

A Study of Internet Use by U.S. General Contractors

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Abstract

Internet use in the world is rapidly growing. The Internet is affecting all aspects of life, as we know it. The world of business will probably be changed forever. The construction industry is a major part of the business world. It is also seeing changes because of the Internet. This study is to provide the construction industry with an understanding of the current use of the Internet by U.S. general contractors. This study consisted of surveying construction general contractors with regards to their current and future Internet use. The study shows that Internet use by U.S. general contractors is the highest at what was identified as the support level. Use at the corporate level was second, while use at the project level was lower. This study demonstrates that companies of every size are using the Internet somehow in order to remain competitive and to enable improvement of performance.

KeyWord : Internet, Construction, General Contractor

1. Introduction

1.1 Background

The Internet has changed the way people and companies do business today. Since government deregulation, which allowed the Internet to be used for profit making, the Internet has become a key part of the business world.

The construction market has a major impact on the overall United States economy. Recent statistics estimate the gross domestic product (GDP) of the U. S. construction industry at some \$480 billion dollars representing approximately 4.8% of the U.S. GDP (BEA 2001). Even though the construction sector is one of the largest industries, construction companies seem to shy away from using a newly proven technology for one reason or another. This research intends to determine if the construction industry has begun to use Internet as a business tool. Korean construction industry has initiated Internet use for their business and this study will also provide a guideline how to adopt the Internet for improving project performance and maintaining competitiveness.

1.2 Research Scope

In order to get a good picture of Internet use in the construction industry, general contractors were decided to be surveyed. Ideally, the entire industry could be surveyed. After considering the entire industry, general contractors would be the best subjects for this survey because of their unique position in

the construction process. They are the middle men of construction, dealing directly with owner organizations, designers, construction managers, subcontractors, and suppliers. With this case study of general contractors, valid conclusions of Internet use in the construction industry could be found.

1.3 Research Objectives

The overall purpose of this research is to provide the construction industry with an understanding of the current use of the Internet by construction companies. This understanding could be found by surveying a group of general contractors. Thus, the construction industry can identify the future need of adopting Internet technology.

More specifically, the objectives of the research are: 1) to establish the list of components to evaluate the degree of Internet use and 2) to identify the degree of Internet use in the U.S. construction industry, and 3) to provide a lessons learned to adopt the Internet in Korean construction industry. The trend and degree of internet use among various categories provided in this study can provide a valuable information to decide priority of various Internet application activities.

2. Literature Review

2.1 Internet and E-Commerce

The Internet and e-commerce are changing the world in many different ways. Many experts predict the global marketplace will be transformed, changing the face of business forever. Many industries are already witnessing

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this transformation. A recent joint study by Booz Allen and the Economist Intelligence Unit found that of the 525 senior executives surveyed worldwide, 90% believe that the Internet will transform or have a major impact on the world marketplace in the near future (North et al, 2000).

A company can use the Internet in many different ways. E-mail and voicemail have changed the way many people and companies communicate. E-mail communication simply replace the passage of paper with the use of electronic exchange of the digital form of the same documents coupled with a document control function to know when something went out, returned, or was modified (CII 2002). Electronic Data Interchange, also known as EDI, can allow business-to-business transactions to occur very quickly and efficiently (CII 1990). Extranet-based applications and groupware can further allow companies to conduct business regardless of distance. Overall, the Internet has taken a big step towards removing the distance aspect of communications in business.

2.2 Internet Use in the Construction Industry

According to an ENR survey in 1997, only 11% of companies in the average construction industry firm were fitted with Web browser software. Project Web sites do appear to be catching on, however. A full 19% of all respondents report creating one or more project web sites (Phair and Angelo 1997).

Recent CII research revealed that e-commerce application in construction may save average 10 - 20 percent on budget based on case studies (CII 2002).

The Internet is changing the construction industry, as we know it today. The possibilities are endless as to what the Internet can provide. Construction companies want to create an Internet that collects, supports, and distributes project decisions and information as quickly as possible. This research will hopefully help to determine if this is currently progressing.

3. Data Analysis

E-mails were sent to a total of 125 e-mail addresses of General Contractors. Of the 125 addresses, 22 responses were received. The response rate is 17.6%. This study with limited number of respondents can not represent all U.S. general contractors and provide statistically proven results, this study is still meaningful to identify the Internet application activities in the construction industry and shows the preliminary result of the degree of Internet implementation.

