THE DEVELOPMENT OF TRUST THROUGH INFORMATION TECHNOLOGIES

IN THE CONSTRUCTION INDUSTRY

An Interactive Qualifying Project Report

Submitted to the Faculty of the

WORCETER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Date: March 5, 2004

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Acknowledgement

Abstract

Trust is important in the construction industry. It is built over time by face-to-face interaction. With the increase of information technologies, face-to-face tend to be eliminated. This study focuses on the impact of information technologies on trust. We presented a literature review on information technologies and conducted a survey. Our result shows that information technologies develop a faster and better communication while face-to-face works much better in complex situation. Therefore, in the construction industry, information technologies and face-to-face communications are complementary to each other.

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CHAPTER 1

INTRODUCTION

1. Background

In the construction industry, projects involve many different contracting parties, so teamwork is a crucial element leading to success. Partnership and group effort should be achieved to enhance the efficiency of teamwork. In order to gain these components, trust must be built among contracting parties. In the past, trust was built by honest commitment, previous dealing, a clear or concise contract, and through a proper face-to-face communication. Today, with the tremendous increase of information technologies, communication does not only build upon face-to-face meeting, but it also builds on the use of the Internet.

This study investigates the expansion of information technologies and how they affect trust among contracting parties in the construction industry. This paper assume that the readers are familiar with the construction industry but not with information technologies. We first confirm the value of trust in the construction industry, and how it is developed either through face-to-face communication or through the Internet. We then introduce the available information technologies—how they can be used, and what are available for the use of the construction industry. At the same time, we remind the readers the technologies could or could not have an effect on the trust relationship among contracting parties. Next, we develop a survey and send it to professionals in the construction industry. In the end of the paper, we discuss the result obtained from the survey complimented with personal experience during the course of the study.

2. Scope

The objective of this study is to determine what approaches of information technologies have affected (if any) the trust among contracting parties compared to face-to-face

communication and a massive reaction of professionals in the industry through that change. The best possible trust-information technologies relationship is investigated and measured up to the face-to-face relationship through the experience of professionals in the construction industry as well as personal experience during the course of the study.

Chapter 2

TRUST

1. Introduction to the Value of Trust

In construction industry, projects could become increasingly large and complex, involving multiple participants of owners, architects, engineers, contractors, subcontractors, etc. People might come together to develop a project for the first time and perhaps the last time because it is very difficult to keep the same project team from project to project, so construction projects are very venturous. As a result, team work is the key of a successful project. Factors such as collaboration and communication are believed to be important and should be promoted in any project. One of the basic elements of a collaborative relationship and effective communication is the building block of trust among team members. The following is a discussion about trust and the development of the trust model.

2. Trust in Organization

Trust is very essential for an organization to work together. Lack of trust among parties would make the team fall apart, producing time delay which increases the project's cost and might lead to an uncompleted project. When we say "trust among parties," we mean that:

1. How much confidence you have in the other parties competence and ability to do what is being asked of them

2. How sound you believe the other parties judgment is

3. How much you believe the other party is willing to help you

4. How certain you are that the other party does not desire to harm you (Serrambana, Victor M., p27, 1991)

However, trust, by itself, still has its own and unique definitions, depending on how one perceives it.

3. Definition of Trust

3.1. Trust in General

Salazar wrote that trust is "…the belief or confidence in the honesty, integrity, reliability, and justice of another person or thing"(Salazar, et a, 1994). Nonetheless, people perceive trust differently. To some people, trust is understood as "relying on something to provide correct information, to perform an operation correctly, to keep a secret, to perform a protocol correctly and not to misuse information or resources" (http://www.aaaarch.org/dublin/salowey/definition_of_trust.htm). To others, trust is comprehended as "where something is a local software and hardware, a remote hardware and software, an organization, and individual and a service"

3.2. The Development of Trust

Stop and think for a minute; then ask yourself, "Why do my friends tell me their secrets. And, why do others not?" One answer might be because your friends feel comfortable with you since you meet them at their emotional and psychological level. They like it when you talk or pay attention to them, so they trust and tell things that no one else knows about. Indeed, you know the identity of your friends which is the case to form a basis of trust. Another answer might be because of the environment your friends and you are in.

When discussing about environment, you have to account computer network environment also. Trust relationships are built on one another, where the bottom layer is self trust and the others might be from different sources from different IP addresses. This is where the problems might come because "on a particular segment of network it may be decided that spoofing IP

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addresses is sufficiently difficult that they can be trusted to identify hosts."

(http://www.aaaarch.org/dublin/salowey/definition_of_trust.htm). One example is NAS

(National Academy of Sciences) network with AAA.
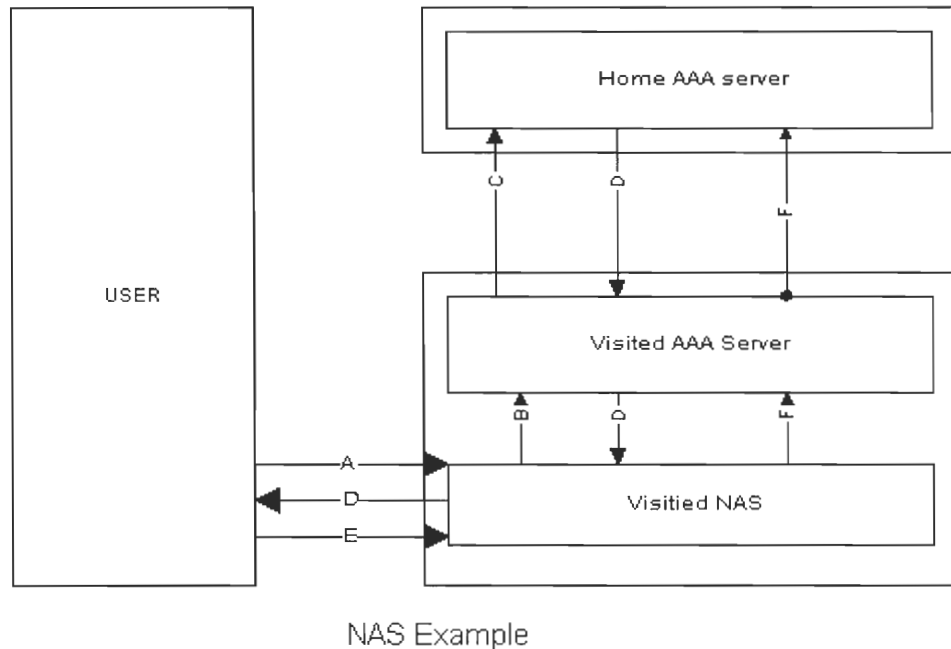
NAS Example

FIGURE 1: NAS EXAMPLE

A represents the trust between the user and NAS, so the user makes a request to visit

AAA from NAS. At B, NAS tries to make a decision whether it should trust AAA. After

deciding to trust AAA, NAS asks for authentication and authorization to visit AAA. Visiting

AAA at stage C, NAS wants to ask for more information from Home AAA, so now it is the time

for AAA to decide whether to trust NAS so that he can provide the information that NAS needs.

At D, AAA makes up his mind and offers a session set up for the user through NAS. However,

stage E shows that the user declined the AAA session, so at stage F, AAA servers are informed

that session has come to an end by NAS.

(http://www.aaaarch.org/dublin/salowey/definition_of_trust.htm)

Through the NAS example, we can see that trust entails in both direction between trustee and trustor. In order for the network system to work, both parties that are involved must trust each other. Although network system can be used to communicate and share information, the project might not be completed. At stage E, the user refuses to receive a session set up perhaps because there are agreements that require the user to sign, which of course can not do through network system. Therefore, we now go back to trusted data consisting of "data signed by an issuer, data bound to a subject, data has validity constraints, data may be bound to a target and used in conjunction with trusted channel"
(http://www.aaaarch.org/dublin/salowey/definition_of_trust.htm)

This is exactly what the purpose of this research is. In truth, the research investigates more on the effect of technologies such as Internet to self trust, direct trust and third party in the construction industry. We are engaged in to answering the question of how trust is established between two parties in the construction industry due to the effect of information technologies.

4. Trust in Construction Industry

In the construction industry, projects depend on multiple factors such as economy, weather, site conditions, availability and productivity of resources. Working efficiently between parties will reduce those problems. As a result, the concepts of partnering, team-building, cooperative alliances etc. need to be considered. To gain those qualities, trust must be built among parties who participate in the project. Indeed, trust is a notion which makes organizations in construction industry work. It assists interpersonal acceptance and openness of expression among parties and establishes positive expectations about the results. There are two types of trust in construction industry that should be taken into account.

4.1. Mutual Trust

Trust in this situation is in giving and receiving equally between two parties. If one party is completely relying on the other party and not thinking about any possibilities of endangerment that might have occurred, the fear of being harmed would typically exist. However, there is no fear of indirect effect because mutual trust benefits interrelationship of two parties. Moreover, mutual trust is an interchanged relationship in which one party has to trust the other in order to enhance the trust of the other party. Therefore, the trust should happen naturally, and it would be harmed or damaged if the trust behaviors discontinue.

4.2. Rational Trust

Trust in this context has two different approaches. It could either be distrust—mistrust or blind trust. Distrust—mistrust is a situation in which trust does not exist at all. Each party lives in the state of war where they always worry about what might the other party can do to harm them. They are in fear of their own survival without any reason, and this holds back a relationship that might have happened between them. One way to explain why distrust comes about is the misperception of being harmed or an experience of being betrayed from the other party, which leaves a tremendous damage. In addition, once distrust is born, it is difficult for the betrayer to gain back the trust from their trustors. Overall, distrust generates more distrust. Another circumstance when one party completely builds upon the other party is called blind trust. This type of trust could cause a dangerous situation where the trusted party has full control over the trusting party. As a result components such as hopelessness, innocence, thoughtlessness and acceptance should be looked after carefully.

Furthermore, trust is believed to be a factor in reducing project costs. In fact, a study conducted at Worcester Polytechnic Institute for the Construction Industry Institute in 1994 has obtained information to imprint this belief. Data was collected from 262 projects. The following

table shows the percentage of respondents who indicated the project cost factors which are

affected by the level of project trust.

Percent of Respondent	Related-Cost Factor
70	Project Term Efficiency
67	Timing of Decisions
66	Project Schedule
58	Project Performance/Quality
54	Timing of Approvals
47	Amount of Rework
45	Administrative Costs
42	Field Suppervision
39	Completeness of Project Scope
34	Project Safety
31	Materials/Equipments Deliveries
24	Contigencies
22	Legal Costs
14	Interest Costs
10	Overhead Multiplier
7	Cost of Bonds
5	Insurance Costs
3	Other

Table 1:COST RELATED FACTOR AFFECTED BY THE LEVEL OF PROJECT TRUST

(Salazar et al, 1994)

In addition, this research study developed a nominal scale of trust measurement. They used questionnaires to determine the level of trust on a scale of 1-100. Complimentary to the trust measurement, they also inspected the cost impact of trust using transactional added cost, cost of increased project-related expenses, and transactional of voided cost, the cost that is saved or not spent. A cost index was then developed to measure the importance of the added or avoided transactional cost (See Table 2).

Using this Cost Index, questions were developed for their research on Cost-Trust Relationship in Construction Industry. With a total response of 165 firms and individuals from 262 projects, the relationship between trust and projects cost was formed by a second polynomial function. As trust between parties increase, the cost of the project decreases. Figure 2 is using regression techniques to present a second degree polynomial of 262 scattering points of the projects from the research database.

			COST INDEX Qualitative Value	Qualitative
VALUE ADDED COST				
	High	**Extreme:**	Cost Impact Increase is the worst possible scenario for the project. Greatly exceeded expectations.	100
		Major:	Cost Impact Increase is exceptional for the project. However it is not the worst possible.	75
		Moderate:	Cost Impact Increase is bad but not exceptional for the project. Above expectations.	50
	Low	**Minor:**	Cost Impact Increases is expected and considered reasonable for the project.	25
		Negligible:	Not noticeable Cost Impact Increase/Decrease	0
AVOIDED COSTS				
	High	**Minor:**	Cost Impact Decrease is expected and considered reasonable for the project.	-25
		Moderate:	Cost Impact Increase is good but not exceptional for the project. Above expectations.	-50
		Major:	Cost Impact Decrease is exceptional for the project. However, it is not the best possible.	-75
		Extreme:	Cost Impact Decrease is the best possible scenario for the project. Greatly exceeded expectations.	-100

Table 2: COST INDEX

(Salazar et al, 1994)
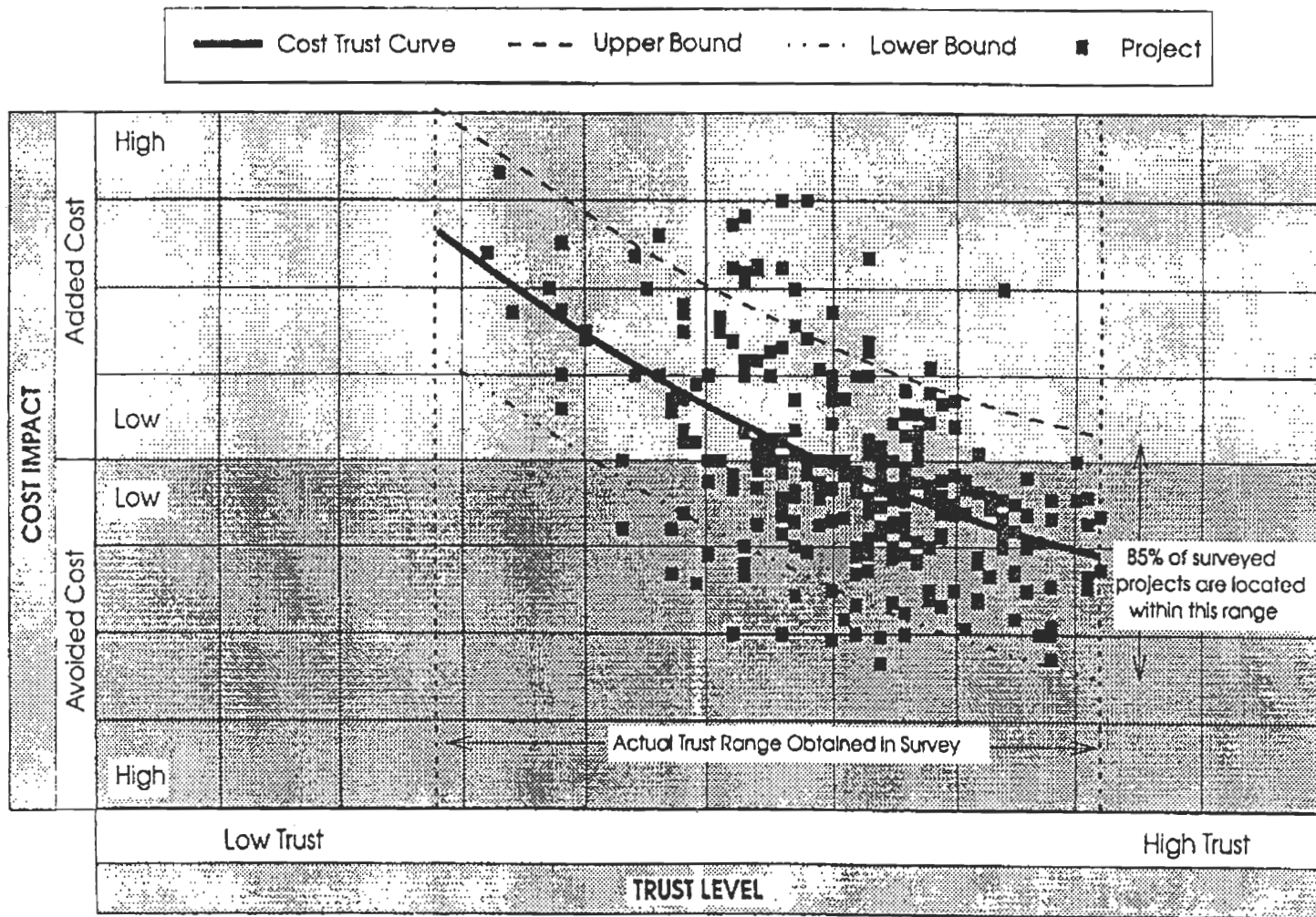
FIGURE 2 . **Cost Trust for 262 Projects**

(Salazar et al, 1994)

CHAPTER 3

INFORMATION TECHNOLOGIES

Samuel Johnson once said, "Knowledge is of two kinds;" we know a subject ourselves, or we know where we can find information upon it" (Doherty, 2000). Naturally, a good business organization is an organization in which the information—knowledge—is shared freely among team members; therefore, a system for knowledge management is needed to store all the documents. In the past, knowledge was kept and explained or shown to others by experts, who held the understanding. If the experts left the organization, this knowledge would go along with them. However, today technology such as the Web and Internet are suitable for efficient knowledge management. Documents those are available on the Web permit team members to share their knowledge. As a result, a system based on the sharing of knowledge through documents has been implemented. This system aims at successfully accomplishing the goals of minimizing each member's work through collaboration and sharing, introducing software agents to enhance members' effectiveness while providing an easy way to use this system and making the global sources of documents on the Internet and Web base accessible.

Most of the material discussed next is based idea presented by Paul Doherty in his book (Doherty, 2000)

1. Information is Equity

1.1 Information Classification

By joining activities such as study, research or instruction, one absorbs more knowledge. In the new Economic era, information is divided into three-areas static/archived/reference, time dated/and fluid/ kinetic.

1.1.1. Static/Archived/Reference Information

This is information used for codes and standards, reference material, detail files within a CAD library, Standard contracts and documents relevant to organizations and manuals of practice published by organization. This information has been printed mainly in book form. For reference information, a better media to store the information would be CD-ROMS and DVDs since they are quicker, cheap and durable, but it is possible that the file might be deleted or the update has not been done yet, or the users do not know where the latest updated CD-ROM is. Internet and relevant technology will be able to solve these problems and provide good help for reference information.

1.1.2. Time-Dated Information

Information such as company/firm brochures, subscription database resources, equipment and product specifications, and technical information, manufacturing's CAD files, material pricing indexes and human resource information are time-date information. This type of information has been methodized in brochures, books and periodicals. Lately, the CD-ROM format has replaced those printed materials, and again, problem such as out-of-date information also exist. Therefore, the Internet becomes an easy and effective tool for time-dated information.

1.1.3. Fluid/Kinetic Information

Construction project information and documentation, local, regional, national and international news, weather, on-line/Internet technology are fluid/kinetic information. There are three important features in fluid/kinetic information. This is the most vital kind of the information, the most room for growth and the most essential to day-to-day operations. Just like reference information and time-dated-information, fluid kinetic information has been used in printed materials, and of course it is only accurate at the time it is printed. Because this information constantly changes, that cost of updating and distribution of the information are

high. Even fax machine has been considered as the highest level technical tool, Internet is the most effective tool, providing a cost-effective and easy-to-use environment. Therefore, the construction industry should use its full potential.

1.2. Do You mean My Computer Is a Telephone?

Nowadays, computers have become a very useful tool for communication, and even more effective than telephone. It provides more than just the production and delivery of information. Images, text and sound are available on computers. In addition, computers can be connected from one to another by networks, and this is very helpful for changing information in the fluid/kinetic information category.

1.3. Information Push and Information Pull

Pushing information is a characteristic of building design. Facilities managers, contractors or architects are pushing information or pushing requests for information. There is no interaction between these people because information is just printed and then delivered. Internet technologies, on the other hand, combine the process of information push with information pull to exchange information. In fact, information is pushed to an area called server, so then the users can pull it from this area. This new technology decreases the percentages of error dramatically.

1.4. Networks

Cable connection among computers, printers and other devices, which provide a roadway for electronic information is known as the network. The network system consists of several rules such as specific length for cabling supporting a specific volume of network traffic. Topology is known as its set up; and Ethernet is the most inexpensive, easy, simple and fast topology. Ethernet moves information quickly in megabits per second—one bit is equal to 1/8 of a

character, letter or number. There are two types of Ethernet—10 Mbps—and fast Ethernet—100 Mbps. Standard Ethernet is better recommended unless video, multimedia or heavy graphics software like CAD or VRML are needed because fast Ethernet requires switching hubs for two people talking and internetworking knowledge.

