

## **Survey of Information Technology Utilization in The Construction Industry in Malaysia**

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### **Abstract**

This paper present the findings of conducting a modified version of the IT barometer survey in the construction industry in Malaysia. The study collects data from 68 firms. The majority of the respondent firms are G3 record 39.70%. However, more than 75% of the respondent firms are in private sector. Seventy-three percent of the participating firms are involved in construction engineering work with experience years ranging between 5 years and 20 years. The study shows the reasonably IT confidence firms (40 - 75% of applications computerized), there was > 80% use of general and technical software, this finding can be correlated with intention to use IT and services. This paper has concluded that the firms are using IT reasonably and the internet usage is one of the primary factors affecting the use of IT in the construction industry in Malaysia. Besides, that understands the level of leading importance of construction and practice to current movement for future directions, and conduct international comparisons.

### **Keywords**

Information technology, Construction, Firm performance, Survey.

## **1. Introduction**

In recent years, Malaysia has gone on board on an ambitious plan to make full use of information technology capabilities. The purpose of this study is to investigate the current extent of IT usage, availability, and its perceived impact in the construction industry in Malaysia. The IT-barometer survey was developed by Samuelson. Samuelson (2002) explains that the IT-barometer survey is designed to be repeatable over time, comparable between countries, and covers all categories of construction companies. The Attar and Swiess (2010) study demonstrates the relationship between IT adoption and job satisfaction within the Jordanian construction industry and it also used a slightly modified and improved version of “The IT barometer survey” which was created at the Royal Institute of Technology (Kungl Tekniska Högskolan) of Sweden. They attempt to explore the relationship between IT adoption and job satisfaction from the perspective of Jordanian contracting firms. They pointed out that more investment in technology increases employee job satisfaction regarding intrinsic and general perspectives. As discussed in Table 1. which provides a brief summary of surveys related to the construction industry from the different perspective of different countries. The paper outline is arranged as follows: research methodology, results and analysis, and conclusions. Therefore, this survey provides an understandable picture of the extent of the use of information technology within

construction firms. The purpose of the survey presented here is to reveal the current and planned use of IT (computer-based, internet and telecommunication technologies as well as to determine their effect on construction firms, in Malaysia. To achieve this purpose, the survey looked at the availability and extent usage of Information technology (e.i. computer-aided drafting software, networks, and so on) among construction firms.

**Table 1: Brief Summary of Previous IT surveys conducted on the Construction Industry**

	Author(s)	Research Problem	Research Findings
1-	Doherty (1997)	A survey was conducted in New Zealand to measure the computer use in the New Zealand building and construction industry.	<ul style="list-style-type: none"> <li>• Large minority did not use computers or used them only casually.</li> <li>• Devise a strategy for changing the attitudes of those who did not accept computer applications.</li> </ul>
2-	Howard et al. (1998)	The IT barometer survey summarized in this paper compared results from Denmark, Finland and Sweden on the use of computer hardware, software and communications in Scandinavia.	<ul style="list-style-type: none"> <li>• Major IT development projects were found under way in Finland and Sweden &amp; it was proposed to measure their progress at the half-way stage by surveying the construction industries in about year 2000.</li> <li>• Denmark needed to carry out more promotion of IT initiatives and measure awareness of these in year 2000.</li> </ul>
3-	Rivard (2000)	A survey about the current and planned use of IT and its impact on the Architecture, Engineering and Construction (AEC) industry in Canada had been conducted.	<ul style="list-style-type: none"> <li>• Many business processes were almost completely computerized and the tendency was toward a greater computerization of the remaining processes</li> </ul>
4-	Arif and Karam (2001)	A survey was conducted to identify the extent of IT application in the building construction context of South Africa	<ul style="list-style-type: none"> <li>• The survey revealed a major dependency on CAD software.</li> <li>• Computer use was clearly concentrated in administration, communication and the core activity of construction drawings production</li> </ul>
5-	Samuelson (2002)	The paper presented the most significant results from the Swedish survey and a few selected results from the comparison between the three countries (Sweden, Denmark and Finland) regarding the use of IT in the Nordic construction industry.	<ul style="list-style-type: none"> <li>• The survey produced knowledge about the use of computers, hardware and software, communications and plans and strategies for the use of IT.</li> <li>• The comparison between Sweden, Denmark and Finland showed that Finland and Denmark had a greater extent of IT adoption</li> </ul>
6-	Lim et al. (2002)	A survey was conducted to measure the actual level of Internet usage and to find the perceived benefits and disadvantages experienced by the users in the Malaysian construction industry.	<ul style="list-style-type: none"> <li>• Respondents have accessibility to the Internet; comparable to countries such as the US.</li> <li>• The main use of the Internet is for emails and information search.</li> <li>• Provision relevant parties in the industry should look into sufficient infrastructure and IT skills training to enable the workers in this industry to fully utilize the potential of the Internet.</li> </ul>
7-	Rivard et al. (2004)	Eleven case studies were gathered from across Canada to define an initial compendium of best practice in the use of IT in the Canadian construction industry.	<ul style="list-style-type: none"> <li>• The following technologies were demonstrated: 3D CAD; custom Web sites; commercial Web portals; and in-house software development.</li> <li>• The industry could achieve substantial benefits from the adoption of IT if it would have been more widespread.</li> </ul>
8-	Goh (2005)	This paper investigated the levels of general adoption of IT in the Singaporean	<ul style="list-style-type: none"> <li>• To avoid the “technology for the sake of technology” trap</li> </ul>

