust was shared throughout the company, others cited marked issues between contractors and subcontractors, and more minor problems between other divisions. Whereas it wasn't directly indicated that this could affect the firm/client relationship, it logically follows that if there is an issue with trust among the firm, this mistrust may manifest among the clientele as well.

2. *What the industry might already be doing.* The primary mode of communication between firms and clients is e-mail. Both groups agreed that e-mail is the most commonly used form of communication between the two parties. Its use might be attributed to its convenience, but the use of e-mail indicates that firms and clients alike are adaptive with regard to technology. Other communication programs were also cited as an improvement, especially those provided by the clients. Cellphones were considered a drastic improvement compared to earlier modes of communication, which may apply to the improvements provided through email, in that many cellphones give users the capacity to communicate via email.
3. *Whether improved communication would improve trust.* Use of information systems alone does not improve trust, but better communication and information sharing (possibly facilitated using information systems) are the proper ingredients for better trust. Both groups asserted that better communication and greater sharing of information would help increase the currently lacking levels of trust between the parties. Clients were quick to point out that these things were necessary, although not necessarily through information systems, to improve the trust. It is understood, however, that information systems can assist in bettering communication and sharing information. In essence, better communication is necessary, and technology makes communication easier, therefore it can be inferred that information systems makes it easier to improve trust.

4. *What might be the best method or use of information systems to improve communication.* The future should result in the implementation of real time information sharing. With the use of real-time information sharing, changes that could require more time or further costs could be indicated to the clients immediately, resulting either in an understanding between the clients and contractors (and further trust) or means to avoid the cost and time expenditure. The firms' employees say that real time data exchanged will be used in the future, and clients mentioned that they deserve such information. With the clients' needs being met by the firms' implementation of information systems, real time data sharing should commence soon. It should be noted that some clients expressed that firms already have the technology to provide information in real time, but they do not do so. The firms' employees' belief that real time information sharing lies ahead, however, is reassuring.

Conclusion of the Findings

The results of this study indicated that improving communications via information technologies offers potential for significant improvement of industry efficiency and business attitudes between the major stakeholders. Improving communications leads to an enhanced relationship between clients and firms by increasing trust and thus raising client satisfaction. Industry image can therefore enjoy similar benefits.

The current study shows that the employment of information systems leads to increased communication between the construction industry and its clients, thereby ameliorating that feeling of distrust between the two parties. This study could help to

dispel the beliefs among members of the construction industry that the use of communication technology may negatively impact profits and may be a waste of time. Much to the contrary of these notions, the findings imply that the widespread use of information systems used in this study could revolutionize the construction industry by increasing efficiency and therefore increasing business activity. Specifically, knowledge gained from this study could be used to better understand clients' needs.

The study demonstrates the importance of technology training for employees in order to encourage use of information systems, particularly among older employees and leaders in the construction firm. This information can be used in conjunction with the findings that increased and consistent use across the organization of information systems can increase business efficiency. Leaders should therefore promote technology training in their organizations to promote information systems usage and potentially, increased efficiency. Knowledge gained from this study could also be incorporated into training techniques for leaders in the construction industry as to how to better connect with clients to ensure successful business transactions. The more widespread and consistent the use of information systems, the more significant could be the benefits across the firm and in relations with the clients.

The study is significant in demonstrating a disparity between perceptions of trust in the relationship between clients and construction firms. Construction firm leaders should recognize this disparity and incorporate methods to reduce the client perceptions of mistrust. The study findings suggest that clients perceive information systems to be useful in providing increased communication, but that information systems use alone is

not sufficient to dispel the perceptions of mistrust. Leaders should then possibly incorporate information systems along with more traditional methods to increase communication and trust between clients and the firm.

The construction industry has an impact on the overall economy of the nation and improvements to this industry can have economic benefit to the U.S. economy as a whole, whether large or small. The findings of this study could be significant to the economy in general if the findings could be extended to industries beyond the construction industry. The results of this study could provide a better understanding of the use and effectiveness of information systems in terms of improvement in the efficiency of businesses across all sectors. Results of this study suggest an advantage in terms of communication and client relations, which could be expanded across other business sectors; therefore, the increased use of information systems could impact the economic development of American industry in general.

Construction Firms

The data from the questionnaires completed by construction firm employees were examined and sorted based on nine thematic categories. From these categories, participant responses were further examined and analyzed and emergent themes were identified based on common responses. The specific themes gleaned from the construction firm employees' data are:

1. Firms believe a good level of trust is maintained with their clients. For example, FW₁₆ said, "The trust level with the client is very good."

2. Construction firms communicate with clients using electronic means. FW₂ explained, “Much of [the] communication is electronic with a progression towards even more electronic communication,” and FW₄ added, “In today’s world, the client and the contractor are linked together electronically and there is full information available.”
3. Construction firms feel they are upgrading their information systems. For example, FW₅ said, “Our Company is always reviewing the latest technology to find ways to improve the flow of business.”
4. Information system technology improves communication and information sharing between the firm and the clients. FW₂₁ explained, “New software has allowed both parties to better communicate with each other.”
5. Reception of information system technology is based on age and training. FW₁₆ said, “Our personnel have been receptive. I think the key to this issue is age. The younger the personnel the quicker they will adapt.” FW₂₀ added, “The key factor in using new informational technology is the training of the people. Once employees have the training, they want to use the technology.”
6. Firm workers perceive clients as receptive to information system technology. FW₁₅ said, “The client seems to be very willing to use new technology,” and FW₂₃ added, “They have been very receptive.”
7. Increased communications and information sharing would increase levels of trust. FW₁₉ explained, “By improving information sharing technologies between the client and the subcontractor this will improve trust.”

8. Real time data exchange will be used in the future. When speaking of the future, FW₁₁ said, “Real time exchange of data, real time input, real time exchange with clients.”
9. Better communication and information sharing would improve firm/client relations. FW₁₄ said, “We must talk to each other.”

Construction Clients

The data from the questionnaires completed by construction firms’ clients was examined and sorted based on five thematic categories. These categories were (a) clients’ description of the relationship between clients and firms, (b) firms’ methods of communication with clients, (c) clients’ preferred method of information sharing, (d) change in trust due to technology, and (e) clients’ suggestions for a better firm/client relationship. From these categories, participant responses were further examined and analyzed and emergent themes were identified based on common participant responses. The specific themes gleaned from the clients’ data are:

1. Clients feel strongly that trust between construction firms and their clients is lacking significantly. C₄ explained, “We don’t have a great deal of trust for construction firms.”
2. Firms use e-mail to communicate with clients. C₁₄ said, “E-mail is really the technology that is relied on quite heavily.”
3. Clients desire real time information. For example, C₁₃ said, “I would love to see firms actually use their online databases the way that they were meant to be used with real time information.”

4. Information system technology alone does not improve levels of trust.
5. Accurate information would enhance firm/client relations. C₁₆ said,
“Companies just need to communicate more easily with use. They need to supply accurate information.”

Recommendations for Action

Construction firms and clients alike could draw from this study and its findings to better gain knowledge about the mistrust in the industry. Construction firms need to be aware of the intensity of the mistrust that clients feel about the industry. The results of this study could lead to improved relationships between clients and vendors. The findings of this research could also be used in the training of those who work for construction management firms, specifically how to better connect with their clients and build a relationship of trust. The results of this study may also serve as an influence to members of the construction industry who are hesitant to implement technology and information systems for improvement in communication and trust. This study may also provide the necessary knowledge to understand what the preferences and desires of their clients entail, especially with regard to communication procedures. The results of this study will add to the existing research regarding construction firm and client relations and information sharing and building trust.

Significance and Social Change Implications of the Study

Based on the results of the current study, the employment of information systems can lead to enhanced communication between the construction industry and its clients,

creating a level of trust between the two parties. Findings from this study may help to alleviate concerns on the part of leadership within the construction industry with regard to the beliefs that the use of communication technology would have a negative impact on profits, and may actually spur the promotion of the use of information systems within the construction firms because the findings imply that the widespread use of information systems could revolutionize the construction industry by increasing efficiency and therefore increasing business activity. Thus, knowledge gained from this study could be used to increase the communication between client and firm, providing a better understanding of clients' needs, while also increasing communication and efficiency within the firm, providing increased business activity.

Another aspect highlighted by this study is the importance of technology training for employees in order to encourage use of information systems, particularly among older employees and leaders in the construction firm. This information could be transferred to other industries, which could also benefit from technology training for employees to increase the consistency of use of information systems within any organization. Knowledge gained from this study could also be incorporated into training techniques for leaders in the construction industry as to how to better connect with clients to ensure successful business transactions.

In terms of social change, this research presented the opportunity to change the way in which the average individual interacts with the construction industry. Although most people, at some point in their lives, interact with members of the construction industry, the perceptions of distrust of the construction industry are present prior to the

interactions. This research can help to provide the construction industry increased information that is needed to change its own public image, as well as to improve the interactions between clients and firms. The end result for social change can be a shift in the way that the public views the construction industry and even affect the amount of needless litigation and bad public relations due to lack of complete information or full communication as to what was needed or expected on a particular project.

Improvements to the construction industry can have very modest but nonetheless tangible economic benefit to the U.S. economy as a whole, especially when considering how the findings of this study could be extended to industries beyond the construction industry. Indeed, the results of this study could provide a better understanding of how communication technology and information systems can improve the efficiency of businesses across a range of sectors. Therefore, the implementation of information systems may be necessary in order to sustain the economic development of American industry in general.

Recommendations for Future Research

It is hoped that this study will inspire future research regarding construction firm and client relationships, and the use of technology to improve this relationship by increasing trust through information systems. Because this study focused on a small sample of large construction firms involved in large industry projects, future research should be conducted to determine the efficacy of other sectors of the construction industry and other types of projects. Future research should also compare the results of such research between various types and sizes. Future research should also consider the

construction industry on a nationwide or even global scale; however, such an endeavor was outside the scope of the current study.

Because this study used a convenience sampling method, future research should utilize other methods as well to try and achieve a large-scale and representative sample so that the findings might be generalized and applicable to other organizations. Because this research may have been limited by the notion of the quality of the information provided by information systems, future research should seek to determine the influence of this variable. Future research could use an instrument to measure the quality of information to determine whether the quality of information or the actual lack of communication, or a combination thereof, is the actual factor causing mistrust in the industry. Future research should also examine the quality of information with regard to the implementation of new information technologies, and determine whether new technologies assist in not only the transfer of information (communication), but the transfer of quality information (quality or effective communication).

Another potential area for future research is in the realm of technology and information systems training within the organization. The study suggests the importance of training in the use of information systems across the organization, particularly among older members and employees. A study looking at the effectiveness of employee training in the use of information systems and the potential benefits of information systems use in the organization would be useful in assessing these benefits and how best to employ system-wide and continuous usage of information systems.

Further research could be used to quantify the usage of information systems and the resultant affect that usage has on client relations directly, as well as the types of technology used for the communications between client and firm. This information would provide insight into the actual mechanism of action in terms of information systems and client relations. This type of study would not only demonstrate a clear relationship between use of information systems and client relations, but may shed light on the most effective use of information systems and modern technology to enhance client relations.

The findings of the present study can develop many ideas into further research, which could benefit both the construction industry, use of information systems technology, and the economy as a whole. More research clearly needs to be done in this regard to demonstrate relevant findings that can be used to create more effective and efficient organizations.

Closing Statement and Reflection

The ability to address the issues of those directly involved in construction projects due to a more comprehensive understanding of these issues would produce more favorable outcomes for both stakeholders and firms. This study provided information that may be new for many construction firms in terms of these issues. Leaders in the construction industry should realize that the future of this industry lies on operating in a world where information sharing and the use of information systems to bring clients and firms together. Changes may be required if the construction industry wants to continue to work with large clients who consider information sharing and communication required elements in doing business.

This research demonstrated further significance because the results could lead to an improved relationship between the client and the vendor. Communication and trust should permeate all levels within construction projects. If a client needs information from the project manager or the supervisor regarding a specific area of a construction site, that individual has the opportunity to assist in the process of building trust, which should lead to improved project success., the findings of this research could also be used to train those working for construction management firms how to better connect with their clients and build a relationship of trust.

This study provided evidence that trust building, the understanding of success factors, and the use of information systems are important constructs for trainers of construction industry personnel. This is important because construction industry personnel respond better to research-based evidence that is grounded in practical application rather than to unsupported theoretical notions. Likewise, clients want to see that their projects are completed on time and within the cost and specification constraints. Client satisfaction, as well as profit expectation, should be the objective of the construction firm. Even with an unexpected cost or time overrun, if the need is communicated properly and the level of trust is high, client satisfaction may still grow. Thus, an application of the tenets presented in this research can lead to the overall improvement of both individual construction firms as well as the industry through a more functional means of communication leading to a healthier relationship between firms and clientele.