1.5. Cabling

10BaseT and thin coax are two kinds of cabling. The 10BaseT is made up of eight wires resembling four wires telephone, and thin coax resembles copper coaxial cabling used for VCR and TV. 10BaseT is recommended for small networks while thin coax is recommended for large networks.

1.6. Network Adapters

Network interface cards (nic) are plugged in the computer's internal expansion slot when the PC is opened up. 486 computers, Pentiums and Pentium Pros require 32-bit or PCI (peripheral component interconnect)—network adapters. For a fast Ethernet network, the network adapter is needed. If there is no expansion slot such as credit card-size PCMIA, a pocket adapter can be replaced to connect to the PC through printer port for networking.

1.6.1. Hubs

A network consisting of a small group of computers can use a box, known as a hub, which is able to connect all the PCs together with 10BaseT. However, for larger networks, thin coax is used to connect a row of 10BaseT hubs. Similar to network cards, hubs run in 10 Mbps and fast Ethernet (100Mbps) versions.

1.1.7. Network Classifications

Depending on geography and protocols (rules governing transmission of information) networks function in two different ways. Below are some common networks:

LAN (Local Area Network): less than 1,000 feet of cable for an office or a single floor.

MAN (Metropolitan Area Network): network connects through out the whole city. It might connect to LAN.

WAN (Wide-Area Network): network in a larger area in miles. It might even connect LAN internationally.

1.1.7.1 Protocols

To transmit data across a network, a set of rules—protocols—is needed for the communication of different computer from different manufacturers. Two examples of protocols are IPX (Internet Packet Exchange) and IP (Internet Protocol).

1.7.2. Network Topologies

Network Topologies are composed of centralized or decentralized network, where centralized topology has   a central computer to control the network, and where decentralized topology allows each workstation to link with other computers individually. There are three types of topologies—bus, star and ring.

1.7.2.1. Bus Network

A single connecting line used in a decentralized network of a LAN is known as bus. It indeed links all the workstations, shared peripheral and file server—node—together. A message is sent individually to each node in this system, so one error in a node will not affect the whole network. The only disadvantage is that a device called repeater is needed for more than 1,000 feet.

1.7.2.2. Ring Network

This works similarly to the bus network except for an addition of a repeater. Accordingly, the network extends further than in the bus network. However, with this system, one error can break the whole network.

1.7.2.3. Star Network

Star network on the other hand has a centralized topology, and all the nodes link to a center called wiring concentrator. Using this system can lead to several disadvantages such as the workstation needs a cable linking; failure of one station might take back to the center and affect the whole system.

1.8. Does This Network Actually Work?

NOS (Network Operation System) is installed in PC for networking to control and exchange files, electronic mails and other information. For homes and small offices, Window 95, Window 98 or Window 2000 is best fit for peer-to-peer NOS. In contrast, for larger community Window NT and NetWare are good for client-server NOS.

1.9. Peer-to-Peer Networks

Peer-to-peer network has 10BaseT cabling a hub. It links more than two PCs together for information transferring. Each PC has its own hard disk drive, which has two tasks of requesters and providers.

The information in these disk drives is sharable. For an instance, a computer A has A and C drives, so as a sharable system a computer B sets up its C drive as a sharable system, which makes computer A has A, C and D drive where D drive is C drive of B. Peer-to-peer network provides many advantages:

a. Because drives are shared, only one install of a software application is needed.

b. No need for network administrator.

c. Fast, easy and inexpensive.

d. Backup copies are available in any PC

1.10. Client-Server Networks

Client-Server Network allows files to store in one center. Data and applications are shared in only one center. Each user has his/her own directories. To communicate, clients have to go through the file server. There are many advantages:

a. Faster than peer-to-peer network.

b. Everything goes through file server which enable the users to monitor their tasks.

c. Work can be redone for faster networking

d. Upgrades can be done directly on file server instead of installing in PC.

1.11. Network Printing and Plotting

A print server is provided for network printing and plotting. It consists of two connectors for a printer and network connection in a small box. To do a print, the task is sent to the print server so that the print server links it to the attached printer, and when the task is done, a result message will be sent to the server printer. This print server is accessible for client—server and peer-to-peer networks.

1.12. Remote Access and Modem Sharing

Remote—node—server is installed so that a client server network can link to computer outside the network. This has modem sharing which enables an electronic link between computers and telephone to translate digital information into a message. The users will be able to access any data over ordinary phone lines. Using this system saves a lot of money because only a modem and a telephone line are needed.

2. The Internet

2.1. What is the Internet

The Internet is a large network community of people all over the world, using computers to communicate. Different types of information are shown on the Internet. It is also a way to keep in touch between people. It consists of a complex web, linking to smaller regional networks. The complex web is like a superhighway, moving at a speed of 45 million bps, and when it links to other small region—computers—it moves at a speed of 9,600 bps to 28,800 bps.

2.2. In the Beginning

Originally, the Internet was introduced by the Department of Defense to transmit data from point A to point B. In the 1960s, US Defense Department's ARPA (Advanced Research Projects Agency) used packet switching to allow the users to share one single line for communication. Its purpose was for the survival of nuclear attack.

In late 1970s, early 1980s, the Internet was expanded even larger. NASA (National Aeronautics Space Administration) and NSF (National Foundation Science) also developed their own packet- switched network at this time, which was a larger community than ARPA. Today, the Internet is very popular, even used among public schools and households.

2.3. How Big Is the Internet?

We do not really know how big the Internet is. Approximately, there are 250,000 networks connecting 95 million computers with more than 400 million people. It grows at a rate of 20% each month and 85% each year. For the construction industry, the use of Internet tripled in a six-month period in 1996. Today, almost every construction company uses it to varying extent.

2.4. What Can I Do with the Internet?

The Internet enables people to send emails all over the world; people from different geographies in construction industry are able to share information and to download files. Its special function reduces the cost for communicating among organizations or even between individuals. However, different computers have different commands, which create difficulty in finding what you want.

2.5. Tradition Versus Progress

A/E/C Dot Com companies are created for independent professionals from different disciplines to connect worldwide teams through a process called Internet Coopetition. This new Internet technology provides 24-hour production of construction documents, on-line conferencing, virtual private networks, collaborative specification writing, and virtual job site meetings to organizations. It changes industry to meet to the clients' expectation of instant information feedback and the expectation of using the same tools as construction industry, including the Internet.

3. Electronic Mail or E-mail

3.1. Electronic Mail

Electronic mail is also called e-mail. It is similar to sending a letter to someone but through the Internet. With e-mail, you are not only able to send letters, but you are also capable of sending drawings and attached files. It provides communication across the world—no matter where you are located.

Anyone, who uses e-mail, has an e-mail address. You can send to one person or many people at the same time by writing the addresses at the top of the e-mail transmission. The e-mail will be delivered in hours, minutes or seconds to the other side of the world while regular mails might take days. The nicest feature about e-mail is that no matter where you send the messages to, no additional bill is being charged like telephone communication.

3.2. E-mail Business Advantages

In business, e-mail allows collaborative work over distance and time. It speeds up the tasks effectively by proving sources of expertise. The most essential feature is that it eliminates the domination of one person over another in one team because of the outspoken personalities in real life.

3.2.1. E-mail at Work

Using e-mail leads to many advantages:

1. Easy to collect information to manage and to operate construction project team.
2. Enhance time saving of members in different location.
3. Enable to select the best people without worrying about geography and allow a variety of staff systems from different offices without moving anyone around.

4. Reduce the cost for assignments.

5. Allow contacting anyone at anytime for a project when needed.

6. Provide the opportunity to ask questions over the world when you are stuck.

7. Obtain skill and specialization over the world.

8. Obtain information resources all over without the need to use the telephone.

9. 24-hours work on construction document. Different time zone is no longer a problem.

10. Provide on-time project.

11. Multiple communications in e-mail is easier than phone.

12. All communication records are kept.

13. E-mail is cheaper than postal mail for a larger community.

14. Small Company can hire to many people for different disciplines, but now they can rely on the globe for experts.

15. Communication is available anytime.

16. All e-mails look the same, so it is possible for a junior employee to talk to a president.

17. Judging the potential of a person is based on his ideas rather than other components.

18. Communication on the net is easier than face-to-face for some folks.

3.3. E-mail Downsides

1. A person can spend a huge amount of time for checking e-mail.

2. E-mail messages can be misinterpreted or misunderstood.

3. Smileys for emotion Icons are used but users might not understand those symbols.

4. Smileys do not reduce displeasure for one to another.

5. There is no privacy.

6. Junk e-mail exists.

7. Have-Messages must be deleted after reading because overwhelming might occur.

8. Size limitation for attachment.

        Appendix A shows how to use e-mails.

3.4. Incoming Mail

Once you get online, the e-mail package will tell you whether you have new mails. It would provide information such as:

1. How many messages are in your mailbox.

2. How many e-mails have come in since the last time you looked.

3. How many messages you have not read yet.

4. Whether there are any files attached to your e-mail message.

If the message is too long, and you pay by the hour, you should use copy and paste to get offline and get back on again when you have read and written your rely message.

3.5. Composing Off-line E-mail Using a Word Processor

Even though using a word processor for composing off-line message is a good idea, there are still rules to follow:

1. Your mail has to be sized to fit the ISP

2. The message might look all fancy in the word process or might turn out to be messy when paste in the e-mail.

3. Only text and ASCII are available for e-mail message. To do this, you have to follow this procedure:

    a. Save your message as TEXT or ASCII when writing it in word processor.

b. Open your e-mail software and go to Create/Compose a New Message.

c. Copy your message in word process and paste it over Compose New Message

d. Type the receiver's e-mail address at To: field.

e. Add the Subject: field

f. Finally, sign on the Internet Service and Send.

(Doherty, 2000)

3.6. Managing Your E-mail

Depending on ISP, your mails—read or unread—will be automatically deleted after a period time. Sometimes, they are just piled up hundred pieces of mail because you do not want to delete them in case you need them later. To eliminate the use of space for storing your e-mails, you can save your message in your computer's hard drive and delete them all in your mailbox.

3.7. Forwarding and Redirecting E-mail

If you want to directly send a message from someone to someone else, you just click on Forward/Redirect command.

3.8. Unsolicited Mail

Junk e-mail or spam can be deal with by complaining to postmaster. All you need to do is write an e-mail and send it to Postmaster@ISP.com of whoever sent it to you. For examples, you can send your complaint to Postmaster@xyz.org or Postmaster@net.com. Do not forget to include the junk mails, which were sent to you.

The Internet service would never ask for password or account information, so do not ever answer if someone asks this.

Free services such as juno.com and hotmail.com are available, yet a trade-off of providing a profile must be involved. However, these free systems do not allow attachment and drawings and downloading to be sent and received.

3.9. Cascades and Replies

Most e-mail software option automatically provides triangle symbols like >< for correspondent's response. Once you reply to an e-mail, these symbols are good indicators of which answer to which questions. Double symbols >> << represent a reply to a reply, so multiple symbols could happen for a vast amount of replies. This is known as cascading.

If you go to Option/Preference section, you can create an electronic version of your signature. This signature automatically provides your name, address, company name, and other information when you send an e-mail. Three or four lines of text are a good netiquette in signature.

3.9.1 Cascades and Relies Versus Trust

Ethic is important, but in a competitive constructional environment, you never know what people intend to do. How do you know if a person is giving you the right information? How do you know if that piece of information is what you need? And finally how do you know if it is the person that you are supposed to hear from? It is possible that people just attach some random documents and claim that it is from the president of his/her company. There is no hand written signature, and there is no one witnessing that you receive this document from a particular person, so if anything goes wrong later, you do not have evidence to prove. People could also use words to mislead you and make you believe what they are sending you through e-mail is what you must do for the project. Worse of all, people can put anything for their name, address, company name in the Option/Preference section.

One could argue that you can save all the e-mails for proof later, but think about how many e-mails you receive through out the life-cycle of the projects. Messages that you have read must be deleted after a period of time because overwhelming will occur. Even if you are capable of keeping all these messages, which means you have proof, there is nothing you could do for the fact that you did the project wrong. You have to take time to fix or do what you did again.

This is when you need to decide whether to distrust or blind trust the other person behind the screen. Should you trust a person through the Internet? To answer this question, you have to remember that people could also send false documents through actual mails and mislead others when face-to-face. So, how has the information technology—Internet—impacted the level of trust in the construction industry? We will discuss about this in later chapter.

3.10. Sending E-mail through Commercial On-line Services

Some commercial on-line services are not a part of the Net, but they go through a gateway to pass the e-mails. Accordingly, these services limit the size of your messages, so you need to be aware of keeping your message short and clear.

3.11. Domains

Domains provide information on which organization or gateway that you are about to involve in. They have suffixes such as .com for business, .edu for educational institute, .org for non profit organization, .gov and .mil for government and military and .net for company or organization. A two-letter code is normally used for a country such as .ca for Canada, .Uk for United Kingdom etc. Usually, lower case or capital letters are not a problem. However, some do not allow capital but to be sure after @ sign, you do not need capital.

(Appendix A shows mail header)

3.12. E-mail Errors: The Mailer Daemon

The users might not have an account with the server, or the domain might not exist. If these errors happen, then the e-mails will be sent back.

3.13. Advanced E-mail

E-mail is not only for sending messages, but it is also for many other uses. Some Internet software does not have access to File Transfer Protocol (FTP). If this is the case, you can attach the files such as spreadsheets, CAD drawings etc. to send to others. Attaching a file is very simple. You just highlight the file then click OK. (See Appendix B)

3.14. Courtesy Copies and Blind Courtesy Copies

CC: (Courtesy Copy) and BC (Blind Copy) are two useful features. In CC, one member in a team project can send an e-mail for request to the entire team by typing all addresses to CC: When an engineer/architect replies, everyone in the team receives the information, so there is no finger-pointing by using this.

If the sender does not want a particular recipient to know who else on CC list that he is replying to, he can use BC tool so that the recipient gets the same information but does not know about others.

3.15. Address Books

All e-mail packages have an address book, where you can add e-mail addresses. Once the address book is filled up, you can create folders, which will then be set up as project folders. By having project folders, you can set up a project e-mail account, called an Alias. With this, you only have to send to one destination to but the entire team is able to receive the message.

3.16. Automatic E-mail Response

If you know that you will not have time to answer the e-mails right away, you can set up a message to inform the senders.

3.17. E-mail Files Sent to the Net as Backup

Sometimes, security detectors at the airport accidentally damage a diskette, which has your PowerPoint presentation for your client. If you have already compressed and sent your presentation to your own e-mail, you can just log on-line and retrieve the representation.

3.18. Two E-mail Addresses, One Computer

A PointNet's sharebox is needed for employee, who share a computer and e-mail program. This eliminates the setting changing among them.

3.19. Observations and other E-mail Features

There are a certain limits, which are needed to consider:

1. An e-mail might not be read right away.

2. Misspelling gives a very bad impression. You need to use spell check at center e-mails packages or Inso's Cyber Spell

3. Good writing is needed for e-mails.

4. If the recipients ask for more and more information, you should understand that your e-mail is not clearly expressed.

5. Body language can be shown through letters for example, capital letters might indicate "yelling."

6. E-mails should be clear, focused and direct because a task might be shared among the users.

7. The readers are human with blood and flesh; therefore, a termination notice would not be good in e-mails.

3.20. Conclusion

E-mail is a good way to communicate. Anytime and anywhere in the world, you can access e-mail easily. It is quick, flexible and necessary for business. However, you can not see the person behind the screen, so it is up to you to either trust whatever you receive or not.

4. Usenet Discussion Group

The Internet is the Great Equalizer. It allows all types of people to talk to each other, and it eliminates sexism, ageism and racism. There are discussion-groups called Usenet (for user network) on the Net where ideas can be exchanged among people. In fact, three forms of communication exist for these discussion groups. They are newsgroups, mailing lists (mailbases) and LISTSERVS. Newsgroups enable people to share interests by posting notes and messages; it is like an electronic bulletin board, kiosk or town square. Mailing lists function like newsgroups except for messages are sent directly to everyone's e-mail box on the list. Finally, LISTSERVS works like mailing list but for a smaller group of people with a target topic. The following paragraphs are further elaborate on these three forms of communication.

4.1.1. Newsgroups

Newsgroups—Usenet—are meeting places similar to chat rooms nowadays, where people gather to talk or to discuss whatever is on their mind. It is not the Internet; it is only a protocol, which relies on the Net's highway to post its information. Messages in here are sent from host system to host system. The host system always stores messages in one place, and

when two host systems meet, they compare their notes. If any message is missing, it is capable of transmitting.

The owner of these host systems—known as host computers—has the power to decide which Usenet will be kept and who can use it because the flow of message is huge and the host can not keep everything. In fact, the host computer is an organization where messages can be ranked—called threads. These threads are built in the newsgroup. This newsgroup consists of conferences, forums and bulletin boards. The following shows how messages are ranked:

Biz: Business

Comp: Computers and related subjects

Misc: Discussions the do not fit anywhere else

News: News about Usenet itself

Rec: Hobbies, games, and recreation

Soc: Social groups, often ethnically related

Talk: Politics and related topics

Alt: Controversial or unusual topics (Architecture and construction topics

naturally fall into this category.)

(Doherty, 2000)

A variety of topics in these messages can be posted in ASCII text or graphic images which are encoded.

4.1.2. Moderated versus Unmoderated

In moderated groups, discussion is focused and on-target. Messages are delivered to one location where a moderator chooses which one is allowed to be posted to the Usenet. Normally, newsgroups and even A/E/C (Architect/Engineers/Contractors) groups are unmoderated. People who are using this setting, control what can be discussed and how to check on those discussions.

4.1.3. Commercial On-line Discussion Groups

For commercial on-line moderated groups such as AOL (American Online) posted messages in moderated newsgroup are for anyone to see and respond. A posted message can not be taken back; therefore, before posting anything, a message needs to be thoughtful and professional.

PLACES forum (go to keyword: PLACES) provides AOL users information on the built environment. There are six different areas where the forum is hosted. Each of these areas distributed different topics of discussion or threads. The system enables the users to read, answer or start a new topic in building industries. The forum also answers any A/E/C question.

In contrast to other Internet discussion groups, AOL is not free. The users have to pay the fee monthly. Therefore, it is important to understand how much information is available by using these.

4.1.4. You May Ask Yourself, "How Did 1 Get Here?"

Discussion forum about construction and architecture in Newsgroup area is known as alt.architecture. The service's Usenet is able to find Newsgroup, you need to go to the pull-down menu of your software and look for Newsgroup or Usenet forums. You can also look for Usenet at sites such as:

http://www.altavista.com

http://www.excite.com

Once you find a message which interests you, you just click on it to read the message without doing any else.

4.1.5. When You Have Something to Say

In Usenet, a posted message will be responded, so then the discussion begins. The users can start a new discussion or involve in the existing one. Before making one of the two decisions, they should observe or read the discussion to have a good idea of what is going on. For joining a discussion, users should always include the posted message because the original one might be gone after a certain period. When reading these messages, you have to be careful about laws for copy right material or illegal activities. Often time, these messages have a fancy signature at the end, reviewing the writer's name and e-mail address.

Often time, when people have problem, they tend to post the same message in many different Usenet newsgroups at once; this is called spamming. Spamming is a bad idea because their message could be in a very inappropriate place while it should be in a right area of interest.

4.1.6. News Readers

If you pay to be on the Net by hour, it is a good idea to get information quickly online then get off-line to read the news. There are three free good ways software packages for message thread news readers. They are such as Forte's Free Agent, which allows users to work on or off-line, build-in Newsgroup for Netscape Navigator or Express for Microsoft Internet Explorer users.

4.1.7. Newsgroup Utilities

FAQ's (Frequently Ask Questions) should be checked before posting any question because the answers can be found here. News answers are a good place to find all sort of information. If you finally decide to post a message, you should think carefully again. A message is created in text or even graphic images, and it is for anyone to see. People can read everything you posted by searching for your name and e-mail address.