	Author(s)	Research Problem	Research Findings
		construction industry	<ul style="list-style-type: none"> <li>• To develop standards, integrated databases and interactive applications.</li> <li>• To focus on people, their IT needs and ability to manage change.</li> </ul>
9-	El-Mashaleh (2007)	This paper reported the findings of conducting a modified version of the IT barometer survey. It benchmarked the current IT usage, availability, and perceived impact in the construction industry in Jordan.	<ul style="list-style-type: none"> <li>• The perceived benefits for IT adoption according to the respondents were mentioned.</li> <li>• The main obstacles for IT use were high investment costs and greater know-how required from staff.</li> </ul>
10-	Tas and Irlayici (2007)	A survey about the current and planned use of IT and its impact on the construction industry in Turkey has been conducted so as to help in the choice of acquiring building products.	<ul style="list-style-type: none"> <li>• The current level of usage and the future expectations for building product information systems have newly become widespread in Turkey.</li> <li>• The development of building product information systems was said to be an important step to solve many problems in construction industry field.</li> </ul>
11-	Scheer et al. (2007)	This paper main objective was to foster greater understanding of IT and its application in the Brazilian construction industry.	<ul style="list-style-type: none"> <li>• Important improvements of international investors' participation in the Brazilian construction market were noticed and consequently more credit availability.</li> <li>• One of the most important steps to be undertaken was academic research and professional educational efforts that would continually increase IT use in undergraduate civil engineering courses.</li> </ul>
12-	Oladapo (2007)	Investigate the state of ICT in the Nigerian construction industry; identify its impact in the industry and the constraints to its adoption.	<ul style="list-style-type: none"> <li>• The main uses of ICT were identified.</li> <li>• The top five constraints to the use of ICT were stated.</li> <li>• A comparison with results of similar studies indicated that IT usage is quite high for a developing country like Nigeria.</li> </ul>
13-	Samuelson (2008)	Describe the development of IT use in construction and facility management sectors during a nine-year period, by presenting the most significant results from the Swedish IT-Barometer 2007 survey, with comparisons with the situation in 1998 and 2000.	<ul style="list-style-type: none"> <li>• There has been a clear increase in the use of IT in the last few years.</li> <li>• The possibility of making use of IT to support new ways of working and to make the process more efficient is increasing.</li> <li>• Contractors have been those who use IT least of all.</li> </ul>

The results will provide directions in research, development, training, and strategies that will respond to the needs of this industry. The paper commences with a description of the survey and methodology used followed by the profiles of the respondents, the findings of the survey, and some concluding remarks.