Concluding Remarks

This study sought to understand how a small sample of large construction firms uses information systems as a way to improve client satisfaction. The study used qualitative measures to assess both construction firm perceptions and client perceptions of the use of information systems and the resultant communication and improvement or non-improvement of client relations. The study makes several suggestions resulting from the findings, which could be used to improve efficacy and efficiency within the construction firm and possibly communication and positive relations with the clients.

One such suggestion was that the availability and the exchange of real-time information through implementation of modern information systems indicated a possible path for resolving the perception of mistrust between the client and the firm. In addition, an enhanced communication system, increasing the level of trust between client and firm may lead to improvement in both business efficiency and client satisfaction, which would in turn improve not only the image of the industry, but also relations between the client and construction management firm. Another suggestion is an acknowledgement of trust issues among the firm as well as between the firm and clientele. Particularly between the contractors and subcontractors, there appeared to be tension that resulted in a breakdown in communication, and thus a negative influence on productivity. Furthermore, communication needs to be concentrated on changes in timelines and costs, in that this was indicated to be the most important information to a client, as well as the information that was reported to be the most inaccurate.

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APPENDIX A

Questionnaire with Consent Form for Construction Management Firms

Interface – Zoomerang Surveys

Questions marked with an asterisk (*) are mandatory.

CONSENT FORM

Dear Participant

You are invited to take part in a research study of communication, trust, and satisfaction in the construction industry. You were chosen for the study because you are currently involved in a construction project that fits the criteria of the study. Please read this form and ask any questions you have before agreeing to be part of the study.

This study is being conducted by a researcher named Michael Jones, who is a doctoral student at Walden University. Michael has is interested in seeing an improvement in the communication, trust, and customer satisfaction in the construction industry.

Background Information:

The purpose of this study is to investigate the level of trust between clients of the construction industry and the construction industry itself. Further, Michael wants to assess whether increased communication could reduce mistrust and whether the increased use of advanced communication technologies would assist in the increase in communication.

Procedures:

If you agree to be in this study, you will be asked to:

- Give your consent for participation through this form.

Voluntary Nature of the Study:

Your participation in this study is voluntary. This means that researcher, Michael Jones, will respect your decision of whether or not you want to be in the study. If you feel

stressed during the study you may stop at any time. You may skip any questions that you feel are too personal.

Risks and Benefits of Being in the Study:

There are virtually no risks regarding your participation.. By participating in the study, you may help improve the understanding of the levels of trust in the construction industry, the communication conducted in the industry, how to increase both of those through the use of advanced communication technologies, and the eventual improvement of future customer satisfaction with industry clients.

1

* Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and Questions:

The researcher's name is Michael Jones. The researcher's faculty advisor is Dr. Tony Lolas. You have any questions you may contact the researcher via 229-798-3363 or mwjbuck@alltel.net or the advisor Dr. Tony Lolas at 803-898-3511 or anthony.lolas@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Director of the Research Center at Walden University. Her phone number is 1-800-925-3368, extension 1210.

Statement of Consent:

I have read the above information. I have received answers to any questions I have at this time. I am 18 years of age or older, and I consent to participate in the study.

If you respond "yes," please respond to the questions below and then click "submit" at the bottom.

If you respond "no," please skip the questions and then click "submit" at the bottom.

YES

NO

2

As a participant in this questionnaire, how would you best describe your role in the construction management process? For example, please share your job title and job function as it relates to the construction management process.



3

What would you say is the current level of trust or mistrust between clients and construction firms? Please also describe the nature for your feelings in terms of the level of trust or mistrust between clients and construction firms.



4

How would you describe the communication between construction firms and clients? For example, what technologies do you use to communicate (i.e. computer system or email, collaboration software, open access to project documents etc.) and how often does that (those) communication (s) take place?



5

What are your thoughts regarding the possible increase in the level of trust through increased communication? For example, do you believe that trust can be increased through improvements in information sharing technologies or the increased communication between construction firms and clients? If so, to what degree and why?



6

What changes have you seen in the use of IT to improve communication between construction firms and clients? Have you or your firm upgraded communication technologies in the recent past?



7

To what degree has the use of IT from your perspective changed in the construction industry overall?



8

How receptive are personnel in your firm to using IT?



9

How receptive are clients toward using IT to increase communication?



10

Where do you see the future of the use of IT in the construction

industry?



11

What can the construction industry do better to build relationships with clients to improve sharing information and use of information systems to manage a construction project?



APPENDIX B

Participant Responses: Construction Management Firms

(Construction Management Firms)

Question 1: Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and Questions:

The researcher's name is Michael Jones. The researcher's faculty advisor is Dr. Tony Lolas. You have any questions you may contact the researcher via 229-798-3363 or mwj buck@alltel.net or the advisor Dr. Tony Lolas at 803-898-3511 or anthony.lolas@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Director of the Research Center at Walden University. Her phone number is 1-800-925-3368, extension 1210.

Statement of Consent:

I have read the above information. I have received answers to any questions I have at this time. I am 18 years of age or older, and I consent to participate in the study.

If you respond "yes," please respond to the questions below and then click "submit" at the bottom.

If you respond "no," please skip the questions and then click "submit" at the bottom.

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Project Engineer - coordinate the project especially role between the office and our superintendent and the field (subcontractors, vendors, suppliers, etc.).
Estimator of metal building projects, order materials, coordinate administrative processes.
Administrator for an electrical contractor
PROJECT MANAGER/ ESTIMATOR IN COMMERCIAL ROOFING, I MANAGE MY PROJECTS FROM THE BIDDING PHASE THRU CONTRACTS AND SUBMITTALS, PURCHASING AND JOB SET-UP, PARTIALLY INVOLVED IN THE FIELD SUPERVISION
Senior Project Coordinator - responsible for running the office. Keep documents where they are readily accessible (plans, submittals, RFIs, etc), produce and process subcontractor contracts, review subcontractor pay requests, put together Owner pay request package, meeting minutes, utilities, invoices, correspondence with subs, agencies, owner, main office, keep flow of information moving.
I am a Preconstruction Manager and I prepare estimates - both conceptual and detailed during the preconstruction phase of a Construction Management job.
Director of Construction Operations - Within Infrastructure, win, staff and oversee the successful completion of Construction Management projects.
For 13 years I was Controller of a multi-million dollar General Contractor - building working in the chemical industry.
General Superintendent: I perform all field management duties to include the tracking of schedule, cost and safety. I am responsible for all craft (145 at the present) and to insure that a quality job is delivered to the client.
Subcontractor Manager: I work directly with client doing contract management. I bid work, award contract and oversee the project work. All contractor on site answer to me.
At the present I am the Project Manager of a major construction/maintenance group. I must maintain a client /contractor relationship at all times. This process is accomplished through safety, cost, scheduling and communication with the client.
Maintenance Manager: My duties require me to supply maintenance personnel to a major chemical plant. I track work orders, making sure the work is completed on time and cost is in budget. I work close with the client to control the monthly maintenance budget. I deal with any emergencies that might occur.
Senior Planner/Estimator. Working for a major construction firm doing construction and maintenance in a chemical facility. I am responsible for the estimating of all projects and scheduling personnel and equipment to complete the project. I track cost against the work completed and report progress to the client.

<p>I am the Area Superintendent for a major construction group. I am responsible for the construction completion of an area of the project. It is left to me to make sure all work is completed on time, within specifications and under budget. I ensure there are enough resources to complete the project. I interact with other area superintendent to coordinate work as needed and report to Project Manager. I complete daily report to client.</p>
<p>Subcontract Manager: Responsible for all Subcontractors working on Project. This includes the bid process and selection of the contractor. Progressing the project and accounting for the cost of the subcontracts as well as the responsible for subcontractors safety program.</p>
<p>Site Manager of major construction group. My duties require me to be responsible for Project Budgets, Schedules and Estimates, Project Reporting to Client, Safety, Training and the ability to complete the project.</p>
<p>Senior Planner/Scheduler. Track cost and progress of projects. Schedule resources as required to complete task. Report project status to client.</p>
<p>Project Manager that is in charge of all functions at the project level. This includes the resources, cost, material and schedule of the project</p>
<p>HSE Manager: My role includes the overseeing of the employee, construction company and client's health, safety and environmental conditions. I deal with state and federal agency as well as local doctors and safety groups. I perform risk management as well as safety training for all employees.</p>
<p>My role is that of Site Manager for a small construction company. I manage the day to day functions of the project. I answer to the client on site and the construction project manager in home office.</p>
<p>I am the Project Manager with the function of total management of chemical project. It is my responsibility to manage cost, schedule, estimates, subcontracts, and approximately 150 craft people.</p>
<p>Question 3: What would you say is the current level of trust or mistrust between clients and construction firms? Please also describe the nature for your feelings in terms of the level of trust or mistrust between clients and construction firms.</p>
<p>At this site the contractor shows more trust than the client. There seems to always be that little bit of information the client will not share with the contractor. This in turn, makes the contractor less likely to give the client the total picture. I know this sounds as if the problem is equally shared by both parties, however in the beginning of the project the contractor shared all information. The mistrust over a two year period has created the current condition.</p>
<p>Given that a significant amount of our work is performed for repeat customers I would say there is a level of trust.</p>

I think the level of trust is pretty good in our area. Our company has a good reputation with our clients and other contractors in the area.
Most client feel that construction firms take short cuts in order to improve their profit margins and therefore hide things.
As a GC, our goal is to keep the client involved with the project and in the loop (so to speak). By doing this, we have a high trust level with our clients.
High trust level, but could be higher. Our customers trust that all buildings will be built to code with proper documentation, inspections, and filings as appropriate. However, customers are still inclined to price check and question pricing information.
In this economy and time, I don't think there is much trust between any construction trades. General contractors/construction managers are too busy looking out for their bottom line and dump extra costs on the other trades. Architects and engineers insist that we follow the "idea" of their specs/drawings rather than the document itself. We aren't mind-readers. Lots of mistrust and anxiety.
PARTICULARILY IN THE ROOFING INDUSTRY THERE IS A GREAT DEAL OF MISTRUST WITH CLIENT UNFAMILIAR WITH A CERTAIN FIRM, WITH THOSE WHO ARE FAMILIAR WITH A QUALIFIED FIRM HOWEVER THERE IS A GOOD DEAL OF TRUST
I think too many clients feel that they can take advantage of the construction firms. With the industry slowing down, the demands from Owners are becoming ridiculous. My project is for a City. The City is fine but their Management firm attempts to justify his existence by placing undue and sometime impossible demands upon our company. The Program Manager has been reprimanded several times by the City and the Architect for his ridiculous requests.
Our clients for our institutional and public work trust us so much that they ask us to do check estimates on their other CM's to be sure the others are giving them the best value
General mistrust that the construction firms are only doing the minimum in quality required and that they may or may not stick with the project to the end.
In as much as all contracts had to be bid on, and the opening of bids carefully scrutinized, there was no real level of mistrust. All bidders had to submit bonds and lists of prior work.
This project is above the average in trust between the contractor and client. Information flow between client and contractor has improved over the past two years, at the present the sharing process is working well.

The trust level is probably normal. By normal, I mean information flows as needed. My trust with the client is good. The biggest issue is the trust between me and the subcontractor. Most of the work is bid as lump sum and there fore the subcontractor feels the total price they bid on the project is all they are required to furnish. There is a struggle to get cost information broken down to more detail reports.

The trust level seems to be good. We are all talking and that is good. All issues are handled at local levels or are passed up the chain for a resolution. Someone take responsible for all issues. When someone fails to follow the set standards of communication, you can see the difference in the trust level. And this difference will start to in only one issue. Trust is something you must work ever day to keep.

I feel the level is very high. We work very closely with the client and have become a very organized team. The client has given the responsibility of Preventative Maintenance to the contractor.

The trust level we have with the client lets me get my work completed. There is room for improvement. I believe the client does not trust the information which they receive from the contractor. They seem to try and second guess and always questioning reports and schedules. In turn the contractor does not get all the information need for a complete estimate, there fore adding extra cost to cover additional work.

I would think we have average levels of trust. Some areas have more or less than others. The variance in areas is due the way the superintendent conducts themselves. Information or the lack of information is the major cause for the lack of trust by both groups.

The Client has shown trust with the contractor, but seen to have little trust in the Subcontractor. Most of the subcontracts are hard money, so there for the sub is only doing the minimum they can get away with. Specifications are not always met and this has created the most mistrust.

At the present I would have to say we have a good trust relationship with the client. There seems to be good information flow between the contractor and client. Both parties do not withhold information or knowledge from each other.

Trust could be better. The client wants to question the accuracy of the reports. The contractor does not always give the most up to date information on the reports. Cost plus projects release more up to date data than hard dollar projects. The contractor will not share all the data with the contractor on hard dollar projects, in fear it will be used against them in the future.

I think the trust level at this site is better than average. The greatest area of mistrust or unwillingness is to share information. This condition exists with both parties. The majority of the problem is the result of the bidding process. Most work is bid fixed dollars. The client wants cost reporting and the contractor is afraid the client will use the numbers to force cost issues on future projects, this thought process is the results of being questioned on bids as to why they are high. The contractor falls in lump sum bidding, once the client has the number that is all the client needs.