4.2. Mailing List, or Mailbases

While Usenet messages are stored in one location, mailing list sends messages to a central moderator. The moderator then sends these messages to people. To get involved to the mailing list, the users only need to send a request to one particular computer. They will be added to the list after that.

Such as information on worldwide construction and architecture, the users have to send and e-mail to Built-enviroment@mailbase.ac.uk, which is an Internet mailbase discussion for Built Environment (Doherty, 2000). There are certain instructions to use mailbase:

- No autoreply facility is allowed

- Built Environment has to be written before the subject title

- A message has to be sent to mailbase@mailbase.ac.uk with a blank subject if you do not want to be on the list anymore or want to request a copy of Mailbase User Guide.

4.3. LISTSERVs

LISTSERVs, an electronic mailing list, are used to automatically send e-mail or post to everyone on the list. Its function is basically the same as Newsgroup except for it only accepts text message. To join LISTSERVs, you need to go with Tile Net's list. The key command is subscribe which will add you to the list. (See Appendix C)

4.4. Newsgroup, Mailbases and LISTSERVs Versus Trust

Since you can not see the person behind the screen, you do not know any background about this person or what type of people he/she is. Although you just share interest and discuss about their interest through Newsgroup, you should ask yourself whether your discussion with this person is reliable. In a competitive environment like the construction industry, when specific information is sent to you as a target audience through LISTSERVs, you never know if

others secretly draw together to play around you. Not to mention, the host computer has the power to control all the conversations. This means your ideas might not be sent, and your request might not be replied to your mailbox through Mailbases if the host computer is your opponent who does not want you to have that one piece of information. So, you must be careful when using those technologies listed above, and it is your decision to either trust what you receive or not.

CHAPTER 4

INFORMATION TECHNOLOGIES IN THE CONSTRUCTION INDUSTRY

Internet technologies provide construction professionals a chance to expand information, knowledge, intelligence, data, facts, news, wisdom etc. for a better environment. Digital databases of information from "New Economy" lead to more efficient, methods for better design, better materials and better construction documents.

In general, construction professionals are information managers. However, in "New Economy", who has more knowledge and understanding in information technologies will control the project. He or she must know the answers for the question of "where are the resources we need?"

One may wonder what New Economy is, and how it relates to the construction Industry. The following pages are ideas from Paul Doherty's book, "Cyber places: The Internet Guide for Architects, Engineers, Contractors and Facility Manager," published in 2000 will explain thoughtfully what New Economy means and its attribution to the construction industry.

1. What is New Economy and Why Do Construction Industry Concern About It?

New Economy is the rate of change of technology, especially the Internet. With the Internet, new jobs have been discovered, and businesses are able to function productively. The prices become cheaper, yet the quality for the products is higher. Time-delivery and computerized accounting are also more effective.

The A/E/C (Architects/Engineers/Contractors) industry is challenged by this New Economy, and in order to fit in, the industry has to take in account of "blur," which occurs in business. It consists of, "Speed: not just the rate of innovation, but the speed at which things happen; connectivity: increased number of things interrelated; intangibles: the non-physical world's increased impact on consumer/business decisions; and blur: blurring of familiar categories, such as the distinction between service and product-based businesses" (Doherty,

2000). Three perspectives in "Blur environment" should be looked at for a full understanding. First, to obtain more profit, a successful change in culture is needed. Second, technology must be applied; your information must be available to be used on the Web. Third, the blur environment function as e-commerce is needed and becomes everyday tool for most clients.

In short, A/E/C business should be created to meet the clients' needs in several ways:

1. Knowledge Management: IT systems provide anticipated needs for the users while Knowledge Management only meets the unanticipated needs of the users.

2. Building Information Life Cycle: There are four basic modules

   a. Date Acquisition: Laptops, Portable Digital Assistants, Web browsers, Java, and Databases.

   b. Data Access: Project Extranets, Corporate Intranets, and Middleware; and

   c. Data Management: Document Management and Groupware; and

   d. Data Leverage: Knowledge Management environments that link disparate data (for example, CAD, SAP/R3, and PeopleSoft) for analysis and decision-making.

   (Doherty, 2000)

For an example, during the design and construction of global facilities, the 3Com Corporation and Brussels Airport Authority have built knowledge-based system to help their project to be done quicker but with a reasonable cost.

To adapt to the new technological environment, many Old Economy companies incorporate New Economy rules and behaviors. As a result, e-business is created for globalization and e-commerce. In fact, rapid globalization and the instant communication used on the Internet are two major components for A/E/C industry.

1.1.1. Globalization: A/E/C Arbitrage Opportunities

The AEC industry nowadays depends on the Internet. Everyone has to study the global framework first before they decide what to do. The New Economy allows them to think globally but act locally. People just click the mouse, and they will receive unlimited features. In contrast, New Economy brings uncertainty to the industry. It provides a fast system and various innovations. This means that the old structure must disappear for the new structure to come, and this creates one discomforted level. However, we can not deny the fact that the Internet allows everyone to be a part of the world. Website and e-mails are available to post information, which then brings an understanding between countries. Therefore, the A/E/C should make decisions faster.

Globalization has three balances affecting one another. The first one is nation-states balance. In 2000, the U.S. was leading this with 75% of Americans using the Net, and it projected for 2003 that other countries would occupy 80%. The second balance is between nation-states and global markets. Many investors use the Internet to move money around. Finally, the third one is between individuals and nation-state. Without associating with the government or other private and public institution, each individual to can directly access the world stage, so everyone has the power to influence markets and nation-states.

These balances enhance the New Economy A/E/C Arbitrage, where an arbitrage is a person who buys and sells securities, commodities or foreign exchange and who negotiates the information between facilities, consultants, departments, business and markets on the Internet.

In design and construction, globalization from nations to business depends on the traditional balance between business, the new balance between business and global markets and the emerging balance between individuals and business. With the help of Internet, these balances work effectively. Accordingly, economic strength relies on the networking to function.

Knowledge Management, known as firm memory, allows an A/E/C arbitrage to manage people, places, and things. A faster learning, better decisions and increased value will take place when an arbitrage has this strength. However, everyone must rely on each other in globalization to succeed. For instance, the IT department should depend on the design department and vice versa.

1.1.2. E-Commerce

Due to the competition of the Dot Com world, the New Economy A/E/C arbitrage must know a certain e-commerce method.

1.1.2.1. E-supply Chains

The E-commerce marketplace could have a positive effect and a negative effect. However, it has demonstrated the advantages more than disadvantages. In some instances, the access of the Web provides real-time on-line assistance for purchase. A window is open to send images or Web pages to visitors' screen. This often makes customers to respond and to accept the offer. In fact, e-commerce sites provide many advantages:

. Search available jobs open for bid in a particular geographic region.

. Research the project at hand.

. Perform accurate quantity takeoffs.

. Submit sealed bids.

. Become part of the on-line Project Team after the bid award.

. View documents like the project schedule.

. Receive notifications in real time about changes via e-mail, fax, beeper, or cell phone.

. Purchase a product in an auction-style format.

. Pick up products at local distribution or direct them to job sites.

Moreover, CAD drawings, e-mails, process orders, post shipping schedules and a reduction of paperwork are some more advantages in automotive B2B (business-to-business) industry. Overall, e-commerce is a way to identify and address customers and existing purchasing behaviors and patterns; it is not an on-line system to force customers to buy stuff.

1.1.3. Aggregated Purchasing

Aggregated purchasing is a generic Web service which allows many people to purchase the same product for the lowest price. When you purchase a product, you track and wait for anyone to purchase the same product so the prices will be lesser as time goes by , and you will wait for the final price to be announced.

1.1.4. Vertical eMarketplaces

B2B (business-to-business) sites try to host product information that will lead to easy on-line transactions for A/E/C e-commerce marketplaces. However, the disadvantages occurred in other industries will also occur in A/E/C industry. When using e-commerce marketplaces for A/E/C industry, more disadvantages are shown:

. If purchases are not made through one time transaction, they often go in a circle before finishing the process.

. Manufacturers do not make an effort when selling the product directly to the contractors.

. The sites do not show any local store after an on-line purchase is made in order to pick up the materials.

. None of the sites have the context of project times and schedules while the purchases are made in this process.

1.1.5. On-line Auctions

Weirton Steel Corp has created an on-line auction site to sell excess inventory. This new tech brings double customers, and their willingness to pay more. However, the site has to take extra steps to prove that the site is trustable and unharmed.

Why are MetalSite and e-Steel successful? Considering on-line vs. traditional auction, there are multiple auctions continuously taking place at the desktop which help to reduce travel expense. The most importance is that companies do not have to buy products from liquidator brokers or retailers, who offer low discount and no-negotiable prices; buyers and sellers are able to contact directly to help determine new price for their product. The on-line auction provides more convenience so that buyers and seller are able to register, enter bids and learn the results immediately or later by e-mails. They could also compare all the bids. Lastly, the system helps to deliver the product and make payment after bid decision is formed. Particularly, advantages are brought to sellers in which losses on excess inventory are eliminated.

However, there are guidelines which buyers should follow when using on-line auctions:

. Find a way to adjust business model to online auction.

. Determine your company's valuable procedure processes to find which areas benefit the most to save money.

. Find and involve in multiple sites which have the products you want.

For vendors, they also have to follow a certain guidelines:

. Examine carefully whether on-line auction is the right tool.

. Develop clear policies.

. Check the site frequently. (Doherty, 2000)

1.1.6. Reverse Auction

This is a situation in which the price decreases rather than increases. There was actually a reverse auction taking place on the Web for a state in Northeastern United States for a request for office furniture. This reverse may sound bad for selling a product, yet when bidding a project if the contractors bid lower and lower, the owner will receive more financial benefit overall.

1.1.7. 5-Commerce (Visual Commerce)

Although e-commerce brings advantages to construction industry, the uncertainty of how a product might be is questionable. To solve this problem, Vector Markup Language (VML) and Virtual Reality Markup Language (VRML), which is know as 5-Commerce, are created to allow architects, engineers, or contractors to see in three dimensions objects and descriptive data before users opt to make a purchase.

2. New Economy Versus Trust

Clearly, New Economy such as Internet provides new and quicker ways to advertise jobs and products, to do online auction and online bidding. The problem is you do not know if everything is posted accurately up there. Companies might look for people to work for them, yet it is possible that they already filled up all their position and forget to delete the web site, so you might be wasting your time to apply and to wait for their reply. Moreover, the question is whether to trust what you see online while you can not see the real product and can not touch it. In a competitive environment, knowing what people think and how they act is very important. However, when bidding online, you only see the price but you can not see people's face, so you

can not really guess what their intention is. Besides, since online auction could make the price go down instead of up, online bidding could also reverse the situation like this.

2. Knowledge Management

Knowledge Management in the A/E/C industry will bring many advantages such as faster decision making. There are some innovative technologies that can help:

PDAs (Portable Digital Assistants) are devices such as cell phones, beepers, and Palm-Connected Organizers used by A/E/Cs. These devices save time and reduce cost. Some PDAs allow members to receive and send all kinds of information to a centralized project database. Some companies even create special products for A/E/C with functions like project scheduling and planning, cost estimates and construction administration.

Palm Devices is a two way communication device which sends and receives e-mail, browses the Web, and populates databases. It can also be used as pager or cell phone. In fact, it provides many features:

> . Transfer of information from one Palm to another on demand.

> . Print-On-Demand (POD) from the field by creating a quick "napkin sketch" in the field. Users can point their Palm to any printing device that accepts IR transmissions and can print instantly.

> . Transmission of information to a central database or extranet.

Punch List has been developed particularly for A/E/C to keep track of punch list items and personnel and send faxes and e-mail transmissions to members

PDA CAD is an Autodesk product, known as Onsite or a G/S, which can be used for downloading maps or CAD files to a Microsoft Pocket PC or Palm device. It can store plans,

maps and other data. Notably, its serve-side application always simplifies data before delivering it to a Palm device.

PDA Printing is a downloading application called JetSend. It allows information to be printed from one device to another device such as from a Palm device to an HP printer. These devices communicate by different methods such as TCP/IP, infrared and Bluetooth. Therefore, cell phones, beepers, printers, laptops, digital cameras and palm devices enhance the qualities of a project by talking the same language and communicating digital information in real time.

PDA Web: With AdvantGo loaded on \ PDVs can be transformed into portable Web browsers and information can be transferred from intranet on Internet to mobile AEC professionals. The users can download the Project Web site onto a Palm or Pocket PC

PDA E-Commerce: Paypal.com is a free service for on-line payment. The users need to download the software and set up an account with Paypal. They simply enter the amount they want to pay into Paypal. Then, later, the recipients will receive the money when they connect to Paypal to deposit to a bank account.

Handspring Visors: The Palm Operating System (OS) is licensed to other hardware vendors besides Palm Inc., and Handspring is one of them. With its eyed module digital camera and design build industry is able to capture and view digital images in color or black and white. Images can be labeled with real date and time, categorized renamed or annotated, but they still have good qualities compared to digital camera of today.

Other Mobile Devices

New versions of Palm continue to be built. For example, the Symbol Palm Terminal family includes of Symbol Bar Code Scanning function, which makes it a more advanced Palm unit. Its special design feature is the 4 foot concrete test, which allows the users to drop it on a concrete floor from 4 feet above without being damaged. Another one is Palm OS (3.5). It

supports color and includes cell phones. Overall, PDAs enable design-build users to access data fast at a high speed and high standard of accuracy. To decision makers, PDA is an easy and inexpensive device with the ability to provide relevant information.

2.1.1. The Effect of New Technology on Facility Management

When using an e-commerce plan, the facility manager becomes an immediate affect on the bottom line. The E- procurement/e-invoicing system allows subcontractors to submit their invoices through a secure Website. The system has a process for invoices to end with direct deposit into a subcontractor's bank account. In fact, this system helped the construction of moving many offices from Manhattan to Times Square in NYC by reducing the cost of an invoice from $120 to $1.

2.2. Trust Issues Related to Technologies on Facility Management

As it is stated above, new technologies have a tremendous effect on facility management. Nevertheless, liabilities such as the use of batteries to power the devices and the need to waterproof the devices etc. should be considered. Portable Digital Assistants (PDA) help to reduce cost and expenditure on a project, yet they might not work if they are subject to rough use or extreme weather condition or if the batteries run out. You could argue that an advanced PDA allows you to drop it on concrete floor without any damage being done, yet it is possible that you could drop the device from a tall building, especially when working in the construction industry. Should you rely on this technology? All the cell phone numbers and beepers of customers, boss, or co-workers are stored in the PDA. Once the device, the PDA, goes wrong, all the connections to these people will be lost. Not to mention, misunderstandings could take place if one Palm device works, and the other does not work. One person can send a message to another person,

but he/she does not receive it; consequently, the first person does not receive any feedback and thinks that the other person slacks off on his work.

In addition, an available file might be infected with a virus. The download process might go through successfully without no concurrent virus infection, if the Palm or Pocket PC malfunctions all the information that has been downloaded will be lost. The website from which the information had been downloaded could be no longer available and so it might not be possible to download the information again.

On top of the obstacles mentioned above, people could corrupt technology to deceive others. Since Handspring Visors are able to show real dates and times for all images, people can set different dates and times on these images. Therefore, one can corrupt this advantage for construction site images in case he/she is a little behind the project schedule and does not want the owners to know. This person can lie and say that they were taken weeks or months ago while they were actually taken more recently. The misinformed owners have no idea and believe that the project has progressed on time; so then later a disastrous time delay might take place, where the owner could have stopped it from the beginning if he/she knew about this from the start.

3. Possible Places to Find the Resources Need for Construction Industry

Besides Doherty's contribution of the Internet technologies provided to the construction industry, there are other places where you can find resources for the construction industry.

3.1. Essential Factors in Knowledge Management with Costs Products

3.1.1. Introduction to Costs Products

A good business organization is an organization in which the information—knowledge—is shared equally among team members; therefore, a system such as knowledge management is

needed to store all the documents. In the past, knowledge was kept and explained or showed to others by experts, who held the understanding, and it would leave along with the experts who left the organization. However, today technology such as the World Wide and other Internet media can handle the job easily.

3.1.2. Background of Costs Products

Since knowledge management is very important to an organization, buying and using a right COST product to enhance the knowledge management system will be helpful in decision making, profits, time, cost of the project etc. Hypertext Approach To Documentation And Management (HATDAM)—an online project proposal product, which consists of a Web-based COSTS—Livelink, is used by JPL and NASA. HATDAM together organizes and displays project proposals; then, together with its Livelink tool, HATDAM provides important features to allow team members meet their needs.

3.1.3. HATDAM Methodology

3.1.3.1 Functions of HATDAM

. Document Management:

This feature enables any user to view the whole collection of documents by moving all documents from HATDAM to its Livelink tool, yet for proposal team members, each one needs to have a Livelink account and some basic understanding of Livelink.

. Project Management and Collaboration:

Once involved members are able to use document management comfortably, they now can learn more advanced features such as task assignment, threaded discussion and workflow in there.

. Knowledge management, extensions and beyond:

After comprehending all the documents well, team members can make their own "knowledge indexes" to present information to other people outside of the project. They basically rebuild all the knowledge, which they have acquired, presenting them in different ways such as timeline, product breakdown structure and product list. Others are now able to choose a certain way to view the presentation.

3.1.3.2. HATDAM Essential Factors

User-Interface, Conceptual Modeling, and Customization:

Livelink increases the effectiveness of team project work; it obviously helps in building knowledge management among team members. However, to the public, external users, Livelink could be an unacceptable system due to the mismatch of information. As a result, project-oriented front-page for the public users is added to the system, where external users are able to search for projects and topics; team members, on the other hand, need to use login procedures for further use. This new page also has another use of projecting project information.

Applying Wizards to Knowledge Management Questions:

People normally face difficulties and have lots of questions when using a new technology. Accordingly, a wizard guide is needed to help them through the starting point and to answer their questions. Indeed, wizards focus on the KR^4—Resources, Repository, Retrieval and Reuse— of knowledge management.

. Knowledge Resources:

Some of the documents such as desktop MIME documents, static and dynamic Web pages, images, databases etc. are not easy to understand. Unfortunately, Livelink does not understand all of them, and that is when

knowledge resources becomes useful. Knowledge resources make sure custom-made information interpreters, automatic transformation of information from one form to another or generic database extractors are provided.

. Knowledge Repository:

This system is working with the recovery and search of stored or external information

. Knowledge Reuse:

Since knowledge is reused, depending on the original information and different forms of the same information, this system is concerned with the issue of how many reuse-related activities can be done here.

3.1.3.3. Integrated Infrastructure

People use knowledge management system through a Web-based interface, which is connected to HTML pages and Livelink. In addition, a separate institutional Oracle server, which contains Livelink and EMS (Electronic Meeting System), is available for Data Repository. Figure 3 shows how the system works.

3.1.4. Discussion about HATDAM

3.1.4.1. Internet Technology: The Enabler

Due to the complexity of new information technology and the high cost of new technology product, Web-based COST software is hard to be adopted by the users. Accordingly, dynamic HTML templates and SWAP protocol are created to enhance the use of Internet technology.

. Dynamic HTML Templates:

These templates are covered around with UI module (just like Livelink), and they are filled before bringing input and output screens (presentations) to the users. Because UI module is written within a standard HTML, the users can depend on any editing tool to adjust these templates. As a result, HTML templates make it easier to use the Internet.

. SWAP Protocol:

   a. Its function:

SWAP is used to put Internet/Intranet services together. Since it works with HTTP, the users do not need to make changes to adjust with the internal codes. In other words, no internal knowledge is required like using COST Software, yet SWAP still consists of many functions such as start, pause, resume, check, status, update and check results.

   b. How it works:

The users need to provide URL with appropriate data in order to make a request. The answer for this request will be provided after the request is sent to Web server/service presenter for help. In our knowledge management case, any request is external system, and any presenter is knowledge management system. Once the information is requested, the answers will be returned through HTML documents.