## 2. Methodology

Two-hundred firms were randomly selected from lists from Construction Industry Development Board (CIDB) directory. Out of these 200 firms, 68 firms returned the completed questionnaire, a recorded 34% of respondents. The questionnaire used in this survey is a slightly modified and improved version from the Canadian context of "The IT barometer survey" which was created at the Royal Institute of Technology (Kungl Tekniska Högskolan) of Sweden in 1997 (Samuelsson 1998). Several surveys have been conducted in the past couple of years to determine the impact of

information technology in the construction industries of various countries. As discussed in Table 1. For this study a questionnaire survey was used that had five sections. The first section named as general information (personal information and company information) designed by the researchers' based on the Malaysian construction industry environment context, the second section is the appropriate use of IT was modified from the study of case studies on the use of information technology in the Canadian construction industry by Rivard et al. (2004) which will be discussed in this paper. This study's scope is on construction firms i.e., G3, G4, and G5 which are registered with the Construction Industry Development Board (CIDB), 2005/2006 CIDB directory, on the region of Kuala Lumpur and Selangor only. The limits of job values for the grades are G3 RM1 million, G4 RM3 million and G5 RM5 million. A survey was done on the higher-ups in the companies' owners, project managers and general managers. As stated above the grade of firms play a very important role in the Malaysian economy, especially in terms of generating employment.

### 3. Result & Discussion

This section presents the results and analysis of the survey. The study collected data from 68 firms. As shown in Table 2 is the characteristics of the respondents of the firm distribution by grade. The majority of respondents from the firms were, 27 (39.70%) were G3, 25 (36.80%) G5, while 16 (23.50%) were G4 and most of the firms specialization background, 50 (73%) were involved in construction works. While their experience years ranged between 5 years and 20 years. However, more than 75% of the respondent firms were privet sector.

**Table 2: Respondents' Profile of Companies (N = 68)**

Demographic Variables	Categories	Frequency Total No	Percentage (%)
Firm Grade	G3	27	39.7
	G4	16	23.5
	G5	25	36.8
Firm Experience	< 5 yrs	16	23.5
	6 - 10 yrs	16	23.5
	11 - 15 yrs	14	20.6
	16 -20 yrs	14	20.6
	21- 25 yrs	6	8.8
	> 25 yrs	2	2.9
Firm Specialization	Construction	50	73.5
	Transportation	-	-
	Structure	4	5.9
	Infrastructure	2	2.9
	Asset Maintenance	-	-
	Material	2	2.9
	Geotechnical	-	-
	M & E	10	14.7
Firm Sector Categories	Private Sector	54	79.4
	Public Sector	14	20.6

#### 3.1 Top Management, Executive and Technician education Level Vs. Firm Grade

Education level is one of the main elements in any discussion on social status of the country; the education level by firm grade is shown in Table 3. As expected, education level increased with the firm grade level. However, very few top members of management had earned a PhD in G3. Executive education level by firm grade is shown in Table 4. As expected, the executive education level decreased with the firm grade level. Again, having a PhD was rare. The technician education level by

firm grade is shown in Table 5. As expected, the technician education level decreased with the firm grade level. Again, having a PhD was zero and having a master's level degree was rare.

**Table 3: Top Management Education Level \* Firm Grade (Crosstab A)**

Firm Grade		Top Management Education Level				Total
		PhD	M S.c	BS.c	Dip.	
G3	N	15	4	6	2	27
	%	71.4%	26.7%	23.1%	33.3%	39.7%
G4	N	4	4	6	2	16
	%	19.0%	26.7%	23.1%	33.3%	23.5%
G5	N	2	7	14	2	25
	%	9.5%	46.7%	53.8%	33.3%	36.8%

**Table 4: Executive Education Level \* Firm Grade (Crosstab B)**

Firm Grade		Executive Education Level				Total
		PhD	M S.c	BS.c	Dip.	
G3	N	4	10	11	2	27
	%	66.7%	58.8%	34.4%	15.4%	39.7%
G4	N	2	4	6	4	16
	%	33.3%	23.5%	18.8%	30.8%	23.5%
G5	N	0	3	15	7	25
	%	0.0%	17.6%	46.9%	53.8%	36.8%

**Table 5: Technician Education Level \* Firm Grade (Crosstab C)**

Firm Grade		Technician Education Level		Total
		Bachelor Degree	Diploma	
G3	N	18	9	27
	%	60.0%	23.7%	39.7%
G4	N	6	10	16
	%	20.0%	26.3%	23.5%
G5	N	6	19	25
	%	20.0%	50.0%	36.8%