I feel the trust is very good at the present time. The doctors cases are down, all environmental issues are being met and information flow is good.

Trust is about average. We get the job done and they seem to be somewhat happy. I tell the client just what they ask and they give me enough information to do my job.

The trust level with the client is very good. There is a open minded approach to our relationship. The contractor is treated as part of the plant and not an outsider. We share in the good and the bad.

Question 4: How would you describe the communication between construction firms and clients? For example, what technologies do you use to communicate (i.e. computer system or email, collaboration software, open access to project documents etc.) and how often does that (those) communication (s) take place?

The communication between the two parties is good. The contractor is on the in-house network of the client and uses the client Email System. The client supplies all software. The contractor is granted access to Project Files on a need to know, with client usually transferring file to an area the contractor has access to.

Much of communication is electronic with a progression towards even more electronic communication. Most is thru email or phone calls followed up with email. Getting communication and directives "in writing" is still important even with a level of trust.

Most often communication is either by phone or email. This takes place daily on jobs that are more involved, otherwise it is about weekly on other jobs.

In todays world, the client and contractor are linked together electronically and there is full informtion available 24/7

We have an open book policy with our clients. We make sure that a Superintendent and Proj Mgr keeps in touch in person, via phone, email or hard copy (depends on client) with status of project at all times. We hold weekly meetings where a job status is given along with any pending, needed or completed info. The client, architect and any necessary personnel are involved in each meeting.

We use fax, email, telephone, face-to-face meetings. These take place in at least one form about 3 times per week - sometimes more sometimes less depending on the size of the project and the customer.

Communication is daily, hourly, sometimes non-stop. We use email, faxes, phones, meetings, job visits, etc. Many times it just muddies the waters more because meetings aren't attended by the same people so there is no consistency.

SOME EMAIL AND ONLINE SHARING OF DRAWINGS ETC. MOSTLY PHONE, FACE TO FACE, AND WRITTEN COMMUNICATION

E-mail has become a big part of communication. Our company is not big on open access to documents. We have documents that they are allowed to review if necessary but some are just none of their business. The only problem with e-mail is that everyone must remember that it has to be saved somewhere in case it is ever needed again and needs to be saved where it is accessible by whatever department within the company needs it.

Our communication is 100% open. We share our complete estimate with our clients in the CM process. I know that this is not true in most cases.

All types listed in the question plus face to face meetings

There were Lead Superintendents on the job, and they communicated with our main office, and had any problems ironed out with the Project Managers and the field Superintendents. At the main office we had each and every job computerized, be it purchases or subcontract payments. Clients would have a representative on the job, be it their Architects or Engineers who had input in drawing up the plans.

My communication is directed through the Project Manager to the client. However, I communicate with client engineering at the field level. This process includes emails and file sharing. Meetings are conducted on a daily basis.

There is a lot of verbal information between both parties. The client never gives all the information for the contractor to do their jobs. And in turn the contractor never tells the client all the detail information in the project. Email is the normal means of communication. The biggest issue is the software doesn't always work together.

Our company and the client have established a communication network that works very well. Email was the most help. As I stated earlier we try to solve problems at the lowest level (when they happen). Email gave us the tool to address these problems and also keep upper management aware of what is going on. The client and contractor has worked together to develop systems and software that works for both parties. Meetings take place on a daily basis.

We have very good communication between the client and the contractor. The contractor uses the client's computer system, software, email and web. All work orders are generated in Maximo. The contractor has the ability to access or enter data into this software. Files are shared. Email is used to communicate between the two parties. Meetings and data transfer takes place daily.

The communication could be better. There is a lot of paper passed between the client and the contractor. I email some files with schedules but they are not interactive. Daily meetings are the norm.

The flow of information is OK. Most information is verbal and sometimes people forget what was said or all that was said. I do email a daily report to the client as well as the contractor project manager. All drawings and reports are on paper. Meetings and reports are daily.

The communication between the client and contractor are on the same page. Contractor is on client email and computer systems, and uses the same software. The problem is the subcontractor is not. The client did not request the software requirement in the bid process. There is a constant issue between the client and the subcontractor. This process makes the contractor generate data in the software the client is using but increased the cost of the contractor.

The contractor works on the client's computer system (email and instant messaging). Both parties have reached an agreement on the type of software that is being used. There are daily meetings where both parties bring issues to the table for resolution. At the end of each Project, there is a review of what we (contractor and client) did that was right or wrong. The contractor sets on all client standing committees.

The communication is good, the data is not always correct. This condition occurs on both sides. Email, computer systems and software are shared with both parties. Some information is placed in files that only the creator (client or contractor) can use or review. Published reports occur daily/weekly.

Email is the most common system used by both parties. Most documents are paper copies. Each party uses their own stand alone computer system. There are daily progress update meetings and weekly progress reports. Schedules are tracked on wall boards and are updated daily.

The communication is very good between the client and the contractor. Information is shared by both parties on a daily basis. At the present, we share the same computer network, work with the same software, and share the same training programs. Contractors set on all client safety and environmental committees. All information is shared in same time by either using email or sharing of files.

Communication works, I give most of my information in a hard copy and receive the same from the client. Most of the data is generated in the home office. I have one computer and communicate with the home office by email. There is no electronic communication between myself and the client.

Like I said we are treated as part of the client and therefore have the use of email, work on same computer system, use the same software and share files. We are involved with all standing committees and share in training.

Question 5: What are your thoughts regarding the possible increase in the level of trust through increased communication? For example, do you believe that trust can be increased through improvements in information sharing technologies or the increased communication between construction firms and clients? If so, to what degree and why?

believe that information sharing as well as increased communications between both parties are required to produce a higher level of trust. By providing the latest means of information sharing technology to both parties there will not be the slow down time or aggravation of no communication. Thus eliminating the thought "If they had wanted me to have this information, they would have sent it in a format I could have opened". This alone will increase the trust between both parties. The ideal of increasing communications between both parties should be based on each party sharing an equal level of importance, meaning that no one party is or feels above the other. This issue will be harder for the client to accept, but for the perfect communication world this must happen.

if there is lack of trust due to failure to communicate then, yes, more or better communication could increase a level of trust. "Talk" is not necessarily communication so purely improving the methods or increasing the volume of talk may do more to damage trust than build it up.

I think it is better to be honest and upfront with a client if there are problems with a job. I think that would greatly increase the level of trust if everyone would do the same.

Communication is the key to improvements in relationships, trust, integrity, etc. The more the better.

We have found if the communication is there and open the trust is there and the project runs smoothly.

Yes, I think to a high degree communication builds trust because the customer feels part of the building process and is kept up to date with problems, solutions, development, and schedules.

Personally, I think that people need to work on trust, morality, and ethics issues rather than communication. There is too much nit-picking - particularly in paperwork.

I BELIEVE A GREAT AMOUNT OF TRUST CAN BE GAINED THROUGH MORE COMMUNICATION. THE MORE A CLIENT CAN TALK TO A QUALIFIED CONTRACTOR THEY WILL LEARN THAT THAT FIRM IS KNOWLEDGABLE AND CAN BE TRUSTED, AND ALSO CAN USE THIS SAME LOGIC TO WEED OUT UNQUALIFIED CONTRACTORS IN MANY CASES.

No. We communicate with our client very openly. The trust issue is with their Program Manager. We communicate with him also but as stated before he attempts to justify his existence with ridiculous requests.

I believe that because we are 100% open with our clients that they trust us. Open Communication and trust go hand in hand. I think that increased information sharing helps with this but you must have direct contact along with the increased information sharing.

One cannot over-communicate. The key communication is face to face and building a personal relationship based on trust and respect. The various methods of electronic communications should be based on data exchange. Anything that requires insight or judgment should be face to face.

This was always the case where I worked. We were always available at our main office or in the field if there were any questions, or problems. Therefore this should always continue. Our Field Superintendent and crew were always checking every step of construction to assure that the subcontractor adhered to the plans. Any problems that arose were immediately, by phone, followed through with the main office Project Manager.

We have proved that the increase communication will increase trust. Over the past two years we have gone from a casual meeting in the field to daily meetings and written communications. The client and contractor feel the written communication has put a sense of ownership and control on the answering party. Parties are held accountable for their actions and this alone has improved the trust between two parties.

I do believe that trust can be built with the use of increased communication. I have seen this happen on past projects. In order to increase the communication flow, the upper level of management for the client and contractor must allow this flow. Once the flow is in process the two parties must agree on systems and software. At the present time we need to work on upper management and software to improve communication. Through the increase I feel we will develop trust.

I think the ability for the client and the contractor to work as a team is the key in developing trust. By sharing the responsibilities and assigning task to members of the team (client and contractor) we are able to bring the client and contractor closer and develop the trust that is needed. By making more people aware of issues, the increased communication will bring added trust.

I feel we have a good level of trust between the contractor and the client. What we have to do is maintain that level of communication to maintain the trust level. This is a every day effort. As new technologies are developed, we will make an effort to use them.

I know trust can be increased with increased communication, I have seen it work on other projects. Anytime a person can get quality information with only a few key strokes, has got to make you feel better. Good feelings will help to develop trust. We must show the client we want to help them not just appease them.

I believe increased communication or technology would increase trust level, at the least keep both groups honest. Any time a person (contractor or client) puts something in writing, they tent to be correct and try to follow it.

By improving information sharing technologies between the client and subcontractor this will improve trust. At the present the client feels the sub is trying to hide something in the transition of data between the contractor and sub. If the sub was working with the same software and it was only an electronic transfer between the contractor and sub, this feel of hiding something would go away.

At the present, I see no room for more sharing of information. The contractor and client shares all information that is requested by either party, with the exception of employee personal information and financial information.

I feel the trust issue needs to be resolved at a higher level. Information must be released to all parties, with no recourse to or by either party. This change can only start at the top.

I feel that the sharing of information will always increase the level of between tow parties. Still, the issue will have to be dissolved at the higher levels of management of both parties. There is a cost savings that can be realized in the use of electronic communication vs. a paper system. With cost savings there always seems to come trust.

We have proven that by sharing information in the HSE area, trust has improved. As always, there is still room to improve and these areas are being worked. The rest of the construction world must accept the facts of sharing information and being open with the client. The client must also have these same goals. Once this has happened there will be great rewards for both parties.

I do not see how technology will increase trust. I give the client as little as possible, so they can't use the information against me. The client does about the same with us.

I totally agree that trust can and will be developed through increased communication. Any time there is a barrier between two parties, there is always room for doubt and mistrust. At the present both parties share information that use to be considered privileged information to a single party.

Question 6: What changes have you seen in the use of IT to improve communication between construction firms and clients? Have you or your firm upgraded communication technologies in the recent past?

Allowing the contractor to operate on the clients network has been a major change. My client(of two years)had this in place when we took the contract. There has not been any changes since then.

We have not upgraded recently. Most changes have resulted in easier ways to transmit information ...not always communication.

I think the fact that we can get in touch with the customer by cell phone or email has increased the quickness in which we can take care of things. If there is just a home phone it takes longer because people are not always there.

Huge changes in IT. We currently have the best that money can buy.

Our company is always reviewing the latest tech. to find ways to improve the flow of business.

We have begun to rely more on email instead of just telephone conversations. It helps in creating a paper trail.

Due to "good-old-boy" networking, the construction industry has been one of the slowest to embrace technology. Fortunately, our boss is more-advanced so we have integrated and continually upgrade our technologies - whether phones or computers.

YOUNGER CLIENTS ARE MORE INTO USING EMAIL AND OTHER ONLINE APPLICATIONS TO COMMUNICATE AND LEARN ABOUT FIRMS AND THEIR PRODUCTS. UPGRADING WEBSITES AND BEING EMAIL COMPETENT IS AN IMPORTANT UPGRADE TO DO FOR COMPANIES WANTING TO WORK WELL WITH YOUNGER CLIENTS

Firms and clients need to learn that teamwork gets a project done. I really haven't seen any real progress in the last few years in teamwork. It really depends on the client and how much they understand about the process and how much they want to know.

We have added a web based project management system to help with the increased communication through information sharing. The web based portion is what allows us to share the information efficiently.

Certainly the form and format for the exchange of information has vastly improved in the last decade. We use multiple systems (e2000, Primavera, PROLOG, etc) and have updated our versions of them.

Email with return receipt showing they read an important message. IM for private communications (for security) to increase instant ideas/concerns/communication.

The biggest change was the development of contractor using the client computer system. This allowed the file sharing and transferring of data. The contractor also upgraded their software to match the clients for ease of communication.

The increased ability for client and contractor using systems, software and email has brought together the client and contractor. These changes have given the client the ability to better understand the progress of the project and better develop the next project. The contractor is now able to share data that will help communication to develop at a faster rate, thus cutting cost. The cost is the driving factor in the big equation. We update communications as needed.