3.1.4.2. Users, Technologies, and Systems

Internet technology is strongly recommended for use in projects. However, there are two problems, which stop knowledge managers to post their information in the new technology. First, they have to follow some procedures for safety purposes. Second, different projects with their different knowledge managers have many requirements, which are not noticeable among themselves that can lead to misunderstanding and distrust.

Web

browser

Internet

Distributed

File system
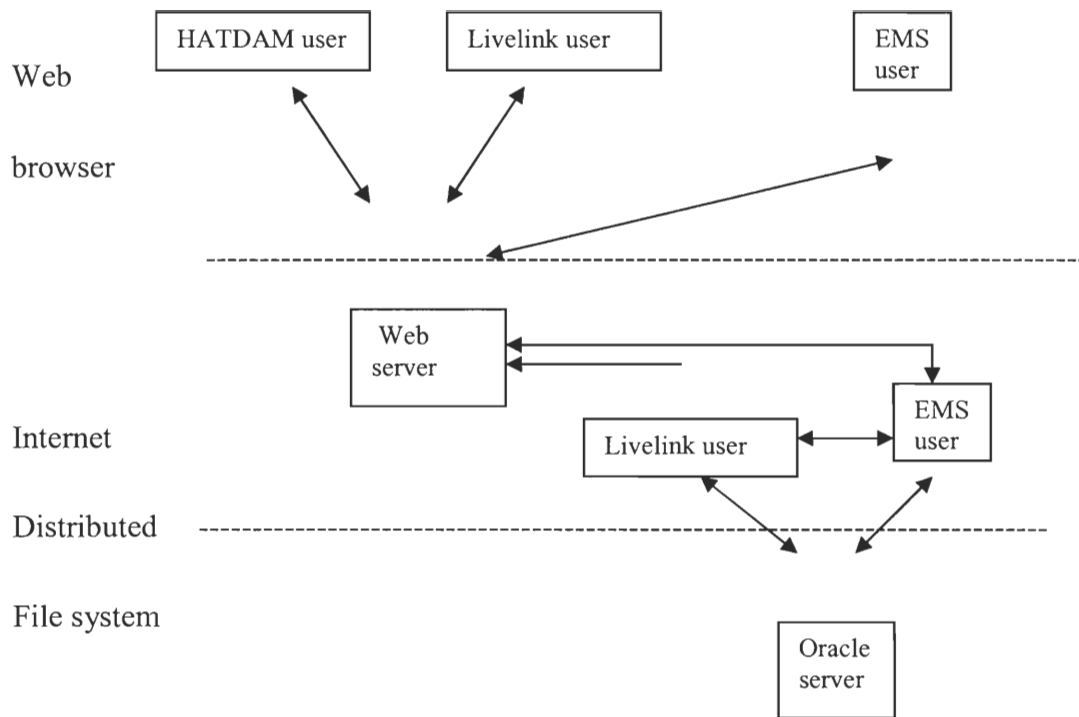
FIGURE 3: DATA REPOSITORY

3.1.5. Conclusion for HATDAM

HATDAM is a solid online product, which builds a strong framework for knowledge among team projects. Even though JPL and NASA were particularly tested on, we are still able to apply it on the construction industry. Nonetheless, as it was stated above, distrust might exist because of the differences in knowledge perception among knowledge managers, so it is possible that confusion may be arrived by using new Internet technologies. In addition, users have to have a basic understanding of how the system works or else you will clutter things around, so you can not present your ideas or share knowledge with others. On the other hand, if everyone is familiar with the software, information will move faster, and everyone will be happy to come together to learn more from one another. This system fosters the closeness between team members; people are friendlier and trust one another more. In short, it is your decision to depend

on HATDAM; it could help the communication among members, yet you have to know how to collaborate it.

Overall, Internet technologies provide a framework for knowledge among team projects, yet they need to take into the consideration of many other existed obstacles. These technologies are not completely reliable.

3.2. Citadon

Citadon website is ***http://www.citadon.com***

3.2.1. Scope of Citadon:

Citadon aims to improve project schedule, total cost and quality of products.

3.2.2. What is Citadon CW?

Citadon CW is online workspaces for design, construction and large projects. It is a combination of business process management and document management, which helps the communication among business organization. In fact, Citadon CW is a 5th generation program to use XML and ODBC. A little of training time and cost are needed in order to use Citadon CW because it blends the Windows-based users and browser-based interface users together.

3.2.3. How Citadon CW Works

Figure 4 shows how citadon works

3.2.4. Citadon Methodology

Citadon uses different methods to make the site works.
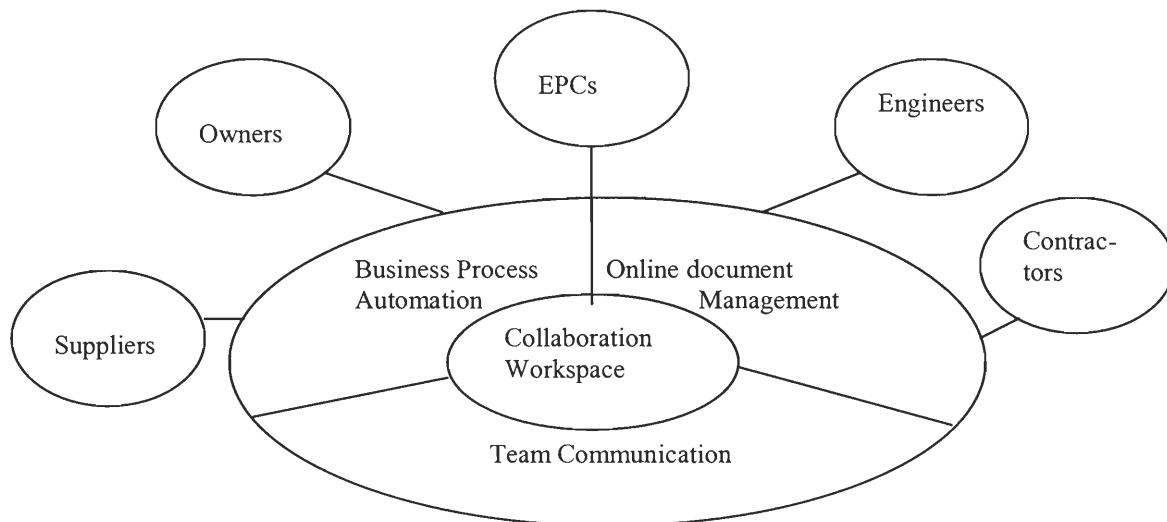
FIGURE 4: CITADON CW

3.2.4.1. Business Process Management

It is a method to reduce project insufficiencies and costs, enhancing ways to make the project faster than schedule; it also eliminates costs and control risks.

3.2.4.2. Document Management

This method provides services for document by using the browser or directly inserting into Windows desktop. Everyone is able to create, share, review and reduce documents in here. All organization can receive the newest information. In addition, it allows communication among geographic or global teams and automatically updates and reviews project documents. Lastly, team members can check progress of the project and read entire history of the project.

There are many useful features in document management including:

. Document redlining, issues and RFIs that allows members to review, add, comment or change on project drawings, contracts etc.

. Able to view over 25 file formats (Auto CAD, Microstation, MS office, PDF, JPEGs etc.) without the need of installing additional application software.

. Multi-file upload and download.

. Advanced search for particular projects.

3.2.4.3. Enterprise Implementation

1. Planning:

    . Understanding business needs, processes, segmentation of business units and project types.

    . Evaluation of infrastructure redlines.

2. Visioning:

    . Review business processes and legacy applications.

    . Determine best approach to product adoption.

3. Configuration:

    . Working sessions to build templates for project deployment.

4. Strategize:

    . Determine educational needs of users.

    . Review and approval of the implementation plan.

5. Implementation:

    . Execution of the implementation plan.

3.2.4.4. Citadon Application Programming Interfaces (APIs)

This feature opens the door for external enterprise client applications to enter Citadon application functionally. By using HTTP/XML (SOAP) technology, client application is allowed to exchange data with Citadon application.

3.2.5. Citadon Consulting

1. Systems Integration Consulting:

    This program helps to the understanding of "integration objectives" and

    deployment of Citadon products. It is a combination of technical expertise and

    industry acumen on the Internet for business use. These services lead to the

benefits of decreasing time-to-market, reducing risk and providing a base for sharing and incorporating.

2. Technology Consulting:

    Consultants in Citadon can help construction teams in:

    . Evaluating legacy systems.

    . Identifying areas that can have a negative impact during project roll-out.

    . Addressing all technical and security concerns

    . Recommending technology updates that work within existing business, technology and security models which ensures timely project starts.

    . Assisting in effective implementation of new technologies.

3.2.6. Citadon Results

Again, Citadon improve the communication among team members and reduce cost of overall project. It, indeed, leads the products to the market quicker than expected.

3.2.7. Citadon Discussion of Results

Even though Citadon enhances a faster time to accomplish a project, it does require time to learn how to use the site:

1. A Getting Started Workshop:

    Four to six hours training class to show how to use Citadon CW application on fundamental use of task management, document management, form creation, workflow and online communication tools.

2. Advanced Citadon CW:

    One day training class to show how to use Citadon CW on engineering and construction projects.

3. Citadon CW Administration:

One day training class showing CW Managers instruction on project site

administration, workflow, setup, security setup, creating programs and reporting.

3.2.8. Citadon Versus Trust

Citadon is a wonderful workspace for design, construction and projects; especially

document management method endorses sharing, creating, reviewing and reducing documents.

The problem is whether to trust available written documents up there or to trust others to post

important information. On the other hand, if the history of the project posted up there looks

good, people would have more confidence, and trust would be built up. Trust generates more

trust. Furthermore, if team members constantly update project progress, when others see

changes on drawings, comment etc. they will know that other members work hard, so they trust

each other more. The workspace also permits external enterprises to read documents, which

makes them feel they know exactly what is going on.   As a result, these external enterprises trust

the company more.

3.3. Web-based Project Management/ProjectNet (http://www.new-technologies.org/ECT/Internet/projectnet.htm)

3.3.1. Blueline Online

3.3.1.1. The Need for Blueline Online

Time consuming and information exchange are the two most essential aspects in A/E/C

(Architecture/Engineering/Construction) project management. Web-based project management

is believed to be very helpful in dealing with these difficulties.

3.3.1.2.The Technology of Blueline Online

With the use of Internet, ProjectNet was developed on Blueline Online system. It allows team members to work collaboratively and to share important information quickly and safely. All the documents are stored and updated daily in this system to make sure everyone is on the same page at all time, which then leads to a faster time to the market, reduces cost, increases revenues and eliminates misunderstanding between team members. The main focus of ProjectNet is the idea of "partnering"—guiding the owners, the planners and architects to complete their task. It allows the teams to communicate quickly and effectively. Overall, it serves for the design, engineering and construction industry, helping the industry to accomplish the project ahead under budget.

3.3.1.3. Blueline Online Benefits

To confirm the advantage of ProjectNet, the following benefits are again emphasized:

. Products can be delivered quicker to the market.

. Control is increased.

. Revenues are also increased

. Members from different geographies can have the newest information all time

. Costs are lessened.

3.3.1.4. Blueline Online Status

ProjectNet 3.3 is currently using Palm and Windows CE devices to assist the collaborated teamwork in AEC system.

3.3.1.5. Blueline Online Barriers

Even though AEC is a large industry—estimating $ 3.2 trillion—it often goes against technology change more than other industries.

3.3.2. ProjectCenter

ProjectCenter is another website that could be used in the construction industry.

3.3.2.1. The Need of ProjectCenter

The cost of paper work is about 1-2% of the total project cost, and FedEx(US)'s shipping cost is about $500 mil/year for distributed teams. Therefore, ProjectCenter was developed to overcome this obstacle. It is a web-based project management tool where team members from different locations are able to share information, documents, drawings and strategies.

3.3.2.2. The technology of ProjectCenter

Many new technologies are included in ProjectCenter system:

1. Oracle and Resides are used at Exodus Communication.

2. Palm Scanners are used to enter and exit the server.

3. Bricsnet server must be authorized by Bricsnet personnel to use

4. Multiple Sun E-450's are in the servers.

5. Sun A-1000 disk is available on Sun Netra T-1

6. ProjectCenter is connected to the internet.

3.3.2.3. ProjectCenter Benefits

. Members are able to control any document in ProjectCenter

. Automated document conversion

. Allows teams to create, review and print documents

. AutoCAD, IntelliCAD and MicrostationCAD are included.

. Members have the power to control who is able to see the information and when.

. By moving the users from previous project administrators can set up new projects in minutes

. Members can create the menu structure.

3.3.2.4. ProjectCenter Barriers

There are certain requirements to use ProjectCenter:

. Computer with Internet access

. E-mail account

. Java-enabled web browser software: The viewer applets for CAD drawings are based on Java Development Kit Version 1.1 (JDK 1.1). Therefore, a JDK 1.1 compliant browser is required.

3.3.3. Internet-based Services for Construction

The followings will be discussed about Internet-based Services for Construction.

3.3.3.1. The Need of Internet-based Services for Construction

Due to the advantages in communication with the web-based., project Management, many global construction companies has been applying this technology.

3.3.3.2. The technology of Internet-based Services for Construction

There are two ways that construction companies can rely on Internet-base services, in-house development or outsourcing this activity to a professional consultant.

1. For in-house development, a company needs to be aware of its financial technical and human resources. Web-servers can be hosted by the company for project we use.. In addition, web-enabled and web-based project management software can be built into the system.

2. By outsourcing this activity to a professional consultant way, companies can hire consultants to make web pages that meet their advertising needs. ConstructionNet and AEC Info [MT] will build free limited web pages for the construction industries. Moreover, Extranet project services are available from fee-base project management centers.

3.3.4. Web-based Project Management and Trust

Web-based project management allows people from all over to work together closely and effectively. It allows partnerships between team members to develop into friendships. The result is that a trusting work environment is created effortlessly. However, problems might occur place when designing a company's webpage for your company. The people that know the company well do not have the expert skill to make the web-site for it. They could hire a consultant to design it, yet he will not know as much as you do about the companies and their current project. So, should they have faith in this consultant and believe that he has an adequate understanding of the company after it is explained to him? Should they trust his work and suppose it conveys the correct information to the viewers of the site?

3.4. Web-based Learning Systems (http://www.new-technologies.org/ECT/Internet/placeware.htm)

3.4.1. Placeware: Web Conferencing

3.4.1.1. The Need of Web Conferencing

Web Conferencing is an efficient, worldwide and inexpensive training program. It reduces the cost and time associated with an in-person meeting and sending a trainer.

3.4.1.2. The technology of Web Conferencing

A combination of phone calls and live web-based, visual interaction is the heart of PlaceWare Web Conference. The system allows trainers to control meetings and present their message effectively by using a wide variety of visual content. More importantly, participants are able to get more attention depending on their ability to comprehend the lesson by asking text-based questions, reviewing slides, chatting and indicating their "mood" through the seating chart. However, people should be careful and ask the other party for permission to allow others to attend the conference. The following is a model of the system.
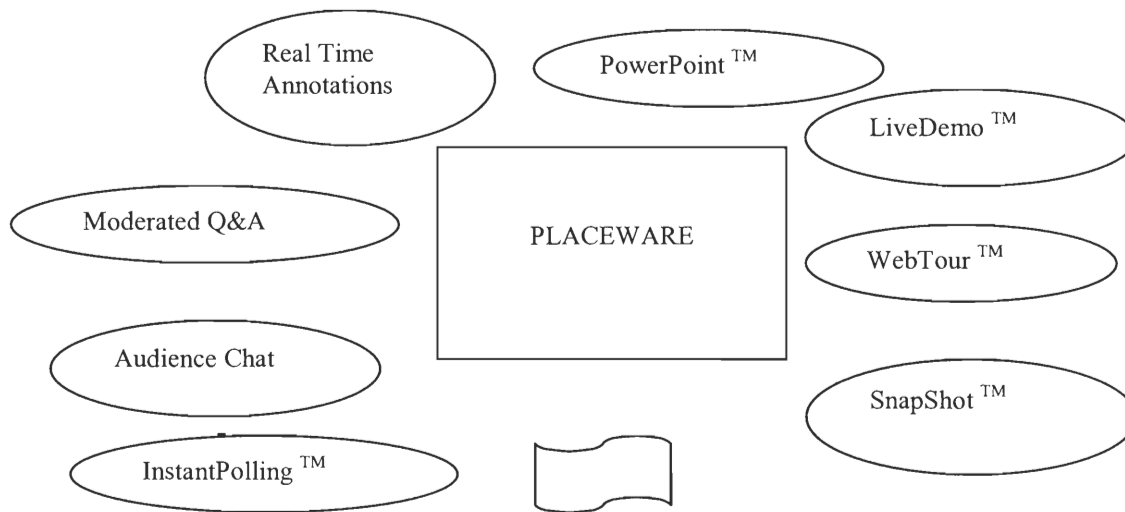
FIGURE 5: PLACEWARE

The advantages of the web-conference are

- . Browser-based

- . No Plug-ins required

- . Hosting

- . Intuitive audience and presenter interface

- . Use existing PowerPoint

- . Drag and drop uploading

. Easy create new content

. FireWall Transparent

. Up to 2,500 concurrent users

. Low bandwidth

3.4.1.3. Web Conferencing Status

PlaceWare's Conference Center 200 ^{MT} is the newest version.

3.4.1.4. Web Conferencing Barriers

Time will be used effectively if the participants' Internet connection is slow.

3.4.2 GC's Online Institute (http://www.new-technologies.org/ECT/Internet/agc.htm)

3.4.2.1. The Need of GC's Online Institute

Online Institute can provide education and training effectively and inexpensively to new employees in order for companies to increase construction volume.

3.4.2.2. The technology of GC's Online Institute

Associated General Contractors Online Institute can educate employees who have web browser version 3.0, Microsoft Internet Explorer, Netscape and plug-ins such as Adobe Acrobat reader, RealPlayer G2, Shockwave and flash Players. Instructors in this institute frequently check on Project Management courses and are available to answer student questions at any time. It consists of three Centers: learning Center, Faculty Center and Administration Center.
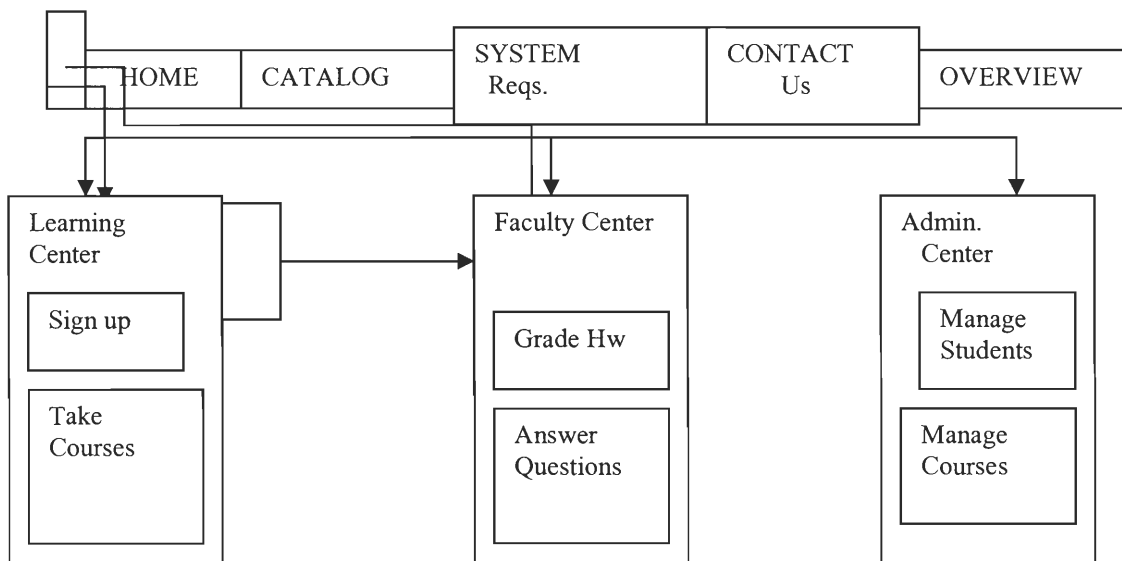
FIGURE 6: ONLINE INSTITUTE

3.4.2.3. Benefit of GC's Online Institute

The training is processed through the Internet; as of now there is no limit to the number of participants, and the participants are encouraged to work at their own pace.