A there is a significant relationship between the education and the firm grade ( $\chi^2= 15.047, p < 0.05$ )

B there is a significant relationship between the education and the firm grade ( $\chi^2= 11.492, p < 0.05$ )

C there is a significant relationship between the education and the firm grade ( $\chi^2= 18.218, p < 0.01$ )

## 2.2 Appropriate Use of Information Technology

This section asked the respondent how is internet accessed at the firm, does your firm have an intranet and if so, what does it contain. Also what is contained on the firm homepage, and finally how often does the firm store and transfer files and documents of the projects by using the internet.

### 3.2.1 Possession of Internet Access

The respondents were asked the way internet is accessed in the companies. Thirty persons (52.9%) stated that the Internet is accessed via LAN and 17 persons (25%) stated that Internet is accessed via a permanent connection.

The results show that all the managers have knowledge about internet connection, perhaps have access to the internet or use the internet. The results also indicated that all the companies surveyed have some kind of internet access. Obviously, without internet accesses the use of IT is impossible. Cumulatively all firms had internet and accessed it by different ways. It has to be one of the primary factors affecting the use of IT, see Figure 1.

### 3.2.2 Firm Intranet Contents

Figure 2. show that the firms that have an intranet, which means a web-environment available only internally in the firm, are the highest of those contained in this project information present with 72.1%, for manuals 2.9%, person information present with 5.9%, and quality information present with only 19.1% of the intranet contained.

### 3.2.3 Firm Home Page Contained

Figure 3 shows the firm home page contained the presentation of the company the most often with percentage of 58.8%, followed by presentation of a project with 25%, and for services and orders it was 8.8%, the other 7.4% is other presentations.

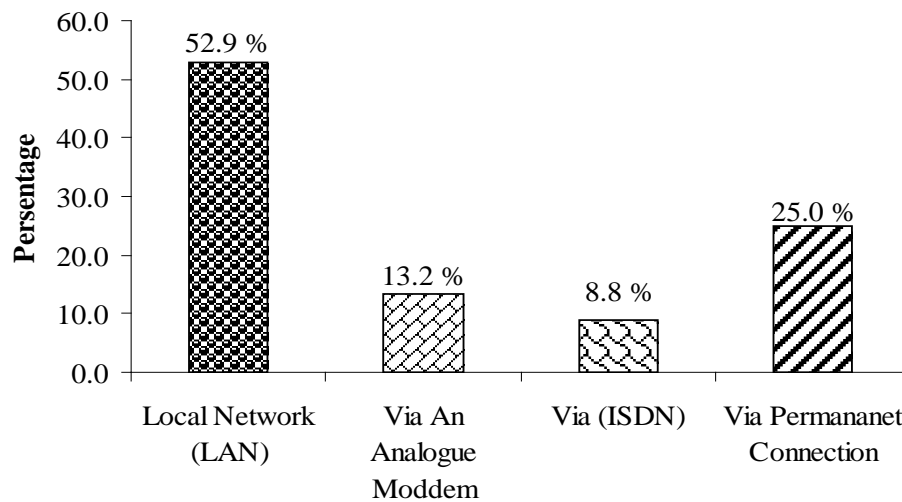
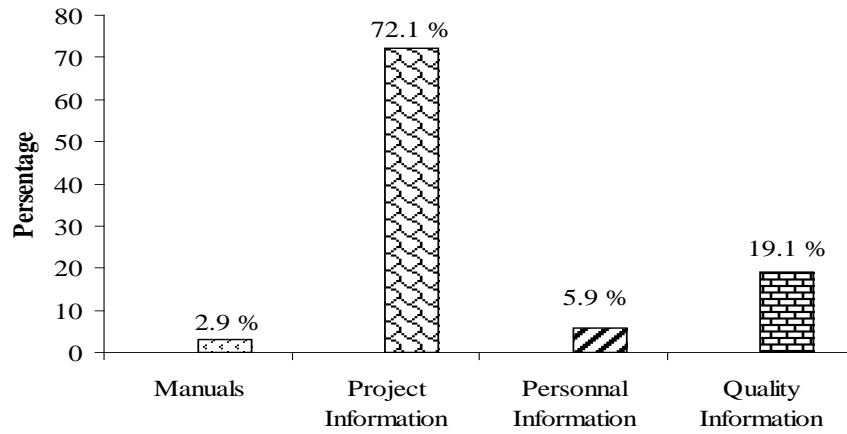
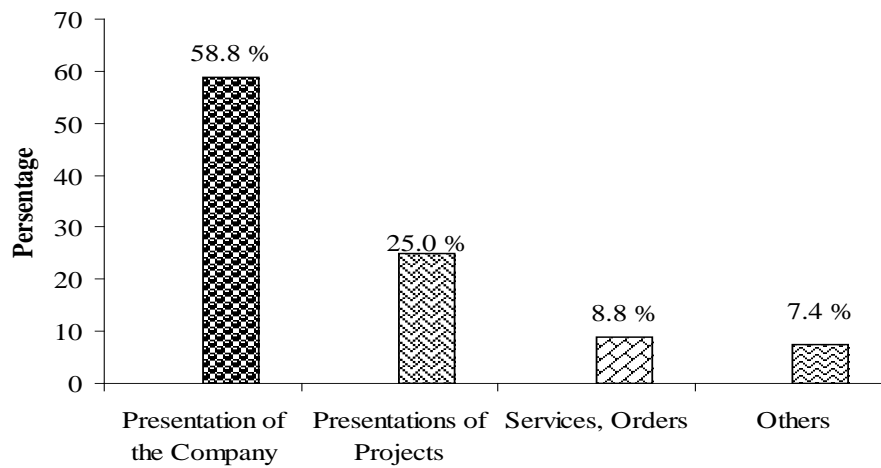