The answers to the survey were gathered on a spreadsheet for further analysis and transformed from text to numeric values in order to directly exploit the data the softwares functions. The data was then manipulated for

analysis.

3.1 Respondent Information

A wide range of companies responded to the e-mail. The range of revenues can be seen in Figure 1. As shown in Figure 1, eleven companies replied are categories under \$100 million revenue per year and nine companies are from over \$100 million revenue per year. The revenue class shows that the companies participated in this survey are middle to large size general contractors. This provides valuable opportunity to research the Internet use of U.S. general contractors even though only 22 companies were included in this study.

Because two companies wished no revenue disclosure, number of employees was used to categorize the company size for analysis. This range led to dividing the companies into two categories for analysis, 1 to 100 employees and over 100 employees. With these categories, 9 companies fell into the 1 to 100 employees range and 13 companies were in the over 100 employees range. These two categories enable to compare the degree of Internet use according to the size of a company. Various statistical techniques like t-test or ANOVA can be used to identify the difference between groups or Internet application activities. However, only 22 cases were used to identify the Internet application activities in the construction industry and review preliminary results at this time of writing.

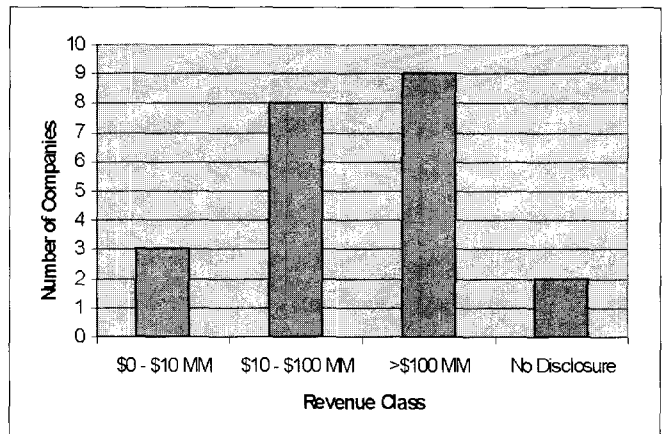


Figure 1 Revenue Class Distinctions

Responses were received from a wide range of general contractor employees as well. All responses were answered by managers or above level.

3.1.2 Survey Results

Information gained dealing with employee computer use was as expected. Most of the companies responding stated that 81-100% of their office workers use computers. Similarly, most of the companies reported 0-20% of their field workers use computers.

The percent of computers with Internet access had similar results, with seventeen companies reporting Internet access for 81-100% of their office computers. Seven companies reported having 0-20% of field computers with Internet access, which is also not surprising. Ten companies, however, reported having 81-100% of field computers with Internet Access. The information is shown in Figure 2. This figure shows that computer has come into wide use in the office. It is reasonable that limited number of field workers use computer for their work because most field workers work on the construction site. However, the ratio of Internet access of field computers is too low to acquire the benefits from the Internet use. The connection via Internet between an office and a field is critical to success Internet implementation. Therefore, companies should supply computers equipped

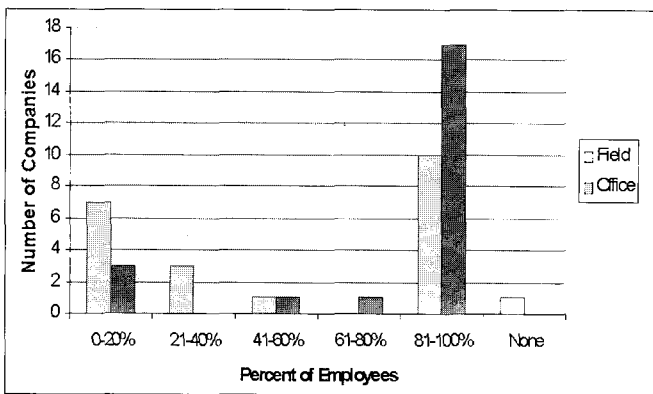


Figure 2 Percent of Computer with Internet Access

with Internet access to the field workers.

The data was evaluated by examining each identified Internet use, and by combining the different Internet uses into corporate level, project level, and support level.