3.4.2.4. Status

Project Management is currently taught within courses: Pre-planning, Short Interval Planning, Conducting Effective Meetings, and Equipment Utilization.

3.4.2.5. GC's Online Institute Barriers

Topics are limited. For now, it only focuses on Project Management.

3.4.3. Web-based Learning System

Although the web-based learning system provides great opportunities for people to run meetings and training sessions online, it lacks face-to-face interaction. Think about the interactive classroom environment. If everything is easily thought through the Internet, nobody would have to go to school. People tend to learn more by working with their peers and their teachers. The Internet, on the other hand, provides no interaction besides that of the computer

and the students, so there is no motivation to inspire learning. Therefore, it is the students' decision to trust the technology or, in fact, to trust that he or she will overcome this obstacle and walk toward success.

3.5. e-Marketplaces

3.5.1. ProcureZone.com (http://www.new-technologies.org/ECT/Internet/procurezone.htm)

3.5.1.1. The Need of ProcureZone.com

In a construction industry, the owners hire engineers and architects to create special functions for the engineered product on their project. The owners' purchasing department sends these special functions to the suppliers; then the suppliers send back technical responses to the engineers or architects but keep the commercial responses. Finally the department combines these two responses before the bid—out of 100% cost for the product, 10% of it is the process cost. However, there are still problems existing in this kind of organization such as inefficient communication, idiosyncratic specs, redundant specs, inefficient product comparison, inefficient supplier searches, bad incentives and lack of management control.

3.5.1.2 The technology of ProcureZone.com

ProcureZone.com is an online organization containing many services such as: "estimating the cost of a purchase; preparing and issuing detailed specification and complete requests for proposals; requesting bids from selected suppliers; communicating with bidders; receiving, comparing and evaluating bids; negotiating offers and conducting auctions, issuing purchase orders with all required attachments; making payment and monitoring schedules and deliveries." Most importantly, ProcureZone.com constructs templates for engineered equipment where all organizations can compare the bids from suppliers.

3.5.1.3. ProcureZone.com Benefits

There are many advantages in using ProcureZone.com including lower search and transactions costs. Team members in construction industry can find partners to transact with more easily. Engineered goods can use one ground bidding and negotiated bids. Online auctions of engineered goods are in real-time. The most essential advantage of ProcureZone.com is that architects and engineers enable any buyers to get involved so that they understand the process. This site prevents many of the typical problems that occur during transactions over the phone or fax by eliminating much of the paperwork. In fact, the site prevents unnecessary customization of specifications and reinvention of the same specifications. It allows supplier searches to be more comprehensive than the scope of the project engineers' personal knowledge.

3.5.1.4. ProcureZone.com Status

ProcureZone.com has been used effectively for awhile.

3.5.1.5. ProcureZone.com Barriers

People are not applying this new technology quickly. All the users must have hardware and Internet.

3.5.2. PrimeContract.com (http://www.new-technologies.org/ECT/Internet/primecontract.htm)

3.5.2.1. The Need of PrimeContract.com

The construction industry has many tasks to take care of such as scheduling, control, regulation, analysis etc. Therefore PrimeContract.com—an online marketplace—is needed. PrimeContract.com allows the buyers to compare the price and availability of product from different companies.

3.5.2.2. The technology of PrimeContract.com

The PrimeContract.com network is a three-tier software design relying on JAVA in a UNIX environment. It basically supports the bidding component of construction. With PrimeContract.com, construction companies can bid for subcontracted work, send RFQs/RFPs to approve contractors and to search for matching contractors. Once contractors respond to available project bids, their responses are put in a bid summary spreadsheets for review. Furthermore, by using this site, the owners are able to compare the cost of different companies. Therefore, they always find the best price for their project. The contractors, on the other hand, can easily advertise their products more on the site and can communicate more effectively.

3.5.2.3. Benefits of PrimeContract.com

. The buyers have the power to control the project.

. Tools for scheduling and contract management such as Primavera Enterprise and Primavera Expedition, are available.

. Communication is saved for futurer need.

. Everyone is allowed to look for sources online.

. The project is accomplished in less time than it was estimated to take.

3.5.2.4. PrimeContract.com Status

PrimeContract.com builds mainly for the A/E/C online market.

3.5.2.5. PrimeContract.com Barriers

. Fragmentation of the AEC and EPCO "industries."

. Lack of technology infrastructure, especially by smaller contractors.

. Slowness of technology adoption across the supply chain in the AEC industry.

. Pricing practices of suppliers, manufacturers, and contractors.

. Myth that a product like this will not allow for "relationship-type" selling.

3.5.3. Builder SupplyNet-Online Trading Community (http://www.new-technologies.org/ECT/Internet/bsn.htm)

3.5.3.1. The Need of Builder SupplyNet-Online Trading Community

Builder SupplyNet is a password-protected, subscription-based online community, which creates a better relationship between general contractors, builders, subcontractors, suppliers and service providers.

3.5.3.2. The technology of Builder SupplyNet-Online Trading Community

SupplyNet is based on the UUNET network. The system links Hamiton software and SQL databases. In this system, people—sellers and buyers—are able to look for products or departments of their interest in real time. They can also pay online, e-mail to ask for bids, seal bids, send messages or orders to one or many individuals, to pass on blueprints, and check e-mails

3.5.3.3. Builder SupplyNet-Online Trading Community Benefits

. Exchange information easily.

. Asks for bid in many areas.

. Eliminating the need for contracts to meet in a particular location.

. Compare the results of different teams, so as to choose the best one possible.

. Saves time normally spent over the phone and the fax.

. Sends one-time and limited time opportunities to customers to get the best deal.

. Selects products through e-mail.

3.5.3.4. Builder SupplyNet-Online Trading Community Status

SupplyNet 5.2 has been used since the fall of 1999.

3.5.3.5. Builder SupplyNet-Online Trading Community Barriers

. Limit geographic market, not totally worldwide.

. Cost $99 per month.

3.6. Information Services

3.6.1. ISqFt AGC Network (http://www.new-technologies.org/ECT/Internet/isqft.htm)

3.6.1.1. The Need of ISqFt AGC Network

IsqFt Network (Associated General Contractors) help decrease the time and cost of traveling and reserving a meeting room. Bidding projects are shown on this site, which allows team members in construction industry to discuss them thoroughly.

3.6.1.2. The technology of ISqFt AGC Network

There are four main parts in IsqFT:

1. Internet Plan Rooms:

   IsqFt and local market own this part, so a portion of the fee associated with a meeting room is given to a local group. It is available to everyone.

2. The ISqFt Construction Office:

   Documents are delivered and stored safely in the management system of the construction Office. The function relies on a dial-up modem connection to download full sized, blue-prints, in less than one minute. After that if necessary, one can order full sized paper prints or files to scale the blueprint. By using this system, the owners have the ability to control the subcontractors

and the suppliers, setup real-time online meetings and view prints or documents. The most special function is that the system automatically e-mails and faxes a message to participants when document changes are made.

3. BuilwarePro (Toolbox):

Its task is to evaluate electronic blueprints on-screen and to transfer related components in an Excel workbook.

4. The Project Desktop:

Construction companies depend on Project Desktop to find new bids and to work collaboratively with the existing customers. The Desktop also has the ability to download plans. It later uses the Toolbox to save the plans.

3.6.1.3. ISqFt AGC Network Benefits

1. Eliminating cost associated with copying and sending blueprints.

2. 24 hours service.

3.6.1.4. ISqFt AGC Network Barriers

Companies have to pay for their computers and the network.

3.6.2. BidExpress – Online Bidding with Digital Sign (http://www.new-technologies.org/ECT/Internet/bidexpress.htm)

3.6.2.1. The Need of BidExpress – Online Bidding with Digital Sign

Bid Express is needed to use Trns.port Expedite TM software, which prepares bids. It is used for highway construction industries. In fact, the Department of Transportation in 36 states currently use Expedite. The software is very easy to use; the users only need to send a bid to BidExpress through Expedite.

3.6.2.2. The technology of BidExpress – Online Bidding with Digital Sign

Security is very tight in BidExpress. Only the Department of Transportation can read bid files. In fact, BidExpress has the same security system as the National Security Agency, banking industries and Interent Commerce. It is available online, and the software is free.

3.6.2.3. BidExpress – Online Bidding with Digital Sign Barriers

None

3.6.3. Mimio-Digito Technology for White Boards (http://www.new-technologies.org/ECT/Internet/mimio.htm)

3.6.3.1. The Need of Mimio-Digito Technology for White Boards

Construction industries can reduce work by applying mimio to projects. It receives handwritten, color drawings and text as real-time data even in a different time zone.

3.6.3.2. The technology of Mimio-Digito Technology for White Boards

Once mimio is hooked up to a whiteboard, it relies on infrared and ultrasound technology to capture any writing or drawings on the whiteboard. After that, it transfers the information onto a computer. When everything is in the computer, team members are able to revise, print, share, export the drawings to HTML or to put the whiteboard notes into window's application. In addition, the INK files can be saved as JPEs and can be shared on the Internet.

3.6.3.2. Mimio-Digito Technology for White Boards Benefits

4. To the Users:

    a. Handwritten words are transferred into text quickly.

    b. Check for spelling errors

    c. Allows team members to fix unclear and misspelled words.

    d. Has a cordless printer that function like a computer mouse.

    1. To the Construction Industry:

Improves communication among presentations, training seminars, corporate training sessions, remote team meeting, distance-learning classes and networked brainstorming sessions.

3.6.3.3. Mimio-Digito Technology for White Boards Status

Around 50,000 miminos are in use, 40% of them outside of the country. Massachusetts Institute of Technology will soon use mimio for the Singapore MIT alliance, a distance learning program.

3.6.3.4. Mimio-Digito Technology for White Boards Barriers

None declare.

3.6.4. Polycom.ViaVideo-Video Conferencing (http://www.new-technologies.org/ECT/Internet/polycom.htm)

3.6.4.1. The Need of Polycom.ViaVideo-Video Conferencing

ViaVideo enables members of the construction industry to meet and share important documents from different locations. By providing conference room quality video and audio distance-based communication is enhanced.

3.6.4.2. The technology of Polycom.ViaVideo-Video Conferencing

Polycom is a video communication. Through its full-duplex audio with echo cancellation, it shows full-screen, full-motion 30 fps business-quality picture. Members can add headset/Mic, headphones or speaker to the Audio In/Out port of ViaVideo.

3.6.4.3. Polycom.ViaVideo-Video Conferencing Benefits

To the Users:

a. Real-time collaboration, sharing and chat.

b. Ability use with Ethernet, Token Ring, Cable, DSL, Frame Relay, FDDI, T-1 and ATM.

c. End to end video communication.

To the Construction Industry:

Communication during presentations, training seminars, corporate training sessions, remote team meetings, distance-learning classes and networked brainstorming sessions is more effective.

3.6.4.4. Polycom.ViaVideo-Video Conferencing Status

ViaVideo has been using all over North America and several areas in Europe, Asia and Central/Latin America since the year of 2000.

3.6.4.5. Polycom.ViaVideo-Video Conferencing Barriers

In order to use ViaVideo, the members need a USB port, Windows 98. Second edition or Windows 2000, a 350 MHz Pentium-class processor with MMX, 128MB RAM, 4MB video memory, SVGA display (800*600) and an IP-based network.

3.6.5. Akamai Streaming (http://www.new-technologies.org/ECT/Internet/akamai.htm)

3.6.5.1. The Need of Akamai Streaming

Akamai Streaming is a Web-centric marketplace. It contains webcasts and many other streaming application services relying on Edge Advantage [TM]. Through its FreeFlow Stream, Akamai sends business information through the Internet.

3.6.5.2. The technology of Akamai Streaming

Akamai Streaming works through On-demand Media and Webcast Media. On-demand Media allows users to place file's URLs. Media changes to ARLs so that the information is accessible on the Internet—the Stream is finally sent to the users. The process when terrestrial or satellite stream transmit to Akamai Entry Point on the carrier's network is called Webcast Media. After transmitting, the stream technology breaks the stream into little streams then reconnects to form a great image.

3.6.5.3. Akamai Streaming Benefits

a. Broadcast quality and performance.

b. Global reaches.

c. Largest audience capacity.

3.6.6. Evoke Communications (http://www.new-technologies.org/ECT/Internet/evoke.htm)

3.6.6.1. The Need of Evoke Communications

Evoke Communication is a meeting planer. Members can change the time of the meeting anytime before the meeting occurs. It allows team members to share information online.

3.6.6.2. The technology of Evoke Communications

The system uses the Internet for chat, question and conference. Team members just need a web browser, a sound card and a speaker, which enable them to listen to and view documents at the same time.

3.6.6.3. Evoke Communications Benefits

To the Users:

Instant access, shared visuals, webcasting, recording, web conferencing controls, participant lists, note-taking capacities, Q&A tools and conference locks.

To the Construction Industry:

Evoke Communication helps in human resources, executive, marketing, sales and training in the industry.

3.6.6.4. Evoke Communications Status

Evoke Communication includes Web-based voice, video and a Java-based media player. Lycos is currently in an agreement with Evoke Communication.

3.6.6.5. Evoke Communications Barriers

A standard Web browser, a minimum of a 28.8kbps connection to the Internet or participation in a Webconference, Internet Explorer 4.0 or higher on a Window Systems and Netscape Navigator 4.0 or higher on Windows Macintosh machines are needed to use Evoke.

3.7. Network Technology and Equipment

3.7.1. Armstrong 1-ceiling-Wireless Systems (http://www.new-technologies.org/ECT/Internet/armstrong.htm)

3.7.1.1. The Need of Armstrong 1-ceiling-Wireless Systems

Cell phones and laptop computers can not be used in a certain buildings or a basement due to technical service

3.7.1.2. The technology of Armstrong 1-ceiling-Wireless Systems

Armstrong 1-ceilings Wireless System serves as ceiling panels. Indeed, Armstrong's WL2 Series of Antenna Panel, which contains 850/1900 MHz dual band voice antenna, one 1900 MHz voice antenna and two 2400 MHz antennas, can be used for voice and data storage.

3.7.1.3. Armstrong 1-ceiling-Wireless Systems Benefits

a. Improves the communication at the work place.

b. Reduces oversight concerns.

3.7.1.4. Armstrong 1-ceiling-Wireless Systems Status

Armstrong World Industries Inc. invented this new technology, and it has been spreading worldwide since February 1st, 2001.

3.7.1.5. Armstrong 1-ceiling-Wireless Systems Barriers

Armstrong 1-ceilings require the antennas for use, but they only cost about $.10-$.15 per square foot.

3.7.2. Bluetooth – Short-range Radio Technology (http://www.new-technologies.org/ECT/Internet/bluetooth.htm)

3.7.2.1. The Need of Bluetooth – Short-range Radio Technology

Bluetooth can be hooked up to any electronic device within 10 meters to eliminate the use of cables for connecting two devices. It can also link data networks to peripheral interface.

3.7.2.2. The technology of Bluetooth – Short-range Radio Technology

Bluetooth functions as a short-range radio, 2.45 GHz, and supports data of a highest speed of 721 KBPS and 3 voice channels. It works by signaling between two devices for information exchange.

3.7.2.3. Bluetooth – Short-range Radio Technology Benefits

a. Connects devices between two devices within a 10m rouge.

b. Allows e-mail to be checked with a in mobile phone instead of a computer.

c. Can connect a computer to the Internet while in a briefcase or pocket.

d. Phone-line hook up is not necessary for checking e-meetings, documents, calendar appointments etc. on the Internet.

3.7.2.4. Bluetooth – Short-range Radio Technology Status

Originally, it was found by Ericsson, but companies such as IBM, Lucent, Microsoft, Motorola, 3Com, Nokia and Toshiba are now involved in the technology.

3.7.2.5. Bluetooth – Short-range Radio Technology Barriers

None.

3.7.3. Starband $_{SM}$ – Satellite Internet Service (http://www.new-technologies.org/ECT/Internet/starband.htm)

3.7.3.1. The Need o Starband $_{SM}$ – Satellite Internet

Since not everyone has Internet access in the U.S., Starband service does not require the use of phone lines or cable modems to connect to Internet. It is a two-way, on high-speed satellite Internet Service, which works greatly for the construction industry.

3.7.3.2. The technology of Starband $_{SM}$ – Satellite Internet

The need for a telephone connection for Internet access is replaced with the need for a satellite modem attached to a PC through a USB port or a pre-configured desktop PC. A 24 by 36 inch satellite dish for the Starband system should be placed on the roof so that signal between the antenna and the satellite is sent to the Starband system.

3.7.3.3. Starband $_{SM}$ – Satellite Internet Benefits

As stated above, StarBand is a two-way, high speed Internet connection with nationwide availability and will soon have multicast capability.

3.7.3.4. Starband $_{SM}$ – Satellite Internet Status

Starband is used everywhere in the U.S. except for Hawaii and Alaska. However, it will be there and in Puerto Rico soon.

3.7.3.5. Starband $_{SM}$ – Satellite Internet Barriers

It costs about $49.99 per month and $399.99 for equipment installation. The installation has to be done by a professional.

3.8. Web-enabled Engineering Software

3.8.1. VizStream: Streaming 3D Technology (http://www.new-technologies.org/ECT/Internet/vizstream.htm)

3.8.1.1. The Need of VizStream: Streaming 3D Technology

VizStream, a streaming technology, can be replaced by a 3D non-streaming technology increase to speeds and improve the distant client relationship.

3.8.1.2. The technology of VizStream: Streaming 3D Technology

VizStream 3D connects to a non-stream 3D without needing time to downloading anything (even works over 28.8 KBPS modem.) It has 3D capabilities even in a low bandwidth connection. To do that, VizStream scans objects that are viewed by the user. Then it sends what it sees in a single stream so that the user sees the objects in greater detail. There are three parts in this technology: VizStream server, VizStream Client and VizStream API. The VizStream server consists of 3D model, running in Window NT. The WizStream Client runs in Windows 95/98/NT has Active X Control/Viewed and permits the members to connect to VizStream. Lastly, the VizStream API has the extensive API for third parties.

3.8.1.3. VizStream: Streaming 3D Technology Benefits

With those functions listed above, VizStream enables the construction industry to work together three dimensionally in real-time. As a result, this technology allows market to be distinguished form others, sales to be presented in 3D, users and technicians are able to help and support each other.

3.8.1.3. VizStream: Streaming 3D Technology Status

RealityWave Inc discovered VizStream. The system consists of the VizStream Webkit TM, a 3D Web and ConceptWorks TM, CAD design program. To access the Webkit, members need to pay $1800 for the server and five users and $360 for each additional user, or they can hook up with a 3DSP account for $15 a month per user for a minimum of two users and three months service.

3.8.1.4. VizStream: Streaming 3D Technology Barriers

VizStream only works with Microsoft NT and Internet Explorer 4.0 or higher.

3.8.2. VRML Application in Construction

3.8.2.1. The Need of 3.8.2. VRML Application in Construction

The construction industry needs to work with web-based 3D technology instead of the old 2D CAD.

3.8.2.2. The technology of 3.8.2. VRML Application in Construction

The NIST Construction Group relies on VRML, Web-based 3D to do the work. They foresee the advantage of presenting steel structures in object modelers by VRML instead of geometrically through CAD. In fact, they only need a VRML browser to perform their job in "The NIST Fire Research," Facility Emissions Control System," "A User-Control Excavator,

Tower Crane and Dump Truck," and "Virtual Cybernetic Building Tested" to permit beams and other building elements use steel structure to control issues related to construction site activities and lastly to take care of fire and HVAC system.

3.8.2.3. VRML Application in Construction Benefits

The present of Web-based 3D makes it easier to model structures as well as complete project in general. Steel structures can be viewed in an object-like-fashion, which makes it easier to update or extend them.

3.8.2.4. VRML Application in ConstructionStatus

NIST is currently using VRML.