We have seen the client allowing the contractor to operate within the clients systems. The sharing has allowed data and files to be shared as needed. The client is also furnishing software and allowing the contractor access to web. All these tools have allowed the client and contractor to maximize communication. Technology is being updated as it becomes available.

The flow of data between the client and contracts by the use of sharing systems and files is one of the largest changes. Software development has saved time and made information timelier. The upgrading of communication technology is done on an ongoing basis.

On previous projects, I have seen interactive software being used by both groups. System and file sharing is another way to improve communication. All of these can only work if both groups have a trust. We, the contractor have made upgrades in software, but this has no connections with the client.

On other projects I have seen the systems that improved communication flow. If the client allows the contractor to use on site client systems and the sharing of files, this will improve communications.

The improvement is an ongoing process between the client and contractor. The problem is the subcontractor and this involves money.

I have seen changes from better equipment to more advanced software. The training of contractor, as well as client in the proper use of software has been the most important change.

IT is updated or improved as needed by both parties. New software has allowed both parties to better communicate with each other.

Not on this project, but other project have matched software and computer systems to streamline the flow of information. We are working on better systems to track cost, produce schedules and improve the ability to communicate within our group.

The sharing of information is the single most improvement. The use of Internet and software has brought client and contractor closer together. Where two systems use to exist, now there is only one, used and managed by both parties. Our company has upgraded and continues to upgrade as change are available. But with more technology comes more training. Out company has trained people, both contractor and contractor, in an effort to get the most value out of new technology. This has worked very well.

The only changes I have seen is the home office want more information to complete reports. There have been no updates on the job site. I think the home office has.

I can remember when the contractor use to update schedules, which were hanging on wall boards with a hi-liter. These schedules were generated by the client. Now the contractor develops the schedule with the input from the client and schedules are passed by files for updates and approval between the client and the contractor. We go through a constant upgrading process and training.

Question 7: To what degree has the use of IT from your perspective changed in the construction industry overall?

When I started 35 years ago information traveled at a very slow pace, usually by mail or overnight packages. Now we can sit in a conference room and have a meeting with groups around the world. I was the one who did not want a computer and now I don't know I would make it through the day without one. The newer technology has made the construction industries much more comparative

Significantly. especially advances in the capability of cell phones.

Technology has made it easier to get plans, prices for services, and more places to get materials from for the contractors.

Improved transparency and productivity.

It helps the field staff stay in better, quicker communication with the office. Sometimes if the staff relies too heavily on email, you lose the personal contact.

I think it has been embraced because we now have quicker mediums to provide answers and communication and still give us the paper trail. Also, with PDAs and Cell phones, project managers are more accessible to customers and staff alike.

While the bigger firms are finally using computers/email/websites, many smaller companies are still lagging - due in large part to financial considerations. It's expensive to be computerized.

THERE HAVE BEEN MANY GREAT ADVANCEMENTS BECAUSE OF TECHNOLOGY. WITH THE INTERNET AND CELL PHONES INFORMATION CAN BE PASSED ALONG MUCH FASTER ALLOWING PROJECTS TO BE COMPLETED FASTER AND FACILITATING ISSUES/PROBLEMS ON SITE TO BE RELAYED TO THE APPROPRIATE PARTIES TO BE SOLVED FASTER.

It's easier and quicker to get responses to critical items like with cost, quality, scheduling, and safety

to the bad - it has decreased the personal relation building that is essential in the construction industry.

to the good - it helps us to document and share information more efficiently

It has increased dramatically in the "normal" types of communications and data bases. It has not taken the step of real time input, photographic exchange, real time data exchange.

It certainly has changed over the years, and all to the good. Technology has made great improvements in this field.

The construction industry has historically kept information to its self and only shared what was required by contract by the client. The field supervision would only answer back to the project management team and they in turn would share what information they felt necessary to satisfy the client. The client on the other hand only gave the contractor what information the deemed necessary to construct the project. Most of this information was paper data. With the use of email and file sharing, the client and contractor has been brought closet together as a team. This has produced better completed projects at less cost.

I think it has made the industry more comparative among them. More date is shared through emails, file and the web and this has raised the level of awareness in the industry. Bids are more comparative, schedules are in greater detail and cost in more controlled.

The greatest change is the ability to take a product to the client with the greatest value. IT has streamlined the effort required to develop and complete a project. This means the cost is reduced and the cost is the bottom line.

I feel that IT has raised the construction industry to a level closer to that of the client. No longer do we have to worry that our systems will not work with the clients. I think the client gives us a little more respect.

It has made the contractor more accountable. The contractor can deliver information to the client in a timelier manner. Overhead cost is reduced and over all cost is making future projects possible.

I think it has made construction groups more competitive.

The new technology has brought client and contractors closer together. This technology also comes with a price.

The ability to move date from the contractor to the client and back to the contractor has improved the relationship between the contractor and the client the most. This process has cut cost as well as improved the record keeping process of a project.

Cost saving is probable the most noticeable. With the changes in informational technology came more interaction with software programs. Data can now be moved with a few key strokes where it ones was retyped.

The saving of time, which equates to cost, is probable the most single rewarding change construction has made. Real time data transfer is probable the second.

It has made it a safer and a healthier place for people to work. By sharing information construction companies can get real time information and educate their people.

I have to get more information to send to the home office. I do get better schedules and estimates from the home office.

The construction industry has grown from IT and branched into other areas that would not have been possible in the past. No more are we just the nut and bolt turners, now we are involved in engineering , testing, design, quality management and many more fields.

Question 8: How receptive are personnel in your firm to using IT?

The use of technology is directly related the age of the group using it. The younger want more and most of the older use it because they have to.

Very receptive! We almost have to guard against using it too much! There are occasions where communication used to demand a more personal touch and we're using text's for example.

Very receptive

Extremely receptive and in fact constantly seek out the newest technologies.

They do pretty well with it, if given the proper training and know there is someone that they can ask questions to about it.

Very receptive. Communication is the key to our long standing relationships with our customers.

To us, it's a matter of everyday use - basically we require computers and email to perform our jobs effectively and efficiently.

PRETTY GOOD FOR THE MOST PART, THE YOUNGER MEMBERS PICK UP FASTER THAN THE OLDER

Very as long as training is provided as many want to learn how to use databases and software like Microsoft Project.

It has been slow but folks are beginning to see the benefits and are warming up to it

Exceptionally receptive, but must be convinced that it adds value. Many times it does not.

It was quite easy for the personnel to become accustomed to the changes, and learned to appreciate it and readily use it.

At the present, people are adjusting very well. When we first started, people wanted to resist the change. Training is the on big factor that got people to accept the new technology and start using it.

At the present, personnel are very receptive. However this came about through training. Training seems to be the key getting people to use the technology.

<p>We have been seen a change in the receptiveness of personnel using new technology. The two factors seem to be the age of the employee and the training the company supplies. The younger employee wants to have new technology and is not afraid to use it and the older needs to have training to see the advantage of the new technology. To date we have accomplished both.</p>
<p>Our personnel have been receptive. I think the key to this issue is age. The younger the personnel the quicker they will adapt.</p>
<p>The people use the new technology. Their first thought is do I really want this and later they are glade they did. I think training helps.</p>
<p>The group of people in management seems to adapt well, however the field managers don't usually get new technology.</p>
<p>As the age level of personnel has dropped the wiliness to use and update has grown uncontrollable.</p>
<p>The key factor in using new informational technology is the training of the people. Once employees have the training, they want to use the technology.</p>
<p>We have a young group people and they welcome IT changes.</p>
<p>Our group is mixed on changes. The younger personnel want more changes and the older are less receptive of change. However, once the older person understands the change they would not go back.</p>
<p>We have created an environment through training and education that makes people wants to get and use more technology.</p>
<p>We are doing the same thing we have always done.</p>
<p>I feel that the personnel working at this site have the desire to push their knowledge to the max. We (contractor and client) are always looking for a better way of doing things.</p>
<p>Question 9: How receptive are clients toward using IT to increase communication?</p>
<p>The client views IT as an easier way to communicate to the contractor. And therefore tent to use it.</p>
<p>Similar to the respnse in 8. We should guard against becoming too impersonal with electronics!</p>
<p>They are liking it more and more all the time.</p>
<p>Very receptive and often clients drive this.</p>
<p>Most clients prefer the tech. used because it gives them more avenues to get answers.</p>
<p>Very receptive - they like being able to communicate on their terms.</p>

Depends on how much their company relies on computers. Most places have at least a fax machine but there is a huge disparity in computer use among our clients.

OVERALL THEY HAVE BEEN QUITE RECEPTIVE TO USING NEWER TECHNOLOGY, SIMILAR HERE AS WITH EMPLOYEES, YOUNGER PEOPLE TEND TO ACCEPT AND USE IT THAN THE OLDER DO, OLDER CLIENTS TEND TO PREFER MORE FACE TO FACE AND 'SHOW ME' TYPE COMUNICATION

Some good, some not so good. For example, some clients like documentation and some like meetings.

They like the efficiency of it

Exceptionally receptive, but hesitant if the costs are significant.

Clients depend on their Architect and Engineers to write the specs of their own, and they too are on computers. Clients expect it as a given.

Once the client realized the contractor had and could use the ability to communicate by the use of email and file sharing, they became very receptive.

It seems to be much easier for the client to get employees to use new technology. I feel this is due in part to the client's constant use of new communication systems. Not only do they have to communicate with the contractor, but must use this in their daily production systems.

The client seems to be very willing to use new technology. I feel this is due to the constant changing of technology within the organization. Production, maintenance and engineering groups are connected by information systems and employees are expected to keep up with changes.

The client is always receptive. It seems to be the mind set of that industry. They are always changing and training to keep their competitive edge.

This seems to be a way of life with the client. It is just part of them doing business, this is one thing the contractor needs to achieve and become a mind set.

They seem to do well.

The client is a little less receptive. Most of this issue can be related to the age of client engineering and management personnel. They are set in their ways and resist change.

With the open policy of addressing problems, comes the use of technology. The client has been very receptive of new technology.
The client is more set in their way of doing business, so there is usually some resistance to change.
The client is very receptive when contractor is passing information to them, but the flow in the other direction is far less receptive. This is part of the problem.
They have been very receptive.
I don't know
The client is in the same boat as we are. There is the desire to be a World Class team.
Question 10: Where do you see the future of the use of IT in the construction industry?
A more aligned group. Information can be more free flowing from Corporate to field project to client to vendors. this will not only cut cost, but should improve the quality of work. More details will be included in scope packages and answers to issues can be resolved faster.
Growing ...by means we haven't invented yet!
Most of our clients are close, but if there were some that did not live near the jobsite, it could be sent over cameras or something like that to the owner.
Nothing but a continuing push to improve.
Better technology is coming but I think good communications with a client is key to success and trust.
I think as the range of IT increases, we will be able to serve our customers better and find ways to transmit information faster. This will also allow us to work in more secluded areas that are developing.
I see more computers at jobsites - not just in the corporate office. Jobsite employees will be required to interact with email, computers, faxes, etc. As skilled electricians, most of the older employees don't know computers and aren't interested. Most of the younger generation are computer-literate and will soon bypass their senior counterparts.
CONTINUING TO GO ONLINE, ONLINE PROJECT MEETINGS, MORE ACCESIBLITY OF ONLINE PLANS/DOCUMENTS, THINGS OF THAT NATURE (WHICH I BELEIVE ALREADY HAPPEN IN MORE URBAN AREAS THAN WHERE I WORK)
About the same. It's just not the same as having a real set of plans on the table
I believe it will be 100% prominent and without it companies will lose jobs to more savvy companies as more owners become accustom to having real time access to all of the job information

Real time exchange of data, real time input (hand held devices), real time photograph exchange with Clients and engineers.
To be frank, the firms I worked for went out of business, not because of lack of IT, but because of low bidders that did not have technology information because they cut back on specs and materials.
As the construction industry becomes more in tune with technology we will see major changes in the way we do schedules, estimates, cost and all general tasks associated with what is now a paper system. With the use of systems, email, web and software the construction industry should become more profitable and therefore grow.
I would like to think it will make the construction industry a more stable group. With all the IT systems, construction should better control their cost. And cost is what keeps us going. The sooner we are able to see a problem within the project the sooner we can fix it and time is money.
I see the linking of systems to better produce a complete package for the client. Also the information required by the construction discipline to complete their work in a timely and cost effective manner. One of the changes will be the changing of job duties in the management field. It will be possible for one person to do complete more task , which are now assigned to two or three managers.
I see more information being linked and time being cut when performing tasks. Reporting and sharing of information between the corporate office, field and client should be much easier.
I see a more efficient way of sharing information between the corporate office and construction field. There will be better ways of linking information between the client and contractor. I think it will bring the contractor up to a closer level with the client.
I would hope the IT is used in the field. This would make field management's job much easier.
More real time data.
The development to better software or software that talks to each other with less programming.
More interaction of systems and software.
I see the sharing of date and real time information as the future. Information will be available to the worker in the field and can be transferred to management in real time. Material will be reordered as supplies are used by our computer systems. All of these things will increase the profit line of construction companies.
Data sharing and transfer between clients and contractors will draw parties closer together. Standards and specifications will become part of all parties' way of doing business. This will stop the duplicated efforts that now exist in creating systems.
This would give the job site a better handle on what is happening.