Figure 1: Internet Accessed

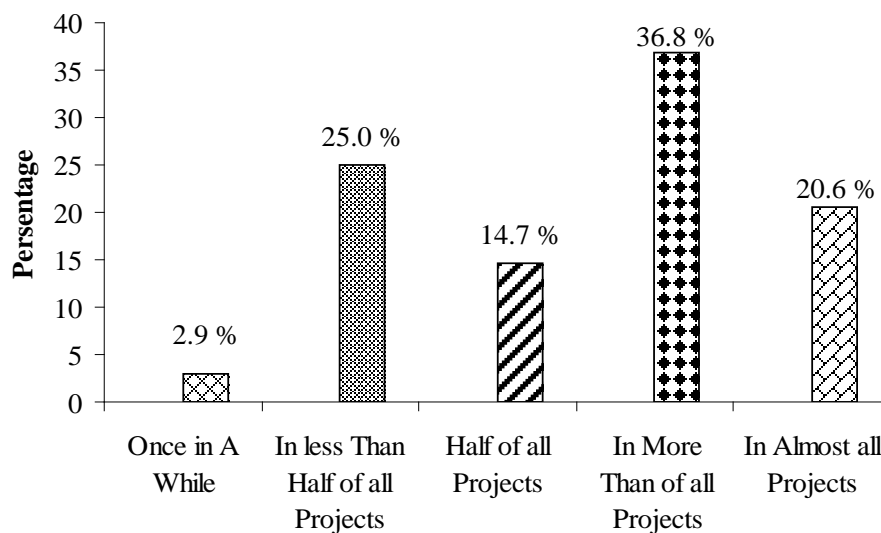


**Figure 2: Firm Intranet Contain**



**Figure 3: Firm Home Page Contained**

### 3.2.4 Project Internet Use for Storage & Transfer, Files & Documents

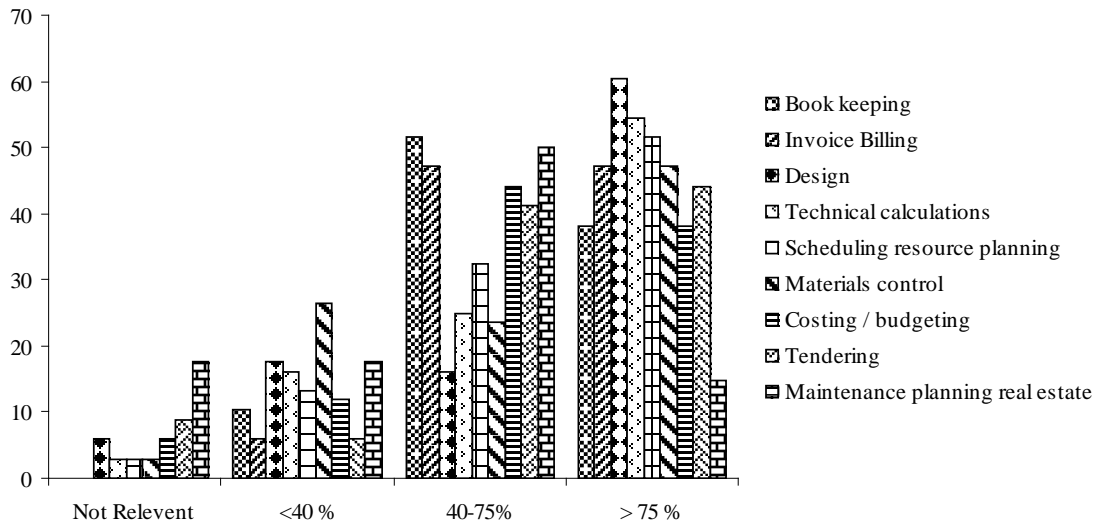


**Figure 4: Use of Internet for Storage & Transfer of Files & Documents**

Figure 4. shows how often the firm uses the Internet for storage and the transfer of files and documents in any project the most often with 36.8% followed by less than half of all projects present with 25%, for the half of all projects present with 14.7%, in almost of all projects present with 20. 6%, and once in while was 2.9%. The result shows that internet is important for storage and files transfer.

### 3.3 Computerized Activities

The companies' top managers were asked about the activities that they performed using IT systems. Twenty six respondents (38.2%) stated that IT systems are used more than 75% of the time for bookkeeping and marketing. Thirty five persons (51.5%) said that IT is used between 40 and 75% of the time for bookkeeping and marketing. Thus, IT is significantly used for bookkeeping and marketing tasks. See Figure 5. The managers said that IT is used between 40-75% of the time for invoicing bills and thirty two respondents (47.1%) said that IT is used more than 75% of the time for bills and invoicing. The use of IT infrastructure and software are crucial in assisting in the performance of the company. Forty one respondents (60.3%) stated that an IT system is used for design purposes.



**Figure 5: Computerized Activities**

Twelve persons (17.6%) said that IT software and hardware are use for design purposes. The use of PCs and software such as CAD and 3D Studio programmes greatly assist in the performance of the company's projects. Thirty eight respondents (55.9%) stated that IT is used more than 75% of the time in technical calculations. The use of calculators, PCs and other forms of IT forms has been an integral part of the staff and the companies. Hiring of staff nowadays involves looking at the IT capabilities of the applicants. Seventeen (25%) managers stated that 40-75% of the time they used an IT related system. Thirty five respondents (51.5%) used IT in scheduling and resource planning. Twenty two (32.4%) use IT between 40-75% of the time for scheduling and resource planning. Thirty two respondents thought that IT is used more than 75% of the time for materials control and purchasing. Eighteen persons (26.5%) stated that IT is used for materials control and purchasing. Nevertheless, IT is significantly use in purchasing and control of materials. Thirty persons (44.1%) said that IT is used 40-75% of the time for costing and budgeting purposes. Twenty six persons (38.2%) said that IT is used more than 75% of the time for costing and budgeting. This explains that IT is necessary in helping the workers perform in every stage of the costing and budgeting processes.