3.8.2.5. VRML Application in ConstructionStatus Barriers

VRML depends on CAD application and protocols to function.

3.8.3. PrologWebSite (http://www.new-technologies.org/ECT/Internet/prolog.htm)

3.8.3.1. The Need of PrologWebSite

Prolog WebSite is a software program which enables contractors, architects, engineers and subcontractors to communicate more quickly.

3.8.3.2. The technology of PrologWebSite

Prolog WebSite has two main features, document management and data management. Document management organizes all the files for viewing, redlining and annotating, and data management. In short, the Prolog Website provides the connection between local members and Internet browser members by working with Prolog Management 5.0. It allows them to create project specific websites without needing company web pages.

3.8.3.2. PrologWebSite Benefits

    a. Teamwork.

    b. Real-time communication

    c. Allows members to monitor project information

3.8.3.3. PrologWebSite Status

Gilbane Construction began using Prolog WebStie for its $12 million BassPro Shops building in Houston, Tx. In addition, Haskell Company considers the Prolog WebSite a central "knowledge base" for its projects.

3.8.3.4. PrologWebSite Barriers

 Can not use any software program other than the Prolog Website.

3.8.4. Design Review and Checking System (DrCheck) (http://www.new-technologies.org/ECT/Internet/drchecks.htm)

3.8.4.1. The Need of Design Review and Checking System (DrCheck)

A special software is needed for the A/E/C industry to come together to learn or exchange knowledge and experience.

3.8.4.2. The technology of Design Review and Checking System (DrCheck)

DrCheck is a software that enables team members to log-in through a free web browser software to review the experiences of others. It contains the Corporate Lessons, Learned System, which can recognize faulty during the review.

3.8.4.3. Design Review and Checking System (DrCheck) Benefits

    a. Cheaper cost than current technology, only 5% of the total project cost.

    b. Gives feedback.

c. Training needed to use browner software.

3.8.4.4. Design Review and Checking System (DrCheck) Status

Nine Corps of Engineer District Offices, the U.S. Department of State's Foreign Building Office, and the U.S. Bureau of Reclamation currently use DrCheck.

2.8.4.5. Design Review and Checking System (DrCheck) Barriers

Must have Internet access.

CHAPTER 5

INFORMATION TECHNOLOGIES AND THE INCREASE OR DECREASE OF TRUST

BASED ON HOW ONE APPLIES THEM

Trust develops closeness, trust builds friendships; and creates a easier working environment. In the past, the only way for people to trust each other was in spending time together or working together in person. Due to the fast pace of today's modern world, when discussing about trust, one has to consider technology.

Especially in a business environment, not only do face-to-face meetings or written letters play an important role in organizing a project but information technologies such as the Internet and electronic mail as well. Such technology is used when Internet software allows team members in the construction industry to chat, mail, work or learn together online. For instance, HATDAM allows project proposals to be displayed. Citadon focuses on developing a better project schedule, lower cost and quality products. Blueline Online and ProjectCenter helps team members share information so that they can work together efficiently. GC's Online Institute provides education and training program for team members. Besides these software, there are many other softwares with similar functions that distribute information among parties and help others complete projects successfully. However, when using these software, people have to account for the development of trust within the system. Accordingly, the question of how information technologies impact the level of trust among parties must be answered.

In doing this research, we must look at other research to learn more about the impact of technology on interpersonal trust among team members. After that we will explore the organizational levels of trust. Conversely, we are not trying to uncover how much trust and information technologies are related, yet we are trying to find a way in that problem to be discovered.

1. Interpersonal Trust and Information Technologies

In Roxanne Zolin and Pamela J. Hinds' research, (Zolin and Hind, 2002) "Trust in Context: The Development of Interpersonal Trust in Geographically Distributed Team," trust between distributed teams and collocated teams are compared. The authors focus on geographically distributed teams in which team members communicate without meeting face-to-face by using new technologies. Accordingly, Zolin and Hinds develop many hypothesizes to be investigated.

The first hypothesis is "trust will be lower in distributed dyads than in collocated dyads." The authors believe that members of distributed teams live in different areas, so they use technologies such as the telephone, video and teleconferencing, Internet chat, and facsimile to communicate. As a result, the team members are unlikely to trust each other. They also account for the fact that in different locations, people have different work schedules, different beliefs, cultural contexts, social norms, etc. Without face-to-face interaction, the team members have a hard time to understanding each other and negotiating. As a result, the authors conclude that team members do not trust each other.

The second hypothesis is "members of distributed teams will modify their trust of one another over time, but lesser than will members of collocated teams." The authors suppose that trust changes over time even though distributed teams do not meet face-to-face; therefore, team members hold trust from the beginning toward the end, and often times, they develop faulty perceptions. Even team when members gradually adapt to the use of technologies, they still have a hard time developing trust amongst themselves.

The third hypothesis is "in distributed dyads, team members' trust will be predicted by perceived risk more so than in collocated dyads." More risky situations lead to less enjoyable work experiences, so trust is withheld in risky situations. In addition, uncertain or untested

technologies create difficulties in completing projects because team members have different understandings and different perceptions of the new technologies.

The fourth hypothesis is "trust will be more important to performance in distributed dyads as compared with collocated dyads." The belief that trust is a contribution toward performance leads to an investigation of the disadvantage of communicating with distributed dyads which make team members hold doubts more than trust in their minds.

After interviewing 12 different teams, where the members were seventh and eight generation the Computer Integrated Architecture-Engineering-Construction of West Coast University, the authors obtained valuable information for the hypothesizes. Using ANOVA analysis, the researchers found no significant difference between the trust of distributed dyads and that of collocated dyads after one month. By using 2 AMOS models to compare the level of trust for distributed teams and collocated teams between month one and month three, Zolin and Hinds disproved the second hypothesis. To test the third hypothesis, risks were added to the AMOS model, and the result shows that distributed teams do not have a higher level of perceived risk than collocated teams. The followings are AMOS models.

MODEL 1: Collocated teams
Perceived Performance→ Perceived trustworthiness→ Trust
(month 1)   (month 1)   (month 2)
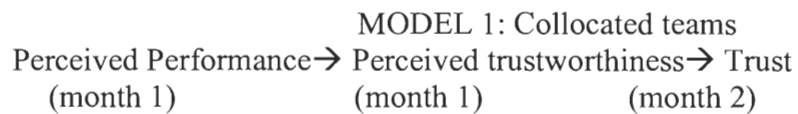
FIGURE 7: COLLOCATED TEAMS

MODEL 2: Distributed teams
Perceived Trustworthiness→ Perceived Performance→ Trust
(month 1)   (month 1)   (month 2)
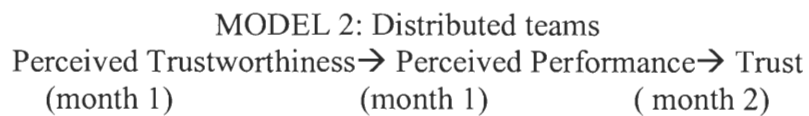
FIGURE 8: DISTRIBUTED TEAMS

MODEL 3: Collocated Teams
Perceived Performance→ Perceived trustworthiness→ Trust
(month 1)   (month 1)   (month 2)
                      Trustor's risk ↗
                      Trustor's reward
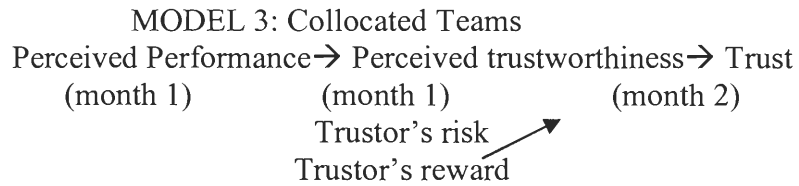
FIGURE 9: COLLOCATED TEAMS

MODEL 4: Distributed Teams
Perceived Trustworthiness→ Perceived Performance→ Trust
(month 1)   (month 1)   (month 2)
                   Trustor 's risk
                   Trustor 's reward ↗
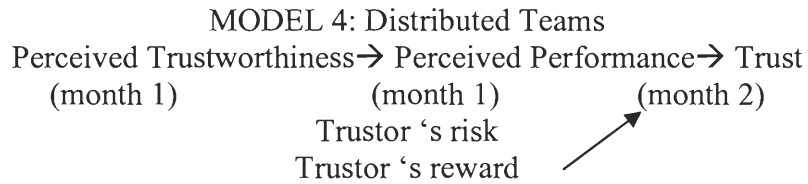
FIGURE 10: DISTRIBUTED TEAMS

To test the last hypothesis, the authors used courses that student had taken in the past to perceive risks and rewards. It is implied that the more courses taken, the better the student's performance. The perceived risks indicate the difficulty of the project. The rewards indicate the motivation to perform. The assumption was that if the perceived risk is slow and the reward is high, students will perform well. Afterward, the authors add the variable trust into the model by increasing trust levels between month one and month three, yet performance was not effected. Hence, the researchers concluded that trust was not more important to distributed teams than to collocated teams.

Overall, Zolin and Hind are saying that trust is the same in both distributed team and collocated team. Supposedly, the lack of face-to-face meeting forces distributed team to use more technologies—telephone, video and teleconferencing, Internet chat, and facsimile —which would decrease the level of trust within the system. However, research findings indicate that the level of trust stays the same. Accordingly, technologies do not have any effect on the level of trust among team members.

2. The Development of Questionnaires for the Application of Information Technologies

2.1. Introduction

Similar to Zolin and Hinds' research, we focus on the potential controversy between information technologies and trust by conducting questionnaires to be the basis of this research. Relying on the cost-trust relationship in the construction industry, information technologies are the main purpose of these questions.

2.2. Methodology

First, we completed a literature review. We examined trust and its definition. We studied the development of trust, and its relationship to information technologies, mainly the Internet. After that, we carefully researched the importance of trust in the construction industry. From there, we learned about information technologies—what are available and how they work. We tried to identify the relationship between information technologies and the construction industry. We presented as much guidance as we could about the software that are helpful to construction industry. However, at the same time, we also reminded the readers how the use of this could discourage, promote or have no effect on trust depending on how team members perceived them, how familiar team members were with them and how much faith they had on the software as well as the new technologies. Furthermore, we looked at Roxanne Zolin and Pamela J. Hinds' research, "Trust in Context: The Development of Interpersonal Trust in Geographically Distributed Team," to get a general idea of how information technologies impact the levels of trust. However, unlike Roxanne Zolin and Pamela J. Hinds' research, we focused more on organizational trust rather than interpersonal trust, and we are not trying to find the answer to how information technologies and trust are related but attempted to develop a reliable method to answer that question.

After developing a concrete idea of how to go about answering the question, we began conducting our survey. Originally, we started with long and detailed questionnaires. However, due to time constraints and the purpose of the research, we shortened our questionnaires. We tried to construct solid yet simple questionnaires. Six versions of the survey were constructed before determining the final structure, which includes three main parts plus a summary section— a) a trust section, b) an experience in the construction industry section, and c) the use of information technologies section.

The trust section consists of two questions. These questions simply bring attention to the importance of trust in project cost. It is a common belief that developing trust is important in completing a quality project. Since the research has so much to do with trust in the construction industry, a person should believe or somewhat believe this relationship is important or else the result would not be reliable. Therefore, this section—more or less—is the key to this research (See figure 11).

The experience section consists of three questions. They basically identify the role and the familiarity of the person in the industry with the kind of work he/she performs mostly. We wanted to make sure that we selected the right individuals in the industry. We also wanted to compare the responses of older folks who had been in the industry before the technologies were in use and the younger folks who had grown up with the technologies. We assumed that older folks are less aware about the growth of technologies. Lastly, we identified how competitive the individuals' working environment is when evaluating the responses (See figure 12).

The use of information technologies section consists of six questions. This portion of the survey produces the bulk of the data. In these six questions, five of them deal with the usefulness of different Internet software for project work and the amount experience in using these software. We wanted to demonstrate the need for information technologies these days, and depict how these individuals feel about them. One question compares the old style of

communicating with using new information technologies. The purpose of this question is to contrast trust in the past with that of the modern day present (See figure 13).

Finally, the summary section consists of two questions which ask the individuals to give their overall opinion the trust-information technology relationship and to provide their idea of how to improve the research. We wanted these individuals tell us their thoughts and their belief about how information technology affects on trust in the construction industry (figure 14)

Trust Section

1. Trust is believed to be a factor in reducing project costs, while lack of trust in business relationships is related to inefficiencies and increased project costs. Do you agree with this statement?

Yes

No

Depend. Please explain

2. Base on your experience, how does Trust between contracting parties develop?

FIGURE 11: TRUST SECTION

Experience on Construction Industry

1. Which of the following typically describes your role in construction project?

Architect

Project Manager

Civil Engineer

Contractor

Subcontractor

OwnerOther.

2. Which of the following better reflects your experience in the construction industry?

Less than 5 years

Between 5 and 10 years

Between 10 and 15 years

Between 15 and 20 years

More than 20 years

3. Your experience has been developed by working mostly in:

Private Project:

20%-40%   40%-60%

60%-80%   80%-100%

Public Project:

20%-40%   40%-60%

60%-80%   80%-100%

FIGURE 12: EXPERIENCE ON THE CONSTRUCTION INDUSTRY

Use of Information Technologies

1. To what extend do you use information technology such as electronic mail and the World Wide Web Internet communication in your project work?

   All the time

   Often

   Seldom

   Never

2. To what extend have you used information technology in project management application such as bidding on-line, project web-site, etc.?

   All the time

   Often

   Seldom

   Never

3. Provide a brief description of the project management application that you have used

4. In your experience, has the use of information technology affected in anyway the existing level of trust between the contracting parties in the project?

5. If you have never met a person before, would you share projects related information in electronic forms (Internet, e-mail, etc.) with that person?

   Yes   No   Depend.

6. Please explain-Rank the following 1-highest, 5=lowest in term of important for development of trust and relationships. Enter zero if the choice is not applicable

   Face-to-face   Phone

   Fax   Writing (Paper writing)

   Electronic Interaction

FIGURE 13: USE OF INFORMATION TECHNOLOGIES

Summary Section
1. Overall, what is your opinion of how does information technology impact the level of trust between contracting parties in construction industry?
2. Would you please provide us with ideas that could help improving the results of this study?

FIGURE 14: SUMMARY SECTION

2.2. Running the Survey

Professional individuals whose jobs are related to a project within the construction industry— particularly, architects, project managers, civil engineers, contractors, subcontractors and owners—were chosen to complete the survey. They were selected because they work in the industry, and have an idea of how important trust is in a project. We wanted an accurate response to fill the potential for a more comprehensive study. Therefore, we were not looking for a massive response from just anyone in the industry, but rather a careful selection of individuals that we knew had experiences dealing with trust or technologies in the construction industry. We wanted them to clearly express their thoughts and specifically express experiences about the impact of technologies on the level of trust.

Eighteen individuals were selected from various organizations in both private and public sectors. They are professionals from different regions of the US. We sent the survey through e-mail and met some of them face-to-face. A few surveys were sent to individuals we did not know, yet trusted to have the same level and skill in the construction industry. All professionals from the East Coast work in different companies and do not know each other. Some of the West Coast professionals, however, work in the same sector and might have worked on projects together. All individuals took the same survey, and all of their answers have been given an equal weight.

CHAPTER 6

RESULTS

The literature allows researchers to become familiar with the experimental subject. Surveys or interviews are the basic of the study. However, the study would not be valid without responses. The following sections summarize the responses we have collected from professional individuals.

1. Part One—Trust Questionnaires

Most people agree that trust is an essential factor in reducing project cost. A minority believe that trust does not have anything to do with project cost. One project manager who has been in the industry for more than 15 years commented, "if trust is indeed a factor in reducing project cost, then it must be a small factor. Among other factors in reducing project costs are careful planning and an intimate knowledge of the proposed project combined with a realistic construction budget." The responses of this minority do not completely disagree that trust is important in project work. We discovered that although they spoke against the common belief, they still consider trust to be important in the construction industry, which is demonstrated in the next result. 75% of these professionals answered "yes" or "depend" to the question, "If you have never met a person before, would you share projects related information in electronic forms (Internet, e-mail, ect.) with that person?" This shows that these three individuals do acknowledge that trust is very important in the construction industry. If not, they would not care whether to have met the person in order to share information. The one individual who said no to this question is an owner. Because I am assuming owners normally are not involved in the conflicts among contractors, project managers, designer, ect, they do not have a clear idea about trust in the construction industry. Not to mention, the owners give demands to others but do not receive demands themselves. Even so, his response is still reliable for the study.

Two civil engineers believe that you cannot answer "yes" or "no" to the question. One said, "[I] agree for the most part, but in a competitive environment, if the project is already low, then contracting business will choose a more trust worthy [such as] performance, quality and work relationship company." The other thinks that even though trust is vital, ethics is more significant. Figure 15 shows the overall outcome of this question.

TRUST IS BELIEVED TO BE A FACTOR IN REDUCING PROJECT COSTS.

DEPEND, 11%

BLANK, 5%

NO, 22%

YES, 62%
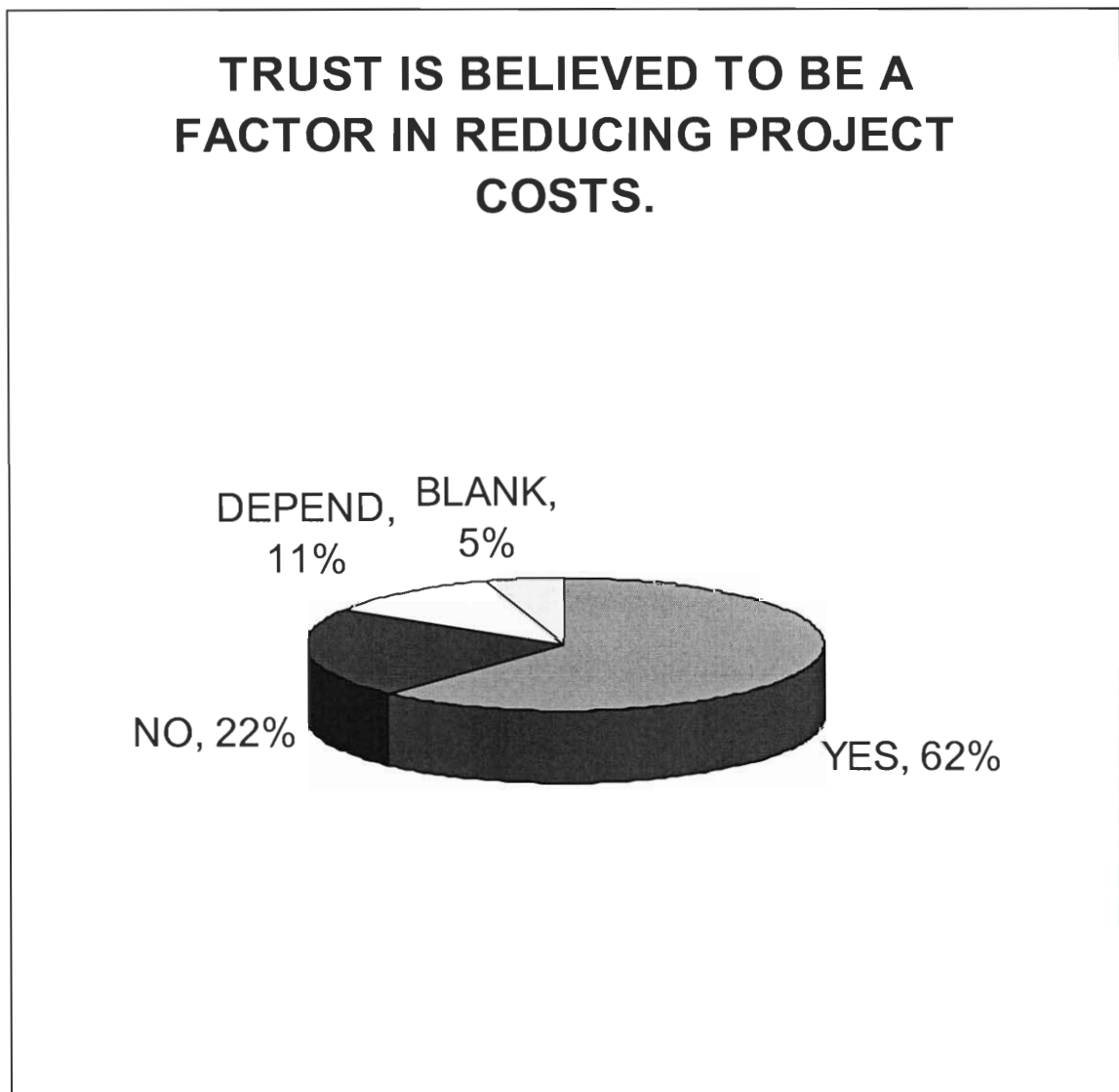
FIGURE 15: TRUST IS BELIEVED TO BE A FACTOR IN REDUCING PROJECT COSTS

Consequently, in general, trust is confirmed to be a major factor in reducing project cost.