I see more real time communication with clients and contractors. More problem solving and information sharing will be done by IT. This technology should cut cost of projects, if by just eliminating wasted time in communications between contractors and clients. This technology will only be good for the construction industries.

Question 11: What can the construction industry do better to build relationships with clients to improve sharing information and use of information systems to manage a construction project?

Training. Construction industries must develop training programs to improve the skills of all groups. This will allow the client to remove the doubt of construction to do a quality job and hopefully allow the release of more complete information by the client. Construction must be able to talk to the client on the client's level.

The will to communicate and to see it's value must come from the inside of a person out! The ability and desire to see the value in relationships is not something that can be mandated by the use of technological advances alone! People who truly care enough about business relationships and building them thru communication can do it with smoke signals! If we in construction fail to communicate and thereby create mistrust, it's not because we don't currently have enough tools or toys to do it with!

First, find out what is the best way to deal with each client. After that, use that way of communication as much as possible.

Behave more like a joint venture than a client contractor relationship.

Learn what the client wants out of the project, what options are in place to transmit the info. and how he would like the information communicated in the beginning.

Use products like PDAs, cell phones, and email. Take advantage of the communication tools, but don't forget about meeting people - personal relationships are the key to repeat business.

Wow. Good question. Consistency of the information being imparted is most important. The biggest problem now is redundancy - people asking for the same thing over & over because departments don't talk with each other or use the same computer programs. It's frustrating to have to perform the same tasks for the same people over and over and over again.

CREATE MORE STANDARDIZED SYSTEMS THAT WOULD BE ABLE TO WORK ACROSSE THE BOARD NATIONWIDE INSTEAD OF THE SEVERAL DIFFERENT ONLINE PROGRAMS CURRENTLY USED SO THAT YOU CAN GO TO ONE AREA/SITE AND ACCESS PROJECTS ACROSS MANY DIFFERENT AREAS INSTEAD OF GOING TO ONE SITE FOR SHARING INFORMATION ON ONE PROJECT THEN A DIFFERENT ONE FOR ANOTHER PROJECT AND SO ON. OFFERING MORE ONLINE CAPABILITIES FOR CLIENTS WOULD BE ANOTHER GOOD IMPROVEMENT, I HAVE SEEN A LOT MORE ONLINE SHARING BETWEEN A CONTRACTOR AND THEIR SUB'S BUT I'M UNAWARE OF HOW MUCH OF THIS GOES ON BETWEEN CONTRACTOR AND CLIENT.

It's the clients who need to learn to build better relationships. They need to be interested in learning and the construction firms more open to teaching

Keep the personal touch. Do not forget to visit IN PERSON their clients AND subcontractors to keep the personal relationships tight. This will help the clients know that the CM is real.

Develop a protocol which becomes standard to develop a project by project, Client by Client agreement on the appropriate data to exchange and what should not be exchanged

Once the Client has put out a set of plans, they should not then try to save money by giving their contracts away to the lowest and untried General Contractor. For that there is no need for technology, just having people in charge who do not cut down on materials and labor.

Information sharing must start at the top level of management and progress down through the ranks. Management must become aligned with the client and share information.

We must talk to each other. This must start at the higher levels of management. With out the buy in of management nothing can happen. There must be some spending of moneys to purchase new systems, but the payout should be quick.

We need to wake up and get with the program. At this site we are ahead of the curve, but in general I feel we have a lot of work to do.

We need to start talking to the client as if we were talking to ourselves. Don't try and hide information from the client and keep everything above board.

The contractor needs to get out of the mind set of what they do is only their business and the client would not understand it anyway. Both groups must start talking more and in a positive manner.

We need to develop a trust between the client and the contractor. Both groups need to start talking to each other.

The most important is training of construction personnel in the use of information systems. Most of the training is being done by the client, this comes at a cost. This is item that starts the project off on the wrong foot.

Be honest with the client and not afraid to release information.

Top management must be willing to release more information to the client, information that was once thought to be only in house information. One to the two parties must make the first move.

Someone must make the first move in allowing the other party to see information once not shared. The construction industry needs to reevaluate the information they are not passing to the client. This means top management must buy into and agree on certain items. This would be a major improvement in the construction world.

Both parties must show openness with information. Maybe construction should be the first to start.

We need to talk to the client more at the site level. Email that I could talk to client would be a good start.

Construction must eliminate the thought process that the client is the enemy and the least amount of information shared is the best. We have proved this is wrong. Until all construction groups accept this thought process there will be issues.

APPENDIX C

Questionnaire with Consent Form for Clients of Construction

Interface – Zoomerang Surveys

Questions marked with an asterisk (*) are mandatory.



CONSENT FORM

Dear Participant

You are invited to take part in a research study of communication, trust, and satisfaction in the construction industry. You were chosen for the study because you are currently involved in a construction project that fits the criteria of the study. Please read this form and ask any questions you have before agreeing to be part of the study.

This study is being conducted by a researcher named Michael Jones, who is a doctoral student at Walden University. Michael has is interested in seeing an improvement in the communication, trust, and customer satisfaction in the construction industry.

Background Information:

The purpose of this study is to investigate the level of trust between clients of the construction industry and the construction industry itself. Further, Michael wants to assess whether increased communication could reduce mistrust and whether the increased use of advanced communication technologies would assist in the increase in communication.



Procedures:

If you agree to be in this study, you will be asked to:

- Give your consent for participation through this form.

Voluntary Nature of the Study:

Your participation in this study is voluntary. This means that researcher, Michael Jones, will respect your decision of whether or not you want to be in the study. If you feel stressed during the study you may stop at any time. You may skip any questions that you

feel are too personal.

Risks and Benefits of Being in the Study:

There are virtually no risks regarding your participation.. By participating in the study, you may help improve the understanding of the levels of trust in the construction industry, the communication conducted in the industry, how to increase both of those through the use of advanced communication technologies, and the eventual improvement of future customer satisfaction with industry clients.

1

* Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and Questions:

The researcher's name is Michael Jones. The researcher's faculty advisor is Dr. Tony Lolas. You have any questions you may contact the researcher via 229-798-3363 or mwjbuck@alltel.net or the advisor Dr. Tony Lolas at 803-898-3511 or anthony.lolas@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Director of the Research Center at Walden University. Her phone number is 1-800-925-3368, extension 1210.

Statement of Consent:

I have read the above information. I have received answers to any questions I have at this time. I am 18 years of age or older, and I consent to participate in the study.

If you respond "yes," please respond to the questions below and then click "submit" at the bottom.

If you respond "no," please skip the questions and then click "submit" at the bottom.

YES

NO

2

As a client, how would you describe your experience working with the construction industry and what type of projects have you been involved in?



3

What methods have you seen take place by construction firms and others involved in construction projects to actually make the clients feel more involved in the entire construction process through information sharing and use of information systems? Further, how would you rate the level of trust you possess for the construction firms with which you have worked?



4

How has the construction firm that you have worked with used information systems or technology to communicate with you regarding your project? For instance, does the construction firm have email systems, collaboration software, or open access to project documents?



5

As a client, how would you like to see construction firms communicate with you about problems or even successes on projects through information systems or other methods where better trust can be achieved?



6

To what degree has the use of IT from your perspective changed in the

construction industry in the recent past? Do you believe that an increased use in IT could change the level of trust you feel for the construction firm? If so, how and to what degree?

7

How would you describe the willingness of construction firms to use IT to communicate with you? Have you encountered any resistance in this area? If so, to what degree has that resistance been experienced?

8

Have you experienced any change in the level of trust for the construction firm with whom you work or have worked? Is this change in any way related to IT usage? If so, how?

9

What can the construction industry do better to build relationships with clients to improve sharing information and use of information systems to manage a construction project?



APPENDIX D

Participant Responses : Construction Management Firms

(Construction Clients)

Question 1: Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and Questions:

The researcher's name is Michael Jones. The researcher's faculty advisor is Dr. Tony Lolas. You have any questions you may contact the researcher via 229-798-3363 or mwj buck@alltel.net or the advisor Dr. Tony Lolas at 803-898-3511 or anthony.lolas@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Director of the Research Center at Walden University. Her phone number is 1-800-925-3368, extension 1210.

Statement of Consent:

I have read the above information. I have received answers to any questions I have at this time. I am 18 years of age or older, and I consent to participate in the study.

I am a junior process engineer for a chemical plant and I assist with the following Construction Administration duties: Submittal and RFI review, site observations, site meetings, punch lists, record documents. In addition, I also assist with owner/contractor meetings during construction document preparation and construction administration, as determined by the Project Manager.

My experience with the construction industry has ranged from annoying to downright troubling. My company has worked with many construction firms on projects for adding on to our existing facilities and plants. We have faced delays, problems that have gone ignored, and outright lies have been told as a way to cover up problems.

We would describe our experience working with construction firms as poor at best. We are a chemical company, so we have worked with construction firms on the building of our plants, as well as storage facilities. We often find ourselves having to yell and scream to get the construction firms to tell us the truth about schedule delays and cost overruns.

What trust? Trust between construction firms and my company is non-existent and always has been. Working as a safety manager for my company, I have heard every lie and excuse that is possible. It seems that construction firms spend more time making up stories as they do actually completing projects.

My experience with the construction industry has been one of turmoil and argument. My company uses construction firms for the maintenance of our existing plants and my job as maintenance manager is to ensure that our needs for the condition of our facilities is met. I often find that construction companies simply ignore the information that we include in the documents about the work that we need completed. They always seem to cut corners to just forget to review the documents.

I have spent nearly 30 years working as a project manager for a major company and in that time, most of my experiences with the construction industry have been much less than perfect. A lot of time is spent arguing about details and then trying to get specific answers on deadlines and project details.

Working with the construction industry is always a guessing game of whether they are going to be helpful or obnoxious. For my part, it is usually the obnoxious part that I experience from the construction industry. This seems especially true when working with the industry as a subcontract manager. They seem to want to throw around attitude, but avoid being helpful.

I would describe my experience with the construction industry as being good. I am a plant manager, so maybe the contractors and others see me as an authority figure, but the work is completed and we don't have too many problems with long delays, so we are happy.

I currently work as a project manager for a manufacturing firm, but have worked in various jobs that have involved coordinating activities with construction firms. In general, the experience is usually one of a lot of yelling and threatening and bad attitudes on the part of people working for the construction firms.

I am an engineer with a company in the plastics industry. My experience with the construction industry has been less than perfect. I experience bad attitudes and outright lies from many firms and their employees, along with a lot of yelling to get anything done.

I have worked for the last 5 years as a plant manager for a chemical company. My experience has generally been negative with the construction industry because of problems related to a lack of information related to deadlines with projects.

I work for a regional chemical company as an Engineering Manager and have had decent experiences working with construction firms. The experiences are never perfect, but the companies that we work with get the jobs completed and generally meet our expectations.

Overall, the experience working with construction firms is very bad. They do not seem to be concerned with providing realistic answers to questions and always provide information that is completely blown out of proportion to what the truth is. I have worked on various types of projects from changes to facility layouts and design to repairs of damaged facilities due to fire and weather conditions.

I am the construction manager for a large company and oversee construction projects throughout the Southeast. I have experienced many incompetent and downright rude people working for construction firms. They do not seem to care about the clients that are paying them for work. They are quick to get very nasty when they don't like something you have to say. There is a general lack of customer service in the industry.

I have worked with construction firms on large projects dealing with safety improvements to existing facilities as a Safety Engineer. The companies that we work with are generally positive to do business with. They understand the problems and deadlines that we face and try to accommodate us.

When I took on the job of maintenance manager a few years ago for my company, I was warned that working with the construction industry was not good. Everyone was right. The construction industry has a bad reputation for a reason. They are not easy to work with.

I cannot speak for anyone else, but as a Safety Manager, the experience with the construction industry is terrible. They do not seem to understand that my job is to be worried about safety issues and to make sure that we don't face fines from OSHA. Instead, it is as though what is needed is not important, regardless of whether we could have an entire plant shutdown.

I would love for the experience to be better, but working with the construction industry is an exercise in stress. As a plant manager, I have had to get angry, scream, and even threaten lawsuits to just get simple answers out of contractors. Sometimes, even their managers and corporate bosses seem to generally have bad attitudes and show a lack of concern.

My title is Process Engineer for a major company. I have worked with many firms of all sizes and the experience is generally very unpleasant.

I am an engineer for a manufacturing firm and have had pretty good experiences working with the construction industry. There are always bad attitudes, but that exists in any industry. You have to look past it and get the job done.