3.2.1 Corporate Level Internet Use

The activities in corporate level Internet use were first identified: 1) a company homepage, 2) Internet advertising, 3) links to other companies, 4) bid information, and 5) accessing information on possible future projects. Each activity was answered in three levels: currently use, plan to use, and no plans for use.

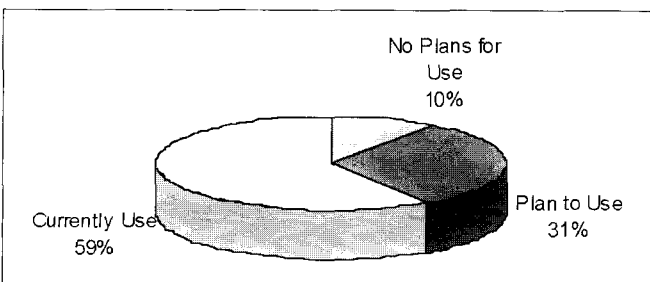


Figure 3 Total Corporate Level Internet Use

When evaluating Internet use at what was identified as the corporate level, well over half of the items on the survey were currently in use, with another 31% coming in the future, as can be seen in Figure 3. Only an average of 10% of the items on the survey were identified as not in use or in the companies plans for the future. Many companies participated in this study have recognized the importance of Internet to do their business at corporate level.

A closer look at corporate level use showed a difference between companies with 100 or more employees and companies with less than 100 employees.

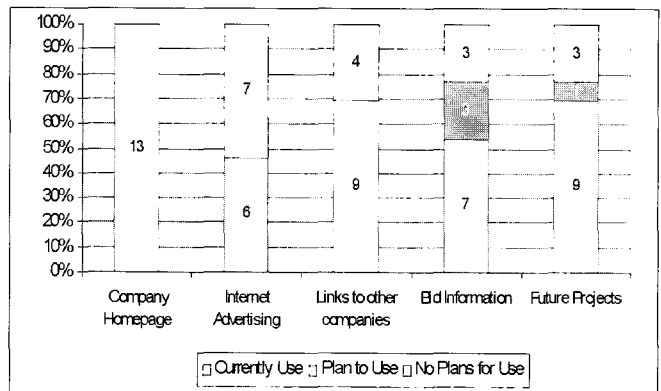


Figure 4 Corporate Level Internet Use (100+ Employees)

All of the companies responding with more than 100 employees indicated that they currently have a company homepage, while only about 55% of companies with fewer than 100 employees replied saying that they have a company homepage as shown in Figures 4 and 5. Figures are presented in percentage of respondents and number of frequency is also included in the bar charts.

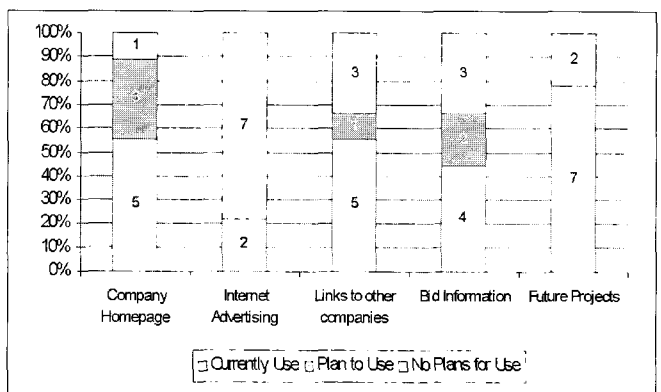


Figure 5 Corporate Level Internet Use (1-100 Employees)

Other observations on corporate level Internet use included the followings. Finding information on 'accessing information on possible future projects' was in high use by both groups. This can explain the current practice how to

obtain future project information. This can be possible because many owners post their future project information on the web. Advertising on the Internet was the lowest area of use by both groups and no company does not have a plan to use the Internet for advertisement in the near future. Companies may consider that Internet advertising is not critical to improve their business performance. Internet links to other companies will enhance the benefits of using the Internet. This will save time to communicate and to exchange information. Therefore, more than half of respondents in both groups are using the Internet to link to other companies. As expected, larger companies generally tend to use more Internet in the corporate level. The results can be seen in Figure 4 and 5.