Regardless of whether people think trust plays a vital role in project cost, when asked how trust is developed, a common answer is found. Everyone seems to agree that a successful previous relationship, open communication, honesty, ability and reliability are important keys in

developing trust among parties. In fact, difficulties such as short cuts, hiding costs or up fair pricing need to be avoided, and a mutual understanding of project needs and expectations needs to be created.

Part 2—Experience in Construction Industry

According to the data obtained from the survey, about two-third of the participants of the study were project managers and civil engineers. We also collected information from professionals who have been in the industry for a long period of time (See figure 16 and 17).

The most interesting information obtained is that 94 percent of these people dealt with public work throughout their career, and only 6 percent work for private projects (See Figure 18).

PART 3—USE OF INFORMATION TECHNOLOGIES

Regardless of the title or experience the professionals have, less than one quarter of them said that they have never used or seldom use information technologies. The others use information technologies all the time or very often. They frequently use programs such as XPM, WPS, Web base project site (Project Solved2), Word Processor, MS Project, MS Database Applications, MS suit of programs, MS Scheduling, Primavera Scheduling, Spread Sheet, CAD(including computer Aided design and drafting or CAICE software and Microstation), Suretrack, Internet, Intranet, E-mail, Video Conferences, Quick-base, Prolog PM software, Timberline Accounting, Bidding Online Software, Hotline, CSJ Bid Hotline, Public Word Project Databases, Capital Improvement Projects (CIP) databases, CIP on web, A web program developed from the city of San Jose to keep track schedule, Scanning of all document for a project and Suretrack.
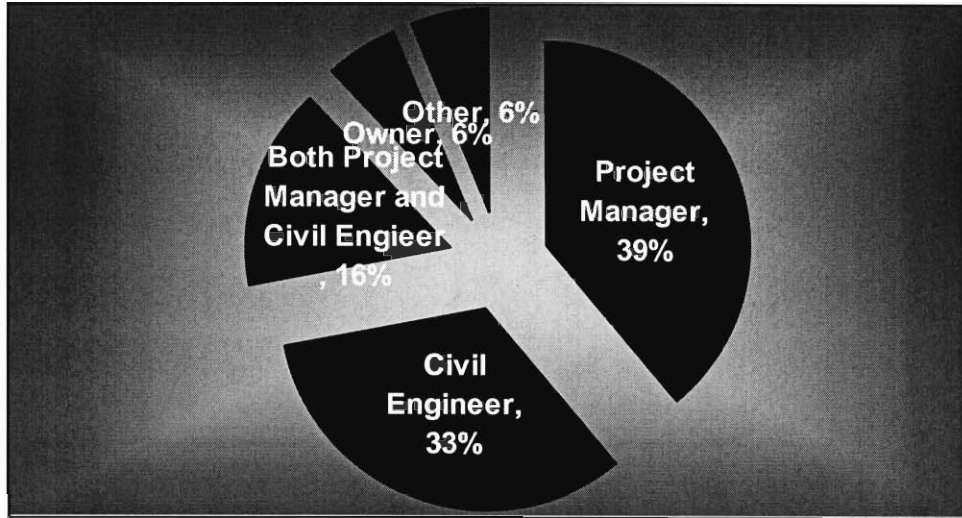
FIGURE 16: ROLE IN CONSTRUCTION INDUSTRY
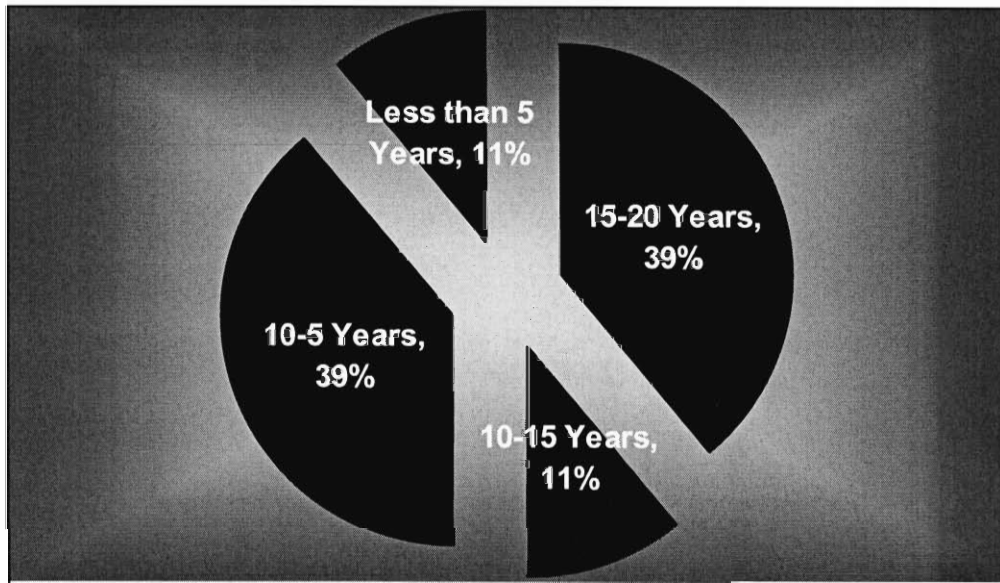
FIGURE 17: EXPERIENCE IN CONSTRUCTION INDUSTRY
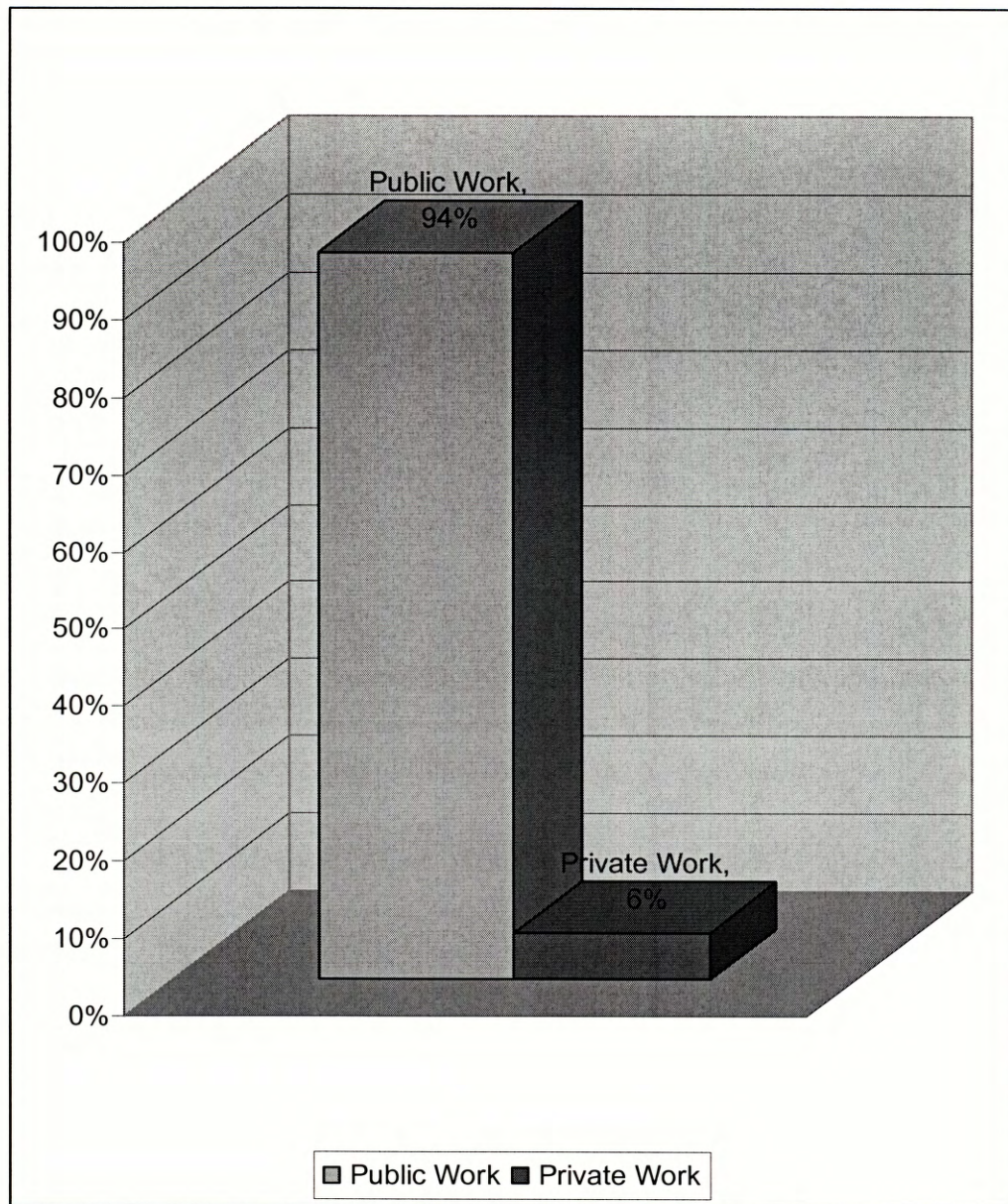
FIGURE 18: EXPERIENCE OF PROJECT WORK

Half of these professionals indicate that information technologies have no effect on the

level of trust in project, and 39 percentages, also from experience, confirm that by using

information technologies, the level of trust increases among contracting parties. They have

observed that information technologies, specifically the Internet and E-mail, have a positive

effect or no effect toward the level of trust. Ironically, 27 percent of these individuals would

share project information in electronic form to a person whom he/she has never met before. The rest say they would not share information this way, or it would depend on what type of information needs to be shared and the level of involvement that is required. When ranking which method of communication is most important in escalating trust between parties, the result is shown in Figure 19.
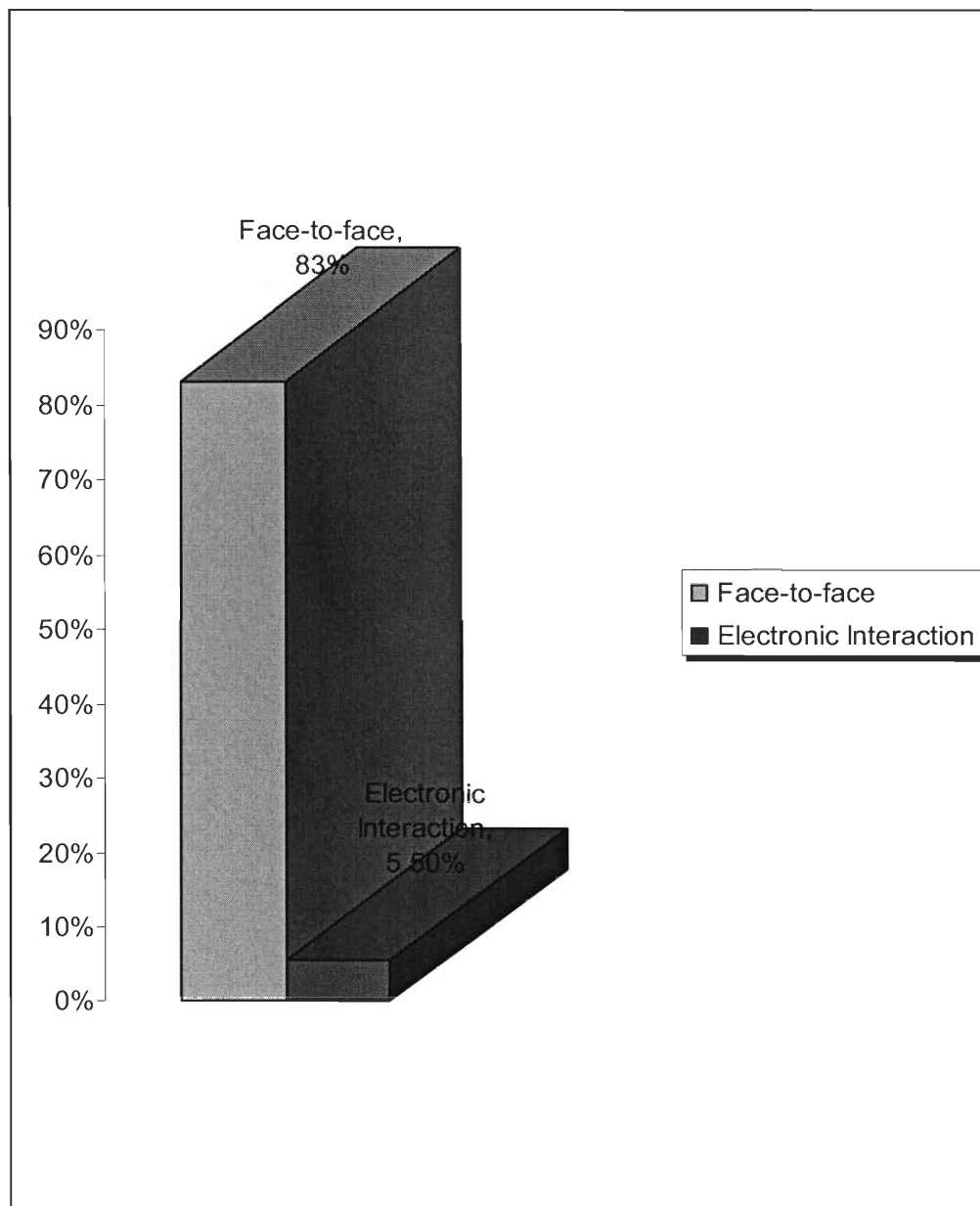
FIGURE 19: DEVELOPMENT OF TRUST BY FACE-TO-FACE VS. ELECTRONIC INTERACTION

The phone typically falls into the second highest method of communication; fax falls into the lowest or the second lowest category, and writing letters consistently falls into the middle categories.

Furthermore, when asked for their opinion of how information technologies impact the level of trust between contracting parties in the construction industry, half of these individuals acknowledge there is no substitute for face-to-face communication. One individual from Daniel Architects comments, "[Internet] makes it harder. I have no idea of what/who is on the other end, nor the extent of that other side of terminal. Only proven, secure technologies should be used in public work." With the same opinion, another individual from San Jose City Public Works states, "[…] trust is an issue concerning how two personalities interact, not the medium they use to communicate. I have no problem communicating with anyone by electronic means. I would suspect that many in the construction industry and legal and government fields would prefer verbal conversation for a controversial issue, rather than written communication […]" On the other hand, there are couple individuals who think that information technologies strengthen and improve the level of trust between parties. One individual expresses, "Information technology does not and should not effect the level of trust; it is only a means for faster and better communication." Another declares, "It has an effect of speeding up the efficiency process that exists on the scope, spec, plans or communication of the project."

CHAPTER 7

ANALYSIS OF THE RESULTS

The statement "trust is believed to be a factor in reducing project costs, while lack of trust in business relationships is related to inefficiencies and increased project costs." seems to well reflect the perception of most professionals in the construction industry. However, there are still a few individuals who believe the opposite. On top of that, a small group of individuals said that trust-cost relationship depends on how competitive the bidding environment is and how much profit would be made on a project. The remaining one third does not consider trust as an essential factor in reducing project cost. These opposing beliefs do not depend on the level of experience of these individuals in the construction industry. Indeed, half of these individuals have been in the industry for more than 15 years. As a result, almost half of these professionals do not see why it is necessary to consider the trust-information technology relationship. Nevertheless, it does not mean that one third of our result is not reliable. As we explained in previously chapter, although these people speak against the common belief, they subconsciously hold the same belief as other professionals in the construction industry.

Similarly to Zolin and Hind's work, this research centers on the trust-information technology relationship. While Zolin and Hind's work centers on the relationship among member of distributed location, this research centers on trust and information technologies among contracting parties of the same or different locations. The result of this research agrees with Zolin and Hinds' work, which basically states that information technologies do not have any dreadful effects on the trust level. In addition to Zolin and Hind's work, this research has found that information technologies have brought a positive outcome toward the trust among contracting parties.

Although the majority of the professional individuals who participated in the survey recognize the convenience of information technologies, they do not depend on information

technologies to share information related to current projects to members whom they have not met before. More importantly, they assert that face-to-face communication is always the best way to build trust between contracting parties. For those reasons, information technologies have obviously increased the level of trust between contracting parties, but they cannot replace face-to-face interaction.

Nevertheless, responses to this survey do not provide certainty to this conclusion. We cannot only examine the surface of these responses. We must understand them at different angles. First, these professionals are very skeptical, and their responses are inconsistent. Even though they have experienced that information technologies only promote faster and better communication, they still know the value of face-to-face communication. They are certain that information technologies either have no effect at all or a positive effect toward the level of trust between contracting parties, yet to them if there is no face-to-face meeting, information is not shared using these technologies.

According to this result, I assume that trust increases at decreases in different stages when using information technologies. However, the first three stages are always the same and are very important.

In the first stage, communication through information technologies is the same as face-to-face. When two people meet and begin working together for the first time, they do not know anything about each other. They might be honest with each other and provide the right information up front or they might not. They are strangers. Likewise, on the Internet, when someone receives an e-mail to another person for the first time, it is difficult for that person to trust the e-mail. The person do not know if the attached documents are the ones he was supposed to receive from the other party, nor does he know if that piece of information is reliable. Accordingly, trust is not established at this stage.

In the second stage, information technologies increase the level of trust significantly. Time is needed to develop trust either face-to-face or through the Internet. In face-to-face communication, trust is developed after two people work together and see each other for awhile. In communicating over the Internet, two people will trust each other after chatting, sending and receiving documents for a period of time. The only difference is that when trust is already established, information technologies help to save time spent corresponding so that the project can be accomplished faster. Contracting parties do not have to meet to discuss a small problem. Documents can be sent and received in couple minutes. Internet technologies may promote trust between parties because project work is accomplished in an efficient manner, so parties on both ends know the other members are working hard.

In the third stage, although information technologies allow work to go more quickly and more smoothly, face-to-face meetings provide a clearer understanding of how project work is moving along. Perhaps, facial expressions, body language interpersonal and interaction create assurance for individuals. For instance, on the Internet, words alone are used to express problems to other contracting parties while face-to-face meetings allow individuals to use your gestures and their tone of voice to help explain difficult problems in addition to words. During face-to-face meetings, the contracting parties will not only perceive the problems but will have an idea of how to solve the problems according to what they see and hear. Therefore, developing trust in this stage is easier from face-to-face meetings than from information technologies.

As shown from these patterns, information technologies could increase or decrease trust depending on the difficulty of the project. When things are moving smoothly and efficiently, information technologies allow the project to more further, thus saving time and money. However, if a problem exists, face-to-face communication is a better way to ensure trust between individuals. .

To illustrate the stages of trust, we should examine the development of this study. The members of my team—the advisor and I—worked remotely. Similarly to the experiences of Zolin and Hind's subjects, the advisor and I met at first to discuss the purpose of the project. At this point, we trusted each other in the expected performance rather than in proven performance because my advisor had never worked with me before, nor had I worked with my advisor.