I hate having to work with the construction industry. It is something that will ruin an entire day. As a project manager for my company, I am expected to work closely with construction companies, but it is not easy and the people in that industry all seem to be angry all of the time.

The construction industry is full of people with big egos, but very little substance. They want to tell you about their experience and knowledge, but do not actually want to work as colleagues with their clients. I have seen this firsthand working for chemical companies as an engineer.

My experience working with construction firms has been one of being threatened and being mistreated at the hands of contractors working for construction firms. As a project manager, I truly dislike visiting project sites because the people working for construction firms act like they can't even stand to talk to you, and we are paying them!

As a client of the construction industry, the process is terrible. You would think that working with electrical contractors because the skills required would be at least cordial, but it is filled with bad attitudes and generally people that do as little work as possible and make lots of excuses. I am an electrical engineer and supervisor for my company.

I have worked as an engineer in a role that requires coordinating efforts with construction firms for the past two years, and the experience is not a nice one. I experience excuses, bad attitudes, and generally not very nice people on a constant basis working in the construction industry.

Working with the construction industry has generally been positive. As a project manager for a large company, construction firms seem to want to do the work that we need and do it on time because they are concerned about their revenues and profits just like us.

Question 3: What methods have you seen take place by construction firms and others involved in construction projects to actually make the clients feel more involved in the entire construction process through information sharing and use of information systems? Further, how would you rate the level of trust you possess for the construction firms with which you have worked?

I see the use of samples, allowing us to choose our preferred style and use of computer animated drawings of possible designs that fit our budget a big asset.

When it comes to trust, I think that the trust level between contractors is lacking because site level managers tend to give me more general information versus specific information that I ask for.

In order to make the clients feel more involved in the entire construction process, I have seen construction firms share information by meeting with clients and discussing the projects, including the progress so far as well as what work will be done in the future. I would rate the level of trust as favorable.

I have seen the use of laptop computers and graphics programs, more, and more. It brings a visual appeal to the customer, and helps to bring about a better understanding those doing the work. I for the most part trust construction firms when communications is officially documented.

The firms that we have worked with have done little more than use email to share information. However, we don't have a great deal of trust for construction firms, so when we receive emails with updates on projects, we often feel the need to double check the information that we are receiving.

In the past few years, we have witnessed constructions firms trying to use various software, such as Primavera and even Microsoft Project, as well as to share information about project schedules and details. The firms that we have worked with also seem to enjoy using Excel for a lot of documents, probably because they assume that all companies have the software and it is relatively cheap. However, this has not really increased my level of trust in the firms. I still feel the need to double check the information that they are providing in the documents and make sure that it seems accurate and realistic.

The firms that I have worked with seem to rely pretty heavily on Primavera for sharing information. They also rely on basic software, like Word and email. Of course, this has not really changed the level of trust. I still receive emails with excuses about why the information in the project software is not accurate or not followed.

I have seen construction firms more willing to use construction and project software to share information and to make sure that everyone is aware of what is needed. Of course, when the information is not followed and the schedules are not taken seriously, this does not improve trust in the construction firms. In fact, it sends a message that the construction firms do not refer to the information that they have received.

I would rate the overall level of trust in the construction industry on a scale of 1 to 10 as a 2. The reason is that they do not seem to want to communicate with clients. Instead, they will send a fax or a phone call at their convenience, but not when information is needed by the clients.

I have not seen much in the way of trying to make clients involved in the process. Firms will use email and the Internet to provide information, but this has not changed their attitude as though you are trying to undermine them because you want information, and want it when you need it and not on their schedule.

I would have to rate the trust for the industry as being somewhat in the middle. The firms seem to embrace technology, but the problem is that when they don't provide accurate information, the technology becomes much less important. We can communicate constantly, but the communication needs to be meaningful and honest.

Not very much has happened with making clients feel more involved. From my experience, it is usually me that has had to make myself more involved with the firms and the work that they have been paid to do. We have firms that are very technology-oriented, but when the project managers for the firms do not update information, then the technology is worthless. Updating information in a timely fashion is how they could improve trust.

I have seen managers of construction firms make access to documents via the Internet available with the idea that the clients will be more involved in making decisions. However, it seems that the actual project managers and contractors do not follow through on this, so a lack of trust sets in immediately when documents are not available or emails and phone calls are not returned when information is needed that is not available.

I have seen construction firms stay in contact using email and project software. However, my trust in the industry is poor because I have seen lots of excuses and information that was even fabricated and then blamed on us when the problems are found in the documents that we have received.

The contractors generally stay in touch with their Blackberries and send out mass emails to everyone involved in a project. The trust often starts high but declines during a project because of people forgetting to provide information or simply doing something without telling us in advance.

The firms that we work with use a lot of email and also Primavera, but not very well. When you don't update information and put in incorrect information, clients do not feel involved in the process. My trust in the industry does not exist because I have seen too many problems to trust anyone in construction at all.

Construction firms seem willing to use very basic technology, such as email and sending PDF files. However, we don't feel more involved and actually don't trust the industry because information is often not forthcoming and is usually late and only arrives when a major problem has occurred.

The trust level seems to fluctuate from neutral to good. The firms communicate a great deal through email, but we often have to initiate the emails to receive anything about project conditions or information from job sites. This causes problems with trust when it happens.

The construction industry uses Primavera mostly, because it is the industry standard, along with basic word processing software and email to provide use with information. This usually does not make us feel more involved because we have to request information repeatedly before receiving it. Our trust level in the industry is low.

The construction companies use basic software, like Microsoft Project, for providing timelines and schedules for projects. Our trust is low because the information is often late and not easily available so we don't feel that we are treated as equal partners in our own projects.

They use most of the basic software for the industry and standard technology like email and fax, but they use it to provide mostly unimportant information so our trust level usually starts low on any project and gets worse before the project is completed.

We don't see any methods being used to make us feel more apart of the process. In fact, there are usually hurdles that are put up, such as excuses about computers not being available or even people not being able to do something as simple as taking a picture with a camera on a cell phone so that we can see what is going on. The trust level is obviously not very good.

The firms like to use the Internet and Microsoft software to send information because they know that everyone has it. The trust level is a problem because we want to trust the construction firms, but often have to deal with problems that is not dealt with by the firms.

Well, the companies that we work with say that they want open communication through email, but we often find our emails go unanswered, sometimes for days. Then, we just get excuses about why conference calls or meetings cannot occur. Trust has never existed between clients and the construction industry and that is certainly true now.

Construction firms use the Internet to keep us informed, but I would not really say involved in the process. Open communicatin is something that we have to beg for just to receive. The trust level is very bad because the firms do not give us a reason to trust them. They do give a lot of reasons for us not to trust them when they can't even answer an email.

The construction firms that we use generally rely on email because it is easy and everyone has it. They try to say that we are working together, but then we receive emails about problems that we should have received days or even weeks prior, so we find ourselves double checking everything that they do. The trust level is very bad.

Trust generally does not exist between us and the construction firms. They do not make us feel involved in any way. They don't seem to like using technology or even know how to use it, except to make lots of excuses when they want to avoid us completely.

Construction firms use technology to send information that is not important, but to avoid sending information that we need. Open communication only seems to really be about one-sided information. I would rate the level of trust to be less than zero.

Our construction firms generally like to communicate via conference call and email. They generally try to get us involved and make us feel like we are working together as a team. As for trust, it is not perfect because there always seems to be a contractor that "accidentally" forgets to tell us something we need to know when things are not going well.

Question 4: How has the construction firm that you have worked with used information systems or technology to communicate with you regarding your project? For instance, does the construction firm have email systems, collaboration software, or open access to project documents?

Yes, contractors that I have dealt with do use information systems to communicate various aspects of a project. For example, contractors share scheduling through applications like Microsoft Project and Primavera. For email communications, contractors are assigned email addresses to use for all contract communications.

I personally have not used email systems or collaboration software in my communications with construction firms. However, I have had open access to project documents, and most of the communication took place either face-to-face or in-person.

Most of our conversations were face to face, which I prefer, but computer diagrams were very useful for both of us. We also used email through Microsoft Outlook to coordinate and schedule meetings.

The firms that we have worked with have only really used email. Of course, we are often the people that initiate the email communications. The firms don't seem to even want to send files via email or fax, let alone trying to use real collaboration efforts so that we can actually know what is going on with the projects that we are paying for.

The firms that we have worked with have begun to use secured web sites as a way to upload documents and to allow us to download them. As stated, they seem to rely heavily on Project, Primavera, and excel. Also, the managers at the firms rely heavily on email, which makes us happy because we find that it is easier to get a response from them via email than through a telephone call.

The firms that I have worked with have used IT to provide project documents, timelines for completion, etc. All of them use email. However, we have still found that we have had to ask for documents before they are freely sent to us.

The firms that I work with like to use Microsoft Project to create timelines and to share information about the materials that will be needed for each step in the process and the expected schedule. They also use the basics, like email and text documents, to send information and share ideas. I would not say that open access is present because you still have to ask them for information on a timely basis.

The construction firms that we currently work with do use some collaboration software, but not in any meaningful way. They have email and use the Internet, but they do not try to coordinate their communications methods with ours. This makes it very frustrating to try and carry out any type of truly meaningful working relationship.

The firms that I have worked with have really only used Microsoft Project to create timelines and to print out charts for specific jobs. Of course, they use email and have their Blackberries on them, but this is normal for most people in today's world.

The firms we work use a variety of technology from the industry standards of Project and Primavera to special collaboration software and even their own online databases.

The firms that we currently work with use a lot of the major software in the industry, such as Primavera, Excel, and email and other applications.

The firms use collaboration software and email. Some of them also have open access to documents from secure web sites

The construction firms generally have their own databases where they upload documents for us to download and view. Of course, email is important in the construction industry because of being in different locations.

Email is really the technology that is relied on quite heavily. Some of the firms do have open collaboration through their own secure web sites, which is nice because we can upload documents to one place and log-in from anywhere and check the status of projects.

The construction industry likes to use Primavera, generally, because it is made for the industry and multi-staged projects. They also use email to send communications and project documents.

Well, the construction industry says that it likes to use the latest software, but often that is just a lot of talk. We have tried to get construction firms to use collaboration software, but we are often the only people collaborating. They just supply information after we have begged and yelled to receive it. The collaboration is truly one-sided.

Most of the communication is through email. They like to use email because the documents can be received and read on their Blackberries, and it is easier for us as well to achieve communications, especially when something goes wrong and we have to demand changes or corrections.

As I said, Primavera seems to be the choice for most construction firms. Microsoft Project is also another piece of software that is widely used. Many firms also use a lot of email to communicate, but the problem is receiving quality information, not just a bunch of excuses when they have made a mistake and not alerted us to the problems when they occurred.

The industry relies on scheduling software like Microsoft Project, but I have to reiterate that I would not say that they use it for collaboration. It is almost as though they are telling us what they are going to do and then we are left to try and correct mistakes and scheduling problems on our own.

Most of the firms use email and the Internet to send documents and information, but again, it is not how they send information, but the quality of the information that is sent. I am not as concerned about the technology that is used as long as the information is accurate.

The firms with which we work like to use email and just send documents as images of PDF files, which is not a problem. However, the communication is usually us requesting documents and then finally receiving them when the firms feel like it.

Generally, the firms that we work with use Microsoft Project, along with Word and Excel. We have no problem with this, but sometimes more advanced software, such as Primavera would be nice because of its functionality.

Mainly, the firms use email. They also use Primavera and Project in some situations. I would not call it as much about communication as it is about trying to appease us when they have refused to communicate for days and weeks at a time and then we finally get angry, so then they send information all at once.

Some of the firms that we have worked with have had their own online systems for uploading files, which has been nice in theory. The problem arises when the documents are outdated or simply incorrect. Then, that is when problems occur and we don't feel that we are being communicated with.

Email and the Internet seems to be the technology of choice. Once in a while, they want to use something a little more powerful in terms of options, such as MS Project.

Really, not very much in the way of technology. Email seems to be about all that they want to use, at least for the construction firms that we work with. We have tried to get them to use collaboration software, but it is often not used or used improperly.

The firms like to use a lot of email and they also use Project initially to schedule various aspects of projects and to let us know what the schedule is, but they don't update it and update the documents when delays occur, even when it truly is a necessary delay, they still don't want to collaborate with us.

Most of the firms that we work with like to use Primavera and email for communication and collaboration purposes. They generally send the documents as PDF files via email because it is easier.

Question 5: As a client, how would you like to see construction firms communicate with you about problems or even successes on projects through information systems or other methods where better trust can be achieved?

I always like to hear about any successes for any project but more importantly, contractors need to communicate existing or potential problems more proactively making effort to share any ideas to correct a potential problem before going forward. From my experience, I see contractors being more reactive versus being proactive and although some problems cannot be avoided, some could be prevented which could help us stay more in line with project budgets.