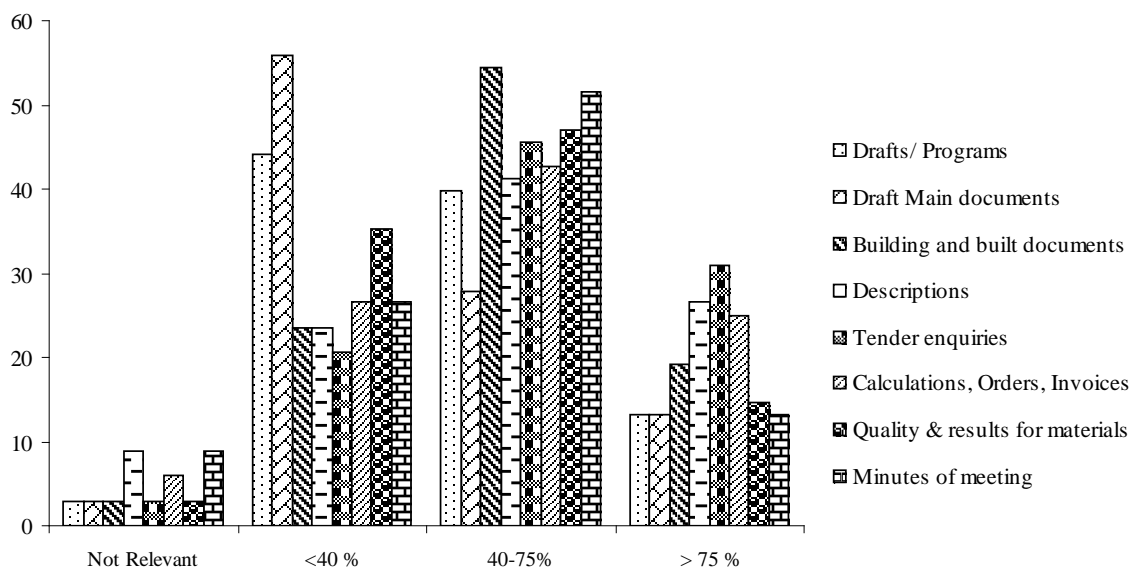
Consistent with the findings on costing and budgeting, thirty persons (44.1%) said that IT is used in the tendering process. Twenty eight (41.2%) persons stated that IT helped the tendering process. It can be summarized that IT is used in acquiring and maintaining the projects. As many as thirty four respondents (50%) stated that IT is used 40-75% of the time for maintenance planning for real estate.



Twelve persons (17.6%) stated that IT is either not relevant to them or used less than 40% of the time for maintenance planning for real estate. This may be due to the fact that some of these companies do not work on real estate or maintenance planning since the companies surveyed are contractors.

### 3.4 Material Digitally Sent (Internally & Externally)

The study also looks to what degree the IT facilities are used. Thus, the survey gained from the respondents how frequently materials are send internally and externally. Thirty persons (44.1%) stated that drafts of programs were used via IT less than 40% of the time and 27 persons (39.7%) said that 40-75% of the time IT systems were used for drafts and programs transfers (see Figure 6). Thirty eight respondents (55.9%) said that drafts and main documents were transferred less using IT. Less than 40% and 19 persons (27.9%) said that these documents were transferred using IT between 40-75% of the time. As much as thirty seven persons (54.4%) stated that they used IT to transfer building and as-built documents. Sixteen persons (23.5%) stated that they used IT facility less than 40% to transfer these types of documents. Two persons (2.9%) said that they do not use the facilities to transfer these types of documents. Twenty persons (41.2%) stated that they use IT services to transfer description material. Eighteen persons (26.5%) said they use IT services to transfer description documents. This explains that IT facilities are used for urgent cases where time is the constraint the companies perhaps use the Internet to transfer documents. Nevertheless, the documents are transferred by hands/ manually. Thirty one persons (45.6%) said that they use IT services to transfer tender enquiries 40-75% of the time and twenty one persons (30.9%) said that IT services more than 70% for tender enquiries transfer. The increase in number is again due to the urgency of the matter where tender inquiries need to be transferred quickly and thus, the companies used IT services such as the Internet to deliver the documents.



**Figure 6: Percentage of Materials Digitally Sent (Internally & Externally)**

Twenty nine managers (42.6%) use IT services 40-75% of the time to transfer calculations, orders and invoices. Eighteen persons (26.5%) said they use IT services less than 40% of the time to transfer these types of documents. This response is balanced with seventeen persons (25%) saying that they use IT services 75% or more for transferring calculations, orders and invoices. Thirty two people (47.1%) stated that quality results, testing results for materials are sent digitally 40-75% of the time using IT services. Twenty four (35.3%) said these documents are sent digitally using IT services. On the other hand, minutes of meetings were sent 40-75% of the time using IT services according to 36 respondents (52.9%). Eighteen persons (26.5%) stated that these documents were sent using IT services such as the internet for minutes of meeting.