After receiving the project, I went back home to California while he remained in Massachusetts. We were separated for about four months before we met again. During this period, we relied on information technologies in order to communicate, mainly the Internet. He would e-mail me to tell me what I needed to do and to correct my work. I would respond by e-mailing him my corrections. In spite of our different environments and background—for example, he is a professor, I am a student, and he was in a university working with other students while was home for the summer—somehow we began to trust each other. He trusted that I tried my best to work on my project at home even though it was summer time for me, and I trusted that he paid attention to my work and would understand it when I ran into obstacles with my research, instead of assuming I was just slacking off and complaining.

The greatest difficulty in communication was the time zone difference. Massachusetts is three hours ahead of California. Sometimes, I would ask questions in the morning, around 9 AM or 10 AM Western time, which is lunch time in the East Coast—12 PM or 1 PM. I would have to wait a few hours later to receive responses to my questions. In the mean time, I would work on other parts of the project. If I sent questions to my advisor later than 1 PM Western time, which is 4 PM Eastern time—the time people leave their work place to go home, I would have to wait until the following day to receive answers. Although frustrating, the time differential did not create a major problem.

Regardless these minor obstacles, the project went forward without any face-to-face communication for four months. However, when I came back to Massachusetts and met with my

professor in person, I was able to discuss the project with him more easily, and I got a better idea of what I had to do. Most importantly, I now had more faith in the project than I had before. For some reason, which can be attributed to the personal contact during that meeting, I started to believe that my project was more interesting than I had thought when I was in California. In fact, the face-to-face meeting made me more confident that I could complete the project well and motivated me to work hard. Even so, we still used e-mail as a main form of communication during project because it is not worth the time and effort to set up a meeting when only a small question is concerned. If there was a major difficulty, I would set a meeting so that I could speak with the advisor in person.

As was shown, the progress of this study illustrates the various stages of trust. Simiarly, to Zolin and Hind's discovery, this experience confirms that technologies do not have a negative effect on the levels of trust. In fact, information technologies and face-to-face communication are complimentary each other; one transfers information faster; the other provides clarity in solving difficult problems.

In addition to these stages of trust, the certainty of the project also depends on who the professionals work for. About 75 percent of the professionals in this study work for government firms rather than private sectors. These professionals work in a more competitive environment where cost-trust relationship is not as important as it is in private sector. Besides, more than three quarter of these "government" professionals work in the same firm. Their responses to the study may be similar since they have had similar projects and experiences in working under the same corporate structure.

Consequently, there is no definite outcome of this particular research as will there ever definite outcome for trust-information technology relationship. Information technologies are the means for faster and better communication. Face-to-face communication can solve the more difficult problems because it provides a clearer understanding. A project will be completed

easier if both form of communication exist: that through information technology and that of face-to-face. A good example is that the survey of this research was posted on the web, and e-mails were sent to invite professionals in construction industry to complete it. This approach was thought to be effective. Only a few individuals responded, those who were friends of the author or known by the advisor. In deed, the individuals who responded trusted the author and the importance of the study. The others did not respond to the survey after the survey was printed out. Professionals working in the same firm were interviewed in person who had previously received an invitation to complete the survey. The most surprising fact is that some of these responses were not hand written but typed and printed. One professional, who was helping me, asked if the survey was available online so that everyone in the company could do it and send it through my e-mail. Therefore, without gaining trust with them by face-to-face meeting, I would not receive any response. However, after gaining the trust of others, information technologies helped me complete the research effectively.

In conclusion, based on the outcome, a few recommendations are made about the trust-information technology relationship. First, when using information technologies—Internet—one has to trust the technologies and build trust with the other parties in order to create an effective relationship. Second, when trust is already established between two parties, one should rely on the efficiency of information technologies to proceed with the project. Third, when difficult problems persist, face-to-face meetings are necessary to remedy the issue quickly. It is important that one use good judgment in deciding which forms of communication are appropriate for the circumstances. In short, information technologies and face-to-face are complementary to each other; one should not be used without the other.

CHAPTER 8

CONCLUSION

The study provided a literature review on the definition of trust, and how it is developed through face-to-face or the Internet. We carefully examined the growth of trust in the construction industry and looked at other research to verify the importance of trust in reducing project costs. We also learned different types of information technologies, and how we could imply them in the construction industry. At the same time, we try to gain the readers' attention to how these information technologies could affect positively or negatively on trust—the trust on the information technologies or the trust between contracting parties.

A survey was created to collect data from the professionals in the construction industry about their experiences to correlate trust and information technologies between contracting parties. This survey was posted on a website, and e-mails were sent to the professionals in the construction industry to invite them to visit the website. At first, only the professionals who were friends of the author or were introduced by the advisor helped to answer the survey. There were a very few other professionals who were introduced by those above professionals contributed to the study. Due to lack of responding from these professionals, the survey was handed to these professionals by face-to-face meeting. As a result, more data was pulled together.

Eighteen professionals in the construction industry contributed their effort for the study. From the data obtained, information technologies help to increase faster and better communication between contracting parties; however, face-to-face communication is a way to remedy the issues difficult problems. In either case, trust is not developed at first, yet it will be developed gradually by working and interacting through a period of time. Therefore, information technologies do not have a negative effect on the level of trust, and if trust is formed in the beginning, then information technologies are the sources to generate more trust as time

goes by.   Nevertheless, the project will be done smoothly and perfectly if face-to-face is also

complimentary to information technologies.

APPENDIX A

1. Electronic Mails or E-mails

1.1.1 How to Use E-mail

When you first sign up with an ISP (Internet Service Provider), you are prompted to create username. You should use your real name or something close to it for business purposes. After choosing a username, the e-mail address is just your username added to the service provider (Ex: Yourname@yourISP.com)   To send an e-mail, you go to "Mail" option, then select "Create/Compose Mail," type the receiver's e-mail address, write your message; and finally press the "Send" button.

1.1.2. Anatomy of a Mail Header

Every e-mail has a header, which resembles a postal mark. This header contains information: e-mail address of the recipient, e-mail address of the sender, date and time, message id, e-mail router, type of e-mail software being used, an indicator whether an attachment is involved, type of information in the e-mail such as ASCII text, full name of the sender in parentheses, and finally a subject on what the message is about.

APPENDIX B

1.2.1. How Does Attachment Work?

Internet software encodes non-text messages—known as binary files—to make the Net think that the message is no different from that of a plain text e-mail. Once the recipient receives the e-mail, the attached files will be decoded into their original form. Programs such as XferPro, MIME, BinHex and UUencoding/UUdecoding are available to encode and decode non-text e-mails.

3.2.2. Which method to use?

The Macintosh system has no option besides using BinHex. True BinHex compresses files to make their size smaller. Compression is very important.

UUencode/Uudecode are the most commonly used methods. However, if the software is MIME-compliant and offers files in Base64, that is a better method. UUencoding/UUdecoding will eventually be replaced with MIME/Base64. The only problem is that the recipient must have a MIME program, or else the decoding will not take place. Uuencode/Uudecode is still useful in these cases.

APPENDIX C

1. LISTSERVs

1.1. ISTSERV Guidelines

1. Information on LISTSERV is private.

2. Pressing the reply feature will respond to everyone on the list. Therefore, to reply a certain people e-mail addresses must be retyped.

3. To send a post/e-mail:

   To: LISTSERV Topic@domain.name

4. The users have to type a subject to identify the e-mail

5. To unsubscribe from a LISTSERv:

   To: LISTSERV Topic@domain.name

1.1.2. Observations and Discussion Group Tips

- Reading messages before posting messages

- Read FAQ's before joining

- Follow all guidelines

- Reference is recommended because Usenet groups might have people from different countries and cultures

- Mailing lists must be taken seriously

- Do not answer questions which are not related to the main subject

- Unsubscribe when taking a break and leaving the computer

- Should be shortened before using them to reply a message.

APPENDIX D

Results Obtained

Trust Questionnaires

1

Yes			
Yes			
Yes			
Yes			
Yes			
Yes			
	No		If trust is indeed a factor in reducing project costs, then it must be a small factor. Among the major factors in reducing project cost are carefully planning and intimate knowledge of the proposed project combined with a realistic construction project.
Yes			
	No		
Yes			
		Depend	Agree for the most part. But if project cost is already low (in competitive environment) then contracting business will choose more trust worthy (performance, quality, work relationship company)
Yes			
Yes			
	No		
		Depend	Trust is an important factor. However, when money or profit is involved, trust can be affected. I believe ethics is more important than trust.
	No		
Yes			

In the professional working relationship and the mutual understanding of the project goals and requirements.
Open communication, mutual understanding of needs and expectations, and positive results from actions or performance.
Trust develops as a result of both parties faithfully carrying out their contractual obligations over a period of time.
Good communications, meet the schedules, respect the needs of both parties, work on to avoid any build up problems, no short cuts, no hiding cost, bid no fair pricing.
Open and frank communication about the parties' concerns and interests. We need to understand the philosophy driving vision and vice versa.
Trust seems to be an issue when money and skill or service are involved. If a service is performed and it meets an owner's expectations, then the owner will pay for the service. Trust is developed on the the owners part if the service provide meets or exceeds his expectations. Trust is lost if the service or skill does not meet expectations. Trust is developed in the service provided if he receives fair value for his services rendered.
A history of successful projects builds trust in working relationships. Unfortunately, the trust is a small part of the picture when working in the real world. A client looks at the bottom line first, the at the other issues. If I want a contractor A because I can trust them to do the right thing in all aspects, and create my "vision for the client, if they are 100,000 higher than contractor B, I will 90% of the time up with contractor B
Proven ability, open communication, honesty and reliability
If jobs get completed without too much problems then trust develops
Typically, verbal communications including field meets and continuous projects status discussions have been of great assistance. Facial expressions and body language have been more influential in developing trust with individuals
1) Positive interactions/relationships in the pas. 2) Follow through with commitments. 3) Being honest and fair with each other. 4) Getting to know each other on a personal level.
When people stick to their word and don't skip steps in completing a project. Good past experiences with an individual or company
Through a clear/concise contract and through proper communication to the contractor and owner
1) Set initial basis of understanding. 2) Set regular meeting throughout the project. 3) Both parties need to show confidence and reliability. 4) Be fair and adheres to ethics. 5) Be honest.
1) Previous dealings. 2) Honesty in Commitment. 3) Putting good effort to generate good product.
By keeping one's word and treating other party as a human being, understanding their pressures and concerns

Experience in Construction Industry

1

Project Manager				
Project Manager				
	Civil Engineer		Other	also as inspector.
Project Manager	Civil Engineer			
Project Manager	Civil Engineer			
	Civil Engineer			
Project Manager				
			Other	engineering technici
Project Manager				
Project Manager				
	Civil Engineer			
Project Manager				
Project Manager				
	Civil Engineer (Design)		Other	material test (const)
		Owner	Other	Inspection
	Civil Engineer			
	Civil Engineer			
Project Manger	Civil Engineer			

2

Between 15 and 20 years
Between 5 and 10 years
Less than 5 years
More than 20 years
Between 10 and 15 years
Less than 5 years
Between 15 and 20 years
Between 10 and 15 years
Between 5 and 10 years
Between 5 and 10 years
Between 5 and 10 years
Between 15 and 20 years
Between 5 and 10 years
Over 20 years
Between 5 and 10 years
Between 15 and 20 years
Over 20 years

					80%-100%
20%-40%					80%-100%
					80%-100%
20%-40%				60%-80%	
20%-40%			40%-60%		
20%-40%				60%-80%	
	20%-40%			60%-80%	
					80%-100%
20%-40%			40%-60%		
		80%-100%			
					80%-100%
20%-40%				60%-80%	
	20%-40%			60%-80%	
20%-40%				60%-80%	
					80%-100%
20%-40%					80%-100%
	60%-80%	20%-40%			
20%-40%				60%-80%	

Use of Information Technologies

1

All the time		
All the time		
All the time		
All the time		
	Often	
	Often	
All the time		
	Often	
	Often	
All the time		
All the time		
All the time		

2

	Often	
	Often	
	Often	
	Often	
	Often	
		Never (skip the next question)
		Seldom
All the time		
		Seldom
	Often	
	Often	
		Seldom
	Often	
		Never
All the time		
	Often	
		Never
	Often	

3

XPM,WBS
wed based project site (ProjectSolve2), MSProject, Primavera, and various inhouse developed applications
Used mainly in communicating information to different branches and units as well as providing for schedules and estimates.
Primarily, the use of a good spreadsheet and word processor to both record and manipulate . information and to exchange same with other members of the management teams. Other programs used include a schedule generator for progress tracking. Recent use of shared drives serves well between contractual parties
Cad, Exel , Surtrake and Microstation
MS suite of programs, Primavera scheduling, MS scheduling.
internet, intranets, Email, video conferences, word processing software (as microsoft word, acrobat reader), spreadsheet software (such as EXCEL), CADD software (including Computer Aided Design and Drafting /or CAiCE software and Microstation software), p
Quick-base
Prolog PM Software, Timberline Accounting and Bidding Software
Bid Hotline, Capital Improvement Projects (CIP) database, CIP on web
The city of San Jose has developed a propriet any database for project management. 17 webs track of scite dues mostly.
Electronic Documents, Bid Electronically, Scanning of all Docs for a project
Primavera, Suretrack, Ms Project Schedule, Ms Database Applications, Ms Excell
Microsoft Project, Excel, Word, Public Works Project Databases, CSJ Bid Hotline, Primavira Scheduling

4

Yes, in a positive manner	
	No, it does not effect
Yes, in a positive manner	
Yes, in a positive manner	
Yes, in a positive manner	
	No, it does not effect
Yes, in a positive manner	
	No, it does not effect
	No, it does not effect
	No, it does not effect
	No, it does not effect
	No, it does not effect
Yes, in a positive manner	
	No, it does not effect
Yes, in a positive manner	
	No, it does not effect

5

			Depending what type of information that he needs
			Depends on what are the needs of the person, what kind person's needs would determine the and level of detail, for what purpose, and the availability of the information/datat? That person's need would determine the information requirement, and methods/medium of delivery.
			The integrity of the project is foremost. Information which favors one contractor over another would not be considered fair.
			Contacts assigned to me, provided they are connected contractually with the project, will be issued data according to their level of involvement.
			For whom they work and the verification of their necessity would drive the decision
			I would be willing to share general project information by email, but I would not provide access to any project-specific files to anyone not entitled to such information.
Yes			
		Depend.	Probably on a limited basis till I develop a level of comfort in their skill/trust level
	No		
Yes			
		Depend	General information on projects would be okay but not specifics
Yes			
		Depend	If the information was generic I would have no problem. If it was sensitive, I would not share it
Yes			
	No		
Yes			
	No		

6

1	2	5	3	3	
1	3	5	2	4	
1	4	3	4	3	
5	4	2	5	5	
1	3	2	2	5	
1	2	5	4	3	
1	2	3	3	3	
3	1	1	3	1	
1	3	3	2	0	
1	3	4	3	4	
1	2	5	4	3	
1	2	5	4	3	
1	2	5	3	3	
1	2	5	3	4	
2	5	4	1	3	
1	2	5	2	2	
1	2	3	3	3	
1	2	5	4	2	

Summary

1

Facilitate and strengthen/improve the level of trust between parties.
In general positively because it provides an additional tool to improve results.
If information shared could be verifiable then it would increase the level of trust.
I have found the use information technology in construction to be a tremendous and overdue tool for the increase of individual productivity and the possibility for positive interaction with project-associated personnel.
I think, it helped to open more channels of communications between deferent parties and differently errors some how. It is faster and it more eliminates the human
It does not detract from it and only mildly enhances it. There still isresolved. no substitute for a face-to-face conversation about the meat of issues to be
I'm not sure about this question. Trust is an issue concerning how two personalities interact, not the medium they use to communicate. I have no problem communicating with anyone by electronic means. I would suspect that many in the construction industry and legal disclaimed later, if necessary and government fields would prefer verbal conversation for a controversial issue, rather than written communication. This would for the denial of things said. Verbal conversation can be
It makes it harder. I have no idea of what/who is on the other end, nor the extent of that other side of the terminal. Only proven, secure technologies should be used in public work.
It impact trust in the same ways, such as level of experience, reliability. But an intract in terms of face-to-face-contract
Not much
For the project I have managed technology has not had a significant impact on trust. The working relationships done face to face have had more of an impact on technology
No significant impact. If anything, the use of information technologies (e-mail in particular) makes the relationships less personal and longer to develop trust than face to face or phone contact
I think it is good for basic issues but nothing bear face to face communication. That is where trust is built
It has an effect of speeding up the process of inefficiency of efficiency that exists in the scope, spec, plans or communication of the project
Minimal
Information technology does not and should not affect the level of trust; it is only a mean for faster and better communication
It has a very little effect. Information technology only increases the speed at which information is desiminated

Try to get as many inputs as possible from professionals in the industry.
In this context of trust and IT, the critical link is people. As such it would be worthwhile to examine the expectations the stakeholders in a construction project would commonly have, and the processes that involves IT to facilitate the fulfillment of expectations and satisfaction of results. IT in and by itself and applied by people/users.has little value unless properly designed
The greater the number of respondents the better the results will be.
I think overall it is good but it would be more beneficial if the questions would be more focused on the type of projects and what the sizes for them. so you can group them in deferent categories.
None at this time
I was confused if this was about trust of using electronic medium for communication, or just trust between groups or individuals. This should be cleared up.
These links may also be helpful: For Project Management http://www.pmforum.org 1 http://www.pmi.org http://www.pmi.org/links For The Role of Information Technology http://www.dot.ca.gov http://www.dot.ca.gov/hq/projmgmt/pm_menu.htm http://svhqsgi4.dot.ca.gov:80/dist4/dslide/dsdeis_execsumm.htm
Trust Curve
To gain trust in the industry you have to work hard, deligent, honest, and fast with good quality product
Trust and Information Technology are not related subjects. If that is purpose of the study (to prove it is) than I have no idea

REFERENCES

Guillermo F. Salazar et al, "Cost-Trust Relationship" (Ph.D. diss., Worcester Polytechnic Institute, 1994)

Guillermo F. Salazar et al, "The Cost-Trust Relationship in the Construction Industry" (Ph.D. diss., Worcester Polytechnic Institute, 1994)

Victor M. Serrambana, "Cost-Trust Relationship" (Ph.D. diss., Worcester Polytechnic Insitute, 1991)

Zolin, R. and Hinds, P. "Trust in Context: The Development of Interpersonal Trust in Geographically Distributed Worked Teams" (Ph.D. diss. Stanford University, 2002)

Paul Doherty, *Cyberplaces: The Internet Guide for Architects, Engineers, Contractors and Facility Managers.* (R.S. Means Company, INC, Construction Publishers and Consultants, 2000).

Essential Factors in Knowledge Management with Costs Products

"Citadon," online posting, 2002 <http://www.citadon.com>

"Blueline Online" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/projectnet.htm>

"Placeware" online posting, 2002 < http://www.new-technologies.org/ECT/Internet/placeware.htm>

"Procurezone.com" online posting, 2002 < http://www.new-technologies.org/ECT/Internet/procurezone.htm>

"Primecontract.com" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/primecontract.htm>

"Builder SupplyNet-Online Trading Community" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/bsn.htm>

"ISqFt AGC Network" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/isqft.htm>

"BidExpress – Online Bidding with Digital Sign" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/bidexpress.htm>

"Mimio-Digito Technology for White Boards" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/mimio.htm>

"Polycom.ViaVideo-Video Conferencing" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/polycom.htm>

"Akamai Streaming" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/akamai.htm>

"Evoke Communications" online posting, 2002 < http://www.new-technologies.org/ECT/Internet/evoke.htm>

"Armstrong 1-ceiling-Wireless Systems" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/armstrong.htm>

"Bluetooth – Short-range Radio Technology" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/bluetooth.htm>

"Starband $_{SM}$ – Satellite Internet Service" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/starband.htm>

"VizStream: Streaming ED Technology" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/vizstream.htm>

"VRML Application in Construction" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/vrml.htm>

"PrologWebSite" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/prolog.htm>

"Design Review and Checking System (DrCheck)" online posting, 2002 <http://www.new-technologies.org/ECT/Internet/drchecks.htm>

<http://www.aaaarch.org/dublin/salowey/definition_of_trust.htm>

<http://www.citadon.com/products/index.html.>