Because it is not always possible to meet in-person to discuss the project and view the progress, I think it would be better to communicate via e-mail, including pictures and/or video of the project progress as well as scheduling plans for the future.

I want to know about the problems up front, not after they have been discussed and worked on. I can get a better idea of what is going on and how they're using their time and how hard it was to find a solution.

We would just like the truth. If construction firms would provide the truth, it would not matter what types of software or tools they use. If the firms are not telling the truth about project delays, then it is not likely that the most expensive collaboration software is going to provide accurate information that we can use.

We would love to see real-time reporting of information via the Internet. The use of web sites to report information and provide details about project delays would provide a single place where all of the information would be contained and where it would not seem like we have to hunt for details that are buried in reports where information is being hidden.

I would love for construction firms to actually share information openly and for the information to be accurately. If they could use project software and email to send documents that are based on facts and not excuses, this would be all that I ask. The question is really not about the software that is used, but about the information and level of sharing that is taking place.

I would love to see firms share information in real-time using the Internet. I would be thrilled if firms would provide me with updated information on a daily basis. They would not even need to contact me, just let me visit a web site and see progress reports. That would be a dream come true.

I would love to see the construction industry communicate using software tools that would allow for real-time information to be exchanged. I would love to not receive information that is weeks old and outdated when it is received. This would do a lot to improve the trust that I have in the construction industry.

I would love to see construction firms using real collaboration and project software to provide clients with useful information. It is not that hard to share information with the technology that is available, the construction firms just seem unwilling to do it.

I think honesty is the key. The software or technology is not the problem, it is the lack of honest that is sometimes present. Just being honest and communicating honestly would improve trust a lot.

I would love nothing more than to receive an email or phone call about problems when they occur. I do not want to have to see a mistake or a delay several days later in a report that I should have received on the day that something took place.

We would love for construction firms to use technology to send us messages and documents instantly. With all of the different options that are available, or even something as simple as email, trust could be greatly improved if they would just communicate and get information to use on time.

I would love to see firms actually use their online databases the way that they were meant to be used with real-time information. Trust would likely be at a higher level if they would just let us know about things before they happen, rather than waiting and then making a lot of excuses about problems.

With everyone having a Blackberry or Iphone, I think an online database would be nice. This would allow everyone to upload information and documents to one place so that no matter if you are using your phone or a computer, the information is completely available. This would likely cut down on excuses and improve trust.

As a client, I want to see the construction industry use any means to communicate. Quite honestly, I would just like to receive a timely phone call about a problem, rather than waiting to see a problem in a report for which we never even received a phone call that a problem was found in the first place. That would be nice.

I just want to see the construction industry take a little ownership of problems. If they want to use technology, then they should use it to update reports, provide accurate information and stop making excuses about delays and problems. That would do a lot to improve trust and communication.

I want to see more timely communication. I think email is fine for communication, but it needs to be used on a regular basis. This would make me have a higher level of trust because I would know that someone is going to send me an email when a problem or delay takes place.

The construction industry needs to not necessary use different technology or software, they just need to use something and stick with it throughout a project. Rather than giving excuses why a document was not updated in the software or new files were not sent, just use something and be honest.

I would like to see the industry provide real-time updates to information. Other industries do this, so I know the construction industry could do it. This would make us feel more involved and informed about the process.

I think it would be very helpful if construction firms communicate in a timely manner about problems and delays. This would improve trust because we as clients would not feel that the industry is just trying to hide information and hope that we don't discover their mistakes and problems. The actual software or technology that is used would be less important if we could just get information at all. The real issue is factual information not being received.

I want the industry to starting communicating at all. They don't communicate now, so any technology that they want to use would be better than nothing. There is a lot of technology available, they just need to choose something and use it.

Online databases would be very nice. This would mean that everyone is on the same page and we would not have to lose trust in the construction companies because we begin receiving excuses about missed emails or documents that were not updated properly.

I have no problem with the firms using just email. I just want them to actually use email and send us information. It is not that difficult to type out an email on a computer or even on a Blackberry. Knowing that real communication was desired would do a lot to improve trust and make us feel like they care about the money that we are spending.

The issue is not the specific technology or the software, it is how it is used. The firms that we work with have access to the technology, but don't seem to require that everyone use it. This creates problems where information and details are missed. By requiring everyone to stay connected, issues of trust could be improved.

I would love to see firms using a single type of collaboration software that becomes the standard and then everyone would have it. Then, there could be no excuses about someone not having access to a problem or not being able to update information. This would remove a widely-used excuse and probably help with the trust issue.

The electrical contractors seem to like to use Project to make schedules, which is fine. I just want them to be honest when they schedule tasks and when delays occur. It is not that they are avoiding technology, they just use the technology to cover up problems and make excuses. The technology will not improve trust, a change in attitudes and ways of working is what is needed.

I would like to see firms communicate with us in a professional manner. I don't care if they just use email, but the emails should be professional and not full excuses and sarcastic language. We are paying them and I would love for them to recognize that.

I think online collaboration would be wonderful. Rather than having to make sure that my work laptop is with me, I could log-in from anywhere and check the status of information and documents. This would really help me and make me feel connected to the firms regardless of my location.

Question 6: To what degree has the use of IT from your perspective changed in the construction industry in the recent past? Do you believe that an increased use in IT could change the level of trust you feel for the construction firm? If so, how and to what degree?

I think that technology has allowed construction companies to communicate projects life cycles more visually using technology and applications like Autocad; however, I am also seeing that many construction personnel on the site level have limited experience with using these technologies. If more site level personnel had the ability to use applications like Autocad or even project management software, I think this could increase the trust at the site level without having to depend on construction personnel at the corporate level who are rarely on site.

The use of IT from my perspective has hardly changed in the construction industry in the recent past. I do believe that an increased use in IT could change the level of trust I feel for the construction firm. It will allow me to have a better understanding of the project and the exact progress updates.

Obviously the more communication media and technology used to document management processes of a construction project, the better off the project will be; however, I have seen and observed contractors cut corners to increase his bottom line not worrying about the advantages of technology available to help manage a project.

We have seen more firms trying to use software, such as Microsoft Project, as well as email. However, I don't see how an increased use in IT would be beneficial if the constructions firms are not providing accurate information. Instead, a greater use of IT is just a way to share inaccurate information faster.

The construction industry, like most industries, has understood that the use of technology can make tasks easier. I do think that an increased use in IT would increase levels of trust. Customers would not feel as though they are being cheated or having things hidden if they could just see all of the information in real-time. In fact, I think that the level of trust in the industry would probably increase by about 50%.

Firms are using technology to communicate more easily, especially when they are working on projects that are based remotely. Contractors can use their Blackberries to send email from almost anywhere. However, this has not really changed the level of trust. I am not sure if a greater use of technology would improve trust because firms have to be honest from the beginning. They cannot try to use technology to simply give excuses.

I think construction firms are using technology much more because clients are demanding it. In order for firms to remain competitive, they are having to use software and technology even when they might not want to. When they show a lack of true willingness to use technology, this only makes the issues of trust worse because you get the idea that they are trying to hid information, even if they are not.

Recently, I have seen construction firms trying to use technology to improve communication. It seems that the younger members of the industry are very much inclined to use technology for communication. However, it is the older members of the industry that still largely run things and are reluctant to use technology to share information.

The use of IT has begun to change somewhat in the past couple of years. I think as the economy has slowed down, more clients are demanding better records and better accounting of activities. This has meant that construction firms have had to respond or risk losing clients and being forgotten within the industry. However, I don't think that this has really improved the trust that exists with clients because firms are only doing this to try and keep clients.

I think the firms are using much more technology than in recent years. I just want to see them using technology to communicate more and to send more timely information. The lack of trust that exists is because clients don't feel connected and don't feel that they are receiving honest information. The better the information that is sent, the higher the level of trust that exists.

The construction industry, at least the major firms, are using technology just as everyone else is using software and computers for communications. I think a better use of technology would improve the level of trust in the industry. They need to use the technology for what it was meant to do, which is actually communicate with people. I would be more trusting if I knew that I would receive information on time.

Construction firms are using technology much more than in the past because it is easily available. I am not sure if using the technology to any greater degree would help trust because the key is to be honest. Unless everyone is honest when they send a document or notify us of a problem, then the trust is still not going to be helped.

Firms are using technology to a larger degree, but I think a systematic means of communication, such as a single online database would be very helpful. This would mean that a construction firm's managers would see who is sending information and the information that is sent. There could not be any lies about emails not being received or files being sent that were never received by because if it were not on the system, then it was not sent.

Firms seem slow to use lots of new technology in relation to previous years. They are doing it, but very slowly. I want firms to use more online tools so that software becomes less of an issue. This would help to improve trust because the software would become less important and the actual information would take center stage.

Construction companies are using technology more. They have moved from simple email to more advanced software. I am not sure if using more technology would change my level of trust in them because technology can be used to cover up problems more easily sometimes than if all documents and files were just on paper.

I think a greater use of standardized technology would improve trust. Rather than using basic software from Microsoft, use online databases and online collaboration. This would mean that people could access the websites from anywhere and see what is taking place. I know this would help my level of trust.

Companies are using more technology and seem to be embracing technology, so this is not the problem. The problem is that they are not using the technology in the best way possible. If firms used the technology in the way that it was meant to be used, then the level of trust would be better.

To be honest, I don't think that any type of technology is going to help trust. Yes, firms are using more technology than in the past, but the excuses and delays have not changed. It is not the technology that makes a difference, it is the attitudes of the people using the technology.

The construction industry is using more technology, but not necessarily the best software or technology. They need to use the same types of tools that banks and other industries use to provide real-time information and to update everyone at once. This would help my level of trust because I would know that everyone is working together.

The companies that I have with are using more technology than in the past, but not necessarily in a good way. They need to embrace using software that keeps everyone updated and informed, and using it accurate and effectively. If this were done, my trust in the industry might improve because I would be kept informed and not have to demand information.

Companies are using more technology than in the past, but only because the technology exists. They don't seem to embrace anything that really makes the clients more involved in the process of that might provide accurate information in real-time. If this were to become standard, then the level of trust that I feel for these companies would actually improve considerably.

Firms are using technology, but I would like for them to use the latest collaboration and project software that is available. This would show us that they are using everything available to stay connected with us as clients. This would definitely help the level of trust.

I really don't think that the industry has changed in the use of technology, it has just accepted technology that is widely used. They are not using high-tech means to communicate, which would do a lot for me to have more trust and to feel more involved with them and the work that is being done.

I think the larger companies are using technology much more than the smaller firms as compared with previous years. I think my level of trust would be improved if everyone used more technology to provide collaboration efforts and sharing of information. At least I would not feel that something is being hidden from me.

The industry has not done enough to use more technology that in year's past. I truly think that the use of a single type of industry software would be better and would improve how I feel about the industry and about the people that work for the construction industry.

The companies in the industry are not using technology any more than in previous years. They still rely mostly on email, which is certainly now an old technology. Using newer technologies would improve my trust because I would feel that they are using new tools and staying current on how their clients are working. I would not think that I am working with people and companies that are out of touch with current trends.

Construction firms have increased their use of technology, but not in a positive way. They still send out information that is not correct. I really don't know that using any more technology would improve my level of trust.

Construction firms are definitely using more technology than in the past. The problem is that they are not using the best technologies. They need to rely on more advanced software than just Microsoft Project. Having online databases would be helpful and improve trust because information would be easier to receive.

Question 7: How would you describe the willingness of construction firms to use IT to communicate with you? Have you encountered any resistance in this area? If so, to what degree has that resistance been experienced?

Even though I think that technology is moving forward and has improved management of construction projects, again, site level personnel even with the site manager need more experience and training with this technology because I do see some hesitation to use technology.

Since not all construction firms have used IT, there must be some resistance. However, I have not experienced any explicit resistance personally.

This does not apply to all construction site personnel but it is like trying to teach an old dog new tricks. For example, I have run into some problems just trying to get some site construction management personnel to use their cell phones and email in addition to other technology and applications like Microsoft Project needed to for weekly schedules. With this being said, there is still some resistance with the construction industry to apply use of technology in the construction management process.

We have begun to ask construction firms to use collaboration software with us. In fact, we have asked them to use whatever software they would like to use. We are often met with responses that they don't have employees that know how to use the software or that they can just send an email or make a phone call when they need to share information.

We have seen firms that are willing to share information, but only with the software or technology that they want to use, regardless of how we feel about it. That is why I stated that the firms that we have worked with have really only relied on a couple of pieces of software. Beyond that, they seem reluctant to invest any resources to use IT in any major way.

We have experienced resistance to use technology to share information. I have asked more than one firm to use a web-based database that we already have in place to share information about safety issues. However, I am constantly met with excuses about not being allowed to use someone's else systems or a lack of compatibility, even though the system is completely web-based.

I think the construction industry is willing to use technology, but only to the point of making the clients happy. They are resistant to invest any additional money to use the software that the clients want them to use. We have actually had to purchase software in the past because the firms would not work with us. Instead, we had to cater to their needs.