3.2.2 Project Level Internet Use

Project level Internet use includes: 1) project specific web pages, 2) procurement, 3) accessing information in branch offices via the Internet, 4) drawings (review, transfer, etc.), 5) permitting, 6) Internet conferencing, 7) virtual teaming, 8) cost accounting, 9) estimating, 10) scheduling, 11) photo log of the project, 12) purchase orders, 13) change orders, 14) application for payment, and 15) document control and tracking.

When examining project level Internet use, the first thing that was apparent overall was the fact that a full 54% of the identified items are not currently used or expected for use in the near future. In fact, only 24% of the items in question are currently being used and 22% of them were planned to use as can be seen in Figure 6.

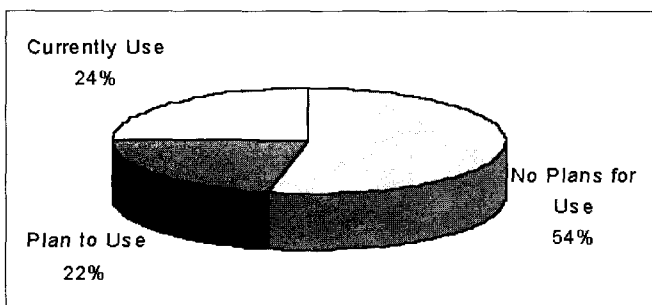


Figure 6 Total Project Level Internet Use

Internet implementation needs financial investment but companies may resist to invest for using the Internet at the project level. This investment issue can be a reason why many general contractors do not use project level Internet use. The respondents of twenty four percentage current use are from relatively large companies that have a financial capability to invest in Internet application. Project level Internet use will be widely used when the benefits are identified.

When examining the results of splitting the responses into the two size categories, the companies with the larger employees consistently showed

higher Internet use in all. These can be observed in Figure 7 and Figure 8.

In case of the companies with over 100 employees, the companies highly use the Internet for drawing, procurement, Internet conferencing, photo log, and project web pages as shown in Figure 7. This research also discovered that other aspects of Internet use, such as permitting, change orders, and payment are not a current priority for most large general contractors participated in this study. Those three activities need connection with other organizations such as owners or public agencies. Therefore, general contractors can not use the Internet for those three activities on their own responsibilities. Internet use of these activities can be fully implemented when the counterpart organizations have same Internet functions.

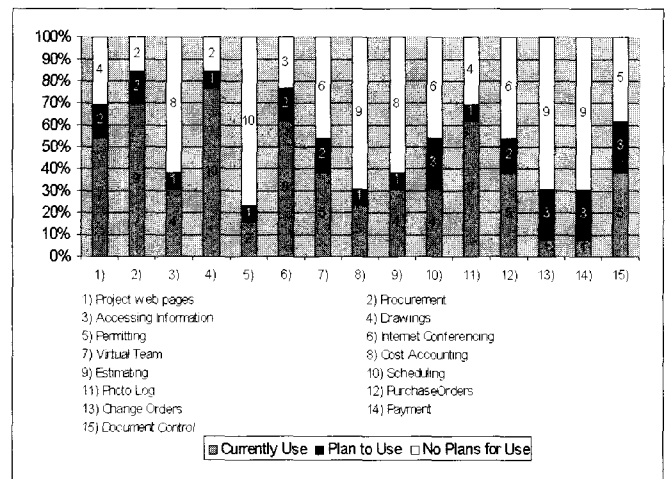


Figure 7 Project Level Internet Use (100+ Employees)

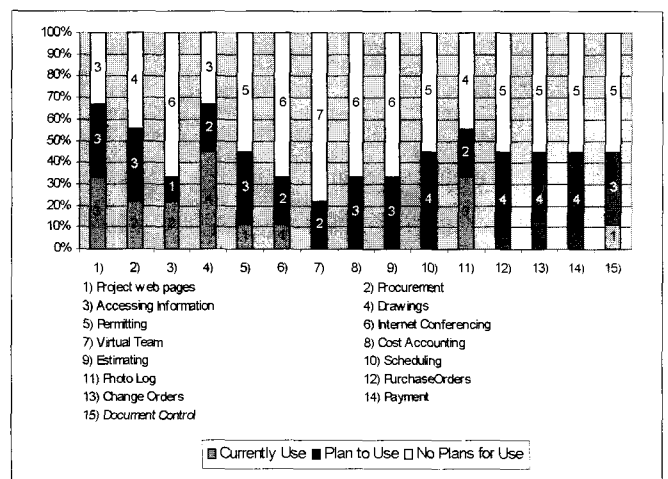


Figure 8 Project Level Internet Use (1-100 Employees)

As shown in Figure 8, most respondents with less than 100 employees do not widely use the Internet at the project level. More than 20% of smaller company respondents use Internet for drawing, project web pages, and photo log but the degree of Internet use is relatively low comparing with large companies. These highly used items are consistent with large companies.