### 3.5 Types of Software Use

In order to confirm a. the importance of IT use in the firms, b. the degree of usability, c. the availability of IT infrastructure and services and d. other possible software used, the survey asked what type of software the firm used to assist in the daily tasks.

Figure 7. Shows the general software used by the firms word processor (83.8%), spreadsheet (77.9%), email software (75.0%), administration software (66.2%) and, lowest, databases and self developed programs (both 60.3%). The firms also planned to use new software, of which the most popular were databases (30.9% of respondents), administration software (25.0%), self-developed programs (23.5%), spreadsheet (22.1%), word processor (10.3%) and email software (7.4%). However, technical software used by the firms is AutoCAD (88.2%), technical calculations (analytical & design software) (76.5%), programs for cost calculations (75.0%), self developed programs (70.6%), planning programs (69.1%) and maintenance planning for properties and GIS (both 66.2%). Even for the reasonably IT-savvy firms (40 - 75% of applications computerized), there was >80% use of general and technical software, Interesting that all the respondents thought that these types of programs are important to them. This finding can be correlated with intention to use IT and services.

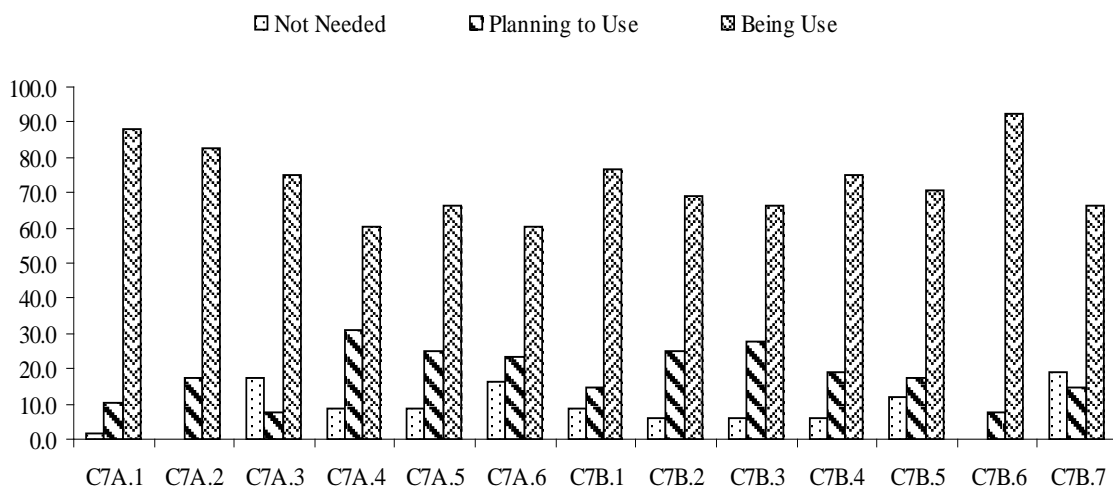


Figure 7: Types of IT Software Used by the Firm

### 4. Conclusion

A survey was conducted within the Malaysian construction industry and most of the respondents were in the private construction sector and they have work experience of more than 5 years up to 20 years in construction and engineering work. The majority respondent firms are G3 record 39.70%. However, more than 75% of the respondent firms are private sector. The participating firms (73%) are involved in the construction engineering work. The study shows with reasonable confidence that firms are using IT (40-75% of applications computerized), there was > 80% use of general and technical software, this finding can be correlated with intentions to use IT and services. This study also indicated that internet usage is one of the primary factors affecting the use of IT. In addition, the study indicated that it is undeniable that the internet has an impact on the way business is conducted including in the construction industry which is supported by a study by (Lim et. al. 2002). The computerized activities and materials digitally sent at the Firm (internally and externally) have been discussed. Thus, general and technical software use would have to increase greatly if the firm performance is to be substantially improved, that is agreed with in study by Oladapo (2007) and Samuelson (2008) in terms of state and importance of IT implementation by construction firms. The study contributes to the understanding of current IT implemented in the construction industry in Malaysia, predicting future directions, and conducting worldwide comparisons.

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