The younger project managers and contractors seem to enjoy using technology and are willing to do so. However, it is the more senior people that seem to be very much against it and outright refuse to do anything that they don't want to do in terms of using technology for communication.

Construction firms are not very willing to communicate openly and in a speedy timeframe. They always say that they do not have computers on the job sites or that they have a hard time getting a signal for their Blackberries. It is weird, though, because when I visit them, my Blackberry and my wireless Internet card work just fine.

The firms are not resistant to technology, they are just resistant to communication and open collaboration.

The constructions firms seem willing to use technology. I have not experienced any reluctance in this regard. It is not about using the technology, it is how they use the technology.

It is not necessarily the firms that are resistant to the use of technology, but the individual employees and contractors. When it comes to sharing information, any suggestion seems to be met with an excuse about not having the software or not being authorized to use particular online tools. The resistance, as with so much in the industry, comes in the form of excuses.

Firms only seem willing to use the technology that they want to use. In one case, we suggested that everyone involved in a project use a single piece of software and you would have thought that we had suggested something evil. We had more angry responses that we would have even guessed. So, to answer the question, the resistance seems to be to anything that the client wants and the companies do not.

We have been met with a lot of resistance. The firms use new technologies and new software, but only after we have to convince them of the time and hassle that will be avoided. This is frustrating because it is like trying to teach something to a five year old.

The resistance is not about using IT, it is about sharing information. When we talk about reports being updated daily, we get all types of excuses and comments about that not being possible.

Firms are willing to use the technology, they are just not willing to share important information. When we have suggested various software or technology, they always appear willing at first. The problem arises when we actually expect them to use the technology and the software for information, that is when the resistance comes into play.

For my experience, construction companies don't seem resistant to new technologies. I have not been met with resistance when I suggest software to be used. Of course, this is probably because of the type of firms that we work with. I have not heard the same easy experiences from other companies and the construction firms that they work with.

Construction companies seem to only want to use certain types of software and don't seem willing to expand or use new technology if it benefits the clients. We have tried in the past, quite unsuccessfully, to get construction firms to use more real-time technology and that has been met with a great deal of resistance.

We have experienced resistance to construction firms wanting to use the latest software or collaboration technology. They really just want to use basic software and not have to use anything that requires a lot of effort on their part. Anytime that a problem arises and we suggest better collaboration software, there is always a lot of excuses and bad attitudes toward the idea.

Companies are really just wanting to use scheduling software and email. They don't really like to use anything that gets us more involved. We have tried in the past and have been met with a lot of resistance so we have basically stopped even trying.

The companies that we work with are very much resistant to use a total project package that will catalogue documents and communications. They seem to want everything spread out between emails, pdf's and other files. We just assume that they are trying to avoid having a standard document trail so that we have a harder time finding their mistakes.

Construction firms are resistant to any technology that requires additional training on their part. If the technology is simple, like email, then they are happy to use it. Anything that requires training or even just time to learn is something that they don't want to do.

The firms are not willing to use IT for communication purposes. They always have excuses and do not want to improve at all. They would probably not even use email if they did not have to.

I don't think construction firms are resistant to using IT, they are just resistant to use it to share information with clients. When we want information, all of a sudden there is a problem or something is not working properly. However, when they want information from us, then the systems are working just fine.

The industry is only willing to use technology when it benefits them. When we want them to use particular software, the requests are often ignored or met with what the ever famous bad attitude that exists in the industry.

The industry really seems completely afraid of technology and resistant to the idea. Even trying to get them to use Project so that we can collaborate on a schedule with more than just something sent in an email is an act of patience on our part.

They are happy to use technology, they just don't want to communicate with us. The resistance comes in the form of reasons why information is not available or requested documents have not arrived. This is something that technology cannot fix.

The firms seem scared for some reason about moving to online collaboration. We have suggested it in the past to mixed reviews. After talking with some people in the industry, there seems to be an idea that clients that want real-time collaboration are trying to use it against them or catch them in a situation that could result in a law suit.

Question 8: Have you experienced any change in the level of trust for the construction firm with whom you work or have worked? Is this change in any way related to IT usage? If so, how?

At this point even with the use of IT site level personnel tend to provide me what I need but response times need to be more efficient as I have had to wait up to a week for an official response on various requests with cost and scheduling updates. The trust is okay but again, when I have to wait for an extended time for an official response, it makes me think that the construction firm is either not prepared or is trying to hide something.

No changes. The good communicators are the best. The ones who promise too much and don't deliver erode trust

At the present time, I still do not see any increase level of trust with my organization and any associated contractors on site because the contractors even with acceptable work still look for ways to take shortcuts and are always looking for ways to create change orders. Even though I cannot make a clear connection with IT, I would think that trust between our organization and associated contractors could be better if IT is used more by all contractor management personnel to communicate all aspects of the job as needed. I would personally love a contractor that could provide me information without me having to ask.

We have not experienced any change in the level of trust with construction firms, so it is difficult to say if IT has had any major role in changing trust within the entire industry.

We have seen very little change in the trust with the construction industry. The use of IT has helped, but as for me, when I see the firms willing to use IT, it seems as though they make it a major ordeal when it should not be that difficult. It seems that everything with these companies must be a major ordeal.

I have not seen in change in the level of trust with construction firms. I think clients feel more connected with them because of email and the Internet, but it has not really changed the level of trust that exists. It just makes the client more able to contact them and here the excuses that they are providing.

I would not say that trust has improved. I would just say that clients feel a little more connected to the construction firms. Technology has meant that we are more easily able to get in touch with firms because we know they have their laptops with them on job sites and they cannot avoid their email.

I have experienced some change with the industry, mainly because of younger contractors and project managers that are willing to actually share information and use technology to do so. This is beginning to improve the level of trust, but there is still a long way to go.

I have not experienced a great deal of change in the level of trust. It may be just me, but when I am told a lie even just once, I tend to not trust them for the rest of the project.

Trust is not any higher now than it has been. Technology has really had no impact on trust in any way.

The level of trust has changed somewhat because of technology. I can remember when all we had were faxed forms and phone calls. You at least feel a little more connected when project documents can be downloaded from the Internet.

I have not experienced any change in the level of trust. Trust has always been bad and continues to be bad between clients and firms. I don't think that is going to change because of new technology.

Not really. The trust has always been a negative reflection on the construction industry. In fact, being able to more easily share information may have made the trust worse because we as clients know they can share information, but just refuse to do so.

Trust has not improved significantly. It changes and fluctuates between projects, but has not improved greatly. Technology has helped to increase some trust, but then again, not significantly.

I think that the level of trust is worse now because we get more excuses more often. I sometimes get three emails a day with nothing more than excuses and lies. Trust has not improved at all.

I don't think the level of trust has changed any. The use of more technology has not meant that information is more widely shared or that the attitudes that are present have improved. In that regard, everything is the same.

I would say that trust has improved because construction companies have become somewhat more professional in their willingness to share information. Technology has definitely helped in this regard.

I think the overall level of trust may actually be lower now because firms say that they want to share more information, but then those promises are forgotten during a project, which leads to ideas that information is being withheld or that problems are being covered up.

I think the level of trust is worse because clients know that companies have the technology to share more information and to do a better job of sharing, but information sharing is not changing and is not improving. This is a clear sign that the construction company simply does not care about trying to improve trust when they could easily do it.

I have not experienced any change, and certainly not any improvement in the level of trust from the industry. I really don't think that IT would make any difference one way or the other. It is about their attitudes and their willingness to work with clients.

I have experienced very little change in the trust with the construction industry. There is more technology for them to send information, which seems fine at first. However, when the information is not accurate, then any gain in trust is lost.

I can't really say that trust has increased. I think that there is always apprehension about working with the construction industry. Technology has helped somewhat, but not that much.

No improvement in trust has occurred. Trust is low and will likely remain low for some time to come. A lot of things will have to change, not just related to technology for the level of trust to improve.

If anything, technology has causes trust in the construction industry to decline. We receive lots of information, but it involves information that is not correct or not on time. When you send repeated information that is false, you lose any trust that you had to begin with

There has been no change in the level of trust in the construction industry and technology cannot really change.

I don't see any change in the level of trust with the construction industry. The people that I work with still don't trust the industry. Technology has not really had an impact on this trust one way or the other.

Technology has the ability to improve our trust in the industry, but then we receive information that is false and our trust goes straight out the window. It is very annoying.

I think that technology has been a double-edge sword in terms of trust. Technology has helped to increase trust, but when it is not used to provide the most accurate information possible, companies begin to wonder if information is being hidden or if something is going wrong. This is not good for increasing trust.

Question 9: What can the construction industry do better to build relationships with clients to improve sharing information and use of information systems to manage a construction project?

To improve relationships with me, the contractors on site need to be more efficient with reporting versus making us wait for weeks at the time and I have had to ask in some cases 3 times to get the information that I needed and I actually had to go as far as calling the corporate managers to get feedback.

The construction industry can build better relationships with clients by providing them with the information they have concerning the projects, including the following: current progress, scheduling plans, etc.

Contractors need to be clear about what decisions need to be made and by when. They need to be clear about the choices. For example, if they are recommending vendors or other sub-contractors they need to be sure the products and services are of good quality and competitively priced. They also need to accept the client's choices if they do not use a contractor preferred vendor.

Construction firms need to use IT to allow customers direct access to reports and information. I would love to see construction firms just use a secured web site to make digital copies of documents and reports available so that we do not have to beg for information and threaten the contractors before we get what we need.

Construction firms need to make information sharing and IT a normal part of their operations. They should act clients what type of technologies and software they would like to use to share all of the information that is needed. This would go a long way to improving trust.

The construction industry needs to focus on using technology to make information available at any time, and not just at their convenience. It is not that difficult to upload documents to a web site or to use software to attach photos, copies of reports, and other information. The construction industry is just choosing not to do it.

The construction industry could improve its image greatly by actually sharing information in real-time using the Internet. Even if they only want to use something as simple as Microsoft Project, at least send changes to the schedule and updates on a daily basis, and don't make us have to ask for those updates.

The industry needs to realize that if they would share information more freely, a lot of problems could be avoided. They need to stop trying to hide information and upsetting clients in the process

The construction industry needs to just be more honest. Doing something as simple as sending an email when a potential problem arises would be the best thing that that the industry could do and it does not even involve costly technology.

The industry needs to be open to communication. I don't think this will be affected by technology, but by a change in attitudes.

The construction industry needs to be better at documenting information and getting it to the clients immediately. The technology exists for this to happen, the firms just need to want it to happen.

Construction firms don't need to try and use technology in a better way, they need to try and share accurate information in a better and more truthful way. That would go a long way to build better relationships.

Construction firms need to do a better job of making information available when it is needed by clients. Embracing IT that is based on real-time updates would help this process greatly.

The industry needs to be faster to use new technologies that are demanded by their clients. This would improve relationships because clients would feel that the industry is responsive to their needs and desires.

The companies need to cut out the negative attitudes and the lies and just make information available. IT can help with this, but the companies must be willing to share the information without being begged and yelled at for it to happen.

Companies just need to communicate more easily with us. They need to supply accurate information. I think real-time updates would do a lot to improve the perceptions of trust in the construction industry.

Construction firms are already embracing technology, so I think that relationship can be improved by just focusing more on client needs and tailoring the software that is used to the needs of the clients.

Relationships can be improved by simply being treated by the industry as though we are actually important. This is not something that technology can do. It is something that the people working in that industry can do.

The industry can improve relationships by not being so against every suggestion that is made by clients to be more involved. When we make suggestions about the software we want to use or how we want to receive information, the companies need to be accommodating and receptive to those things.

Construction companies just need to try and make us feel more apart of the process. I am not sure that information systems would do. I think it is really about the attitudes of the industry and their willingness to work with their clients.

In terms of information systems, construction companies just need to be willing to use the software that we want used and provide the updates that we need to improve relationships. This would make us feel like we are part of the process and that we are being treated with respect as customers.

The use of information systems should focus on providing all of the information in one place and in a timely manner. This would improve relationships because clients would know that up-to-date information is available and always updated.

Construction companies should be focused on providing real-time information and reports. This would improve relationship because we would not feel that we need to fight just to get a report about the projects that we are financing.

The industry just needs to use technology to be more honest with clients. It is not about the type of technology that is used, but just how it is used and the information that is being shared with clients.

The industry can share information more freely to build better relationships. This means real-time information and using software to make information available via the Internet.

I don't think the industry can do anything associated with information systems to improve relationships. The industry needs to completely think about the way that it interacts with customers and how egos and attitudes get in the way of that.

The industry needs to be more honest. It can use almost any technology that it wants as long as honest exists between the companies and their clients.

I think more real-time collaboration software would improve relationships. This would make clients feel that they are on top of everything that is taking place and make them feel that they don't have to yell or threaten companies just to receive the information they want.