Seven items out of fifteen in project level Internet use have never been used by general contractors with less 100 employees. These are virtual team, cost accounting, estimating, scheduling, purchase orders, change orders, and payment. Some companies however, have a plan to use the Internet for the items that have not been used. Because concrete benefits of using the Internet at the project level have not been identified, companies may hesitate to implement the Internet. However, if some companies benefit from Internet use, it will be spread quickly to all general contractors.

3.2.3 Support Level Internet Use

The activities of support level Internet use are: 1) access to archived information, 2) searching for subcontractors, 3) searching for materials suppliers, 4) access to product information, 5) searching for specialty services, and 6) research and development.

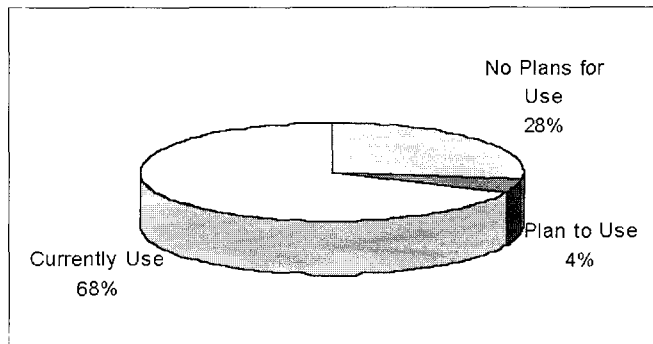


Figure 9 Total Support Level Internet Use

Support level Internet use scored the highest in level of use among the three categories used for this survey: corporate level, project level, and support level. The survey results indicated that general contractors were currently using 68% of the items identified, with an additional 4% planned for use in the future as can be seen in Figure 9.

Support level Internet use responses split into the two size categories can be seen in Figure 10 and Figure 11. The results of support level Internet use is different from previous results shown in the corporate level and the project level. As shown in figures 9 and 10, there is no difference between large and small companies in most activities at the support level.

Figure 10 Support Level Internet Use (100+ Employees)

Figure 11 Support Level Internet Use (1-100 Employees)

The figures show that smaller firms indicated using the Internet for gathering product information more than larger companies. Smaller companies also seem to be using the Internet for searching subcontractors more than larger forms. However, the difference is not critical. Not surprising, the use of the Internet for research and development is larger for large

companies. This result shows that many general contractors use the Internet for exploring information and their contracting parties like subcontractors or suppliers.

Another part of the survey asked if there were any other areas of Internet use that companies are currently exploiting or plan to use that were not included in the questionnaire. One company mentioned that they were using the Internet for marketing, employee recruiting, training, and pre-qualification for a specific project.

No companies reported allowing other companies access through an extranet. Finally, more than half respondents stated that they worried about Internet security.

There are fundamental issues that show why only a few companies have ventured very far into using Internet to do their business in the construction industry. Issues included:

- Availability to connect to remote sites
- Cultural resistance
- Resistant to invest

4. Conclusions

The results of this research indicate that the construction industry is using the Internet for some areas of business. Larger companies are more developed in Internet use than others. Internet use also appears to be growing. The study shows that Internet use by U.S. general contractors is the highest at what was identified as the support level. use at the corporate level was second, while use at the project level was lower. This study demonstrates that U.S. general contractors are using the Internet somehow in order to remain competitive and to enable improvement of performance.

This research results can provide Korean general contractor with the guideline to develop a introduction scheme for Internet.

5. Recommendations

Based on the results of this survey, the author believes that further, in-depth research with sufficient sample size dealing with Internet use in the construction industry would be beneficial. Other research areas could include: determining the benefits, if any, construction industry Internet users have seen, discovering what the driving force for adding Internet use is, comparing the results of this survey with the results from a similar survey of other industries in order to better evaluate where the construction industry stands, and International benchmarking of the Internet use. A broader survey or interview would also be beneficial to obtain more reliable results.

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