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Evaluate the Need for Information Technology in Construction Business and Industrial Marketing: Problems and Roles

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Abstract
The objective of this study was to gauge the lacking of using Information Technology (IT) in Malaysia construction firms based on the problems of these firms and by focusing on five IT roles. Literature review ranging from books, theses and articles were carried out to establish research framework. A questionnaire to survey the issues of construction firm problems and IT roles was designed and formulated. One hundred and fifty respondents from selected large construction firms in Kuala Lumpur, Malaysia were selected for the study but only 30 questionnaires were returned. Method of data analyzes was mean comparison by SPSS software. The results revealed the lacking of implementing IT in Malaysia construction firms. This study reported difficulties and problems in the flow of information in construction firms. This study also discovered the weakness of IT roles by many professionals in Malaysia construction firms.

1. Introduction

The construction industry is an information intensive industry where huge amounts of documentation are generated and exchanged among the individual parties contractually bounded to the project. This information intensiveness can also be a barrier to the overall goal of industry collaboration. Indeed the considerable quantities of documentation being created continue to rise depending on the type of project being undertaken which results in the operatives almost being submerged in information (Sommerville, 2006). The construction industry is fragmented due to its multidisciplinary/organizational nature, which has led to well documented problems with communication, information processing and low productivity in construction projects. Many problems are currently available in construction work, particularly in the construction projects, mainly when there are a number of overseas projects belong to one construction firm, or one project sharing between some of construction firms. The project problems could be appointed as following up to date the current events of the work progress, work problems and satisfying the optimum distribution of the resource management (Kjeld & Per, 2006). Depending on a paper based system for handling the multi processes that involved in the work of construction firm, mostly, cause lower productivity and profitability than the firms that follow digital based system. The Information Technology (IT) considering the best solution for all these problems and it is the tool that all construction firms need by connecting all the division of the construction firm and providing a software systems that can make the documentation and processing of data and information easy and reduce errors (Correia et al. 2014). Also, the construction firms need IT to satisfy the

requirements of competition. The use of IT can reduce these fragmentations by improves coordination and collaboration among firms participating in construction project, leading to better communication practices (Stewart, 2003). This study focused on the need for implementing IT in construction firm and this might the way to remove the misunderstanding, and challenge to implement IT in construction firm.

2. Construction Business Needs for It

Many small and medium sized of construction firms in the world have experienced problems with effectiveness and efficiency of their workflows. An international investigation pointed out that it is important to strengthen the industries innovation e.g. by increased use of information technology and increased collaboration with education and research institutes (Kjeld & Per, 2006). Although IT is important, it is need to be involved by construction management because IT requires organization and planning in line with the business requirements (Hollingworth, 1986). At the national level, communication standards have to be agreed upon before a national infrastructure can be set up for a smooth flow of information among organizations. Public agencies in many countries have plans for the dissemination of construction information to participating organizations, and new technologies are being tested to make this possible. Many problems with data exchange standards and classification, have to be solved before texture and graphical information can be shared among divers applications in separate organizations (Krishan et al. 1993).

In most of the world economies the construction industry has suffered from poor productivity and recently also from poor profitability. As in other sectors of the economy, Information Technology (IT) comes in focus when these problems are being discussed. IT has become the solution to the strategic problem that arises from current economic force such as globalization, deregulation, political turmoil, etc. IT has become of strategic significance in modern business from a position of being a support technology for information processing (Betts et al. 1991). Also IT is important in competition among other construction firms and to be up to date with new technology and new innovations.

3. It Role in Construction Business Firms

The functional role of IT can best be considered from three standpoints: the tool used in each of the various stages of a construction project i.e. pre tender, post-tender and post completion. How IT affects procurement and the eventual routes adopted for each project and organization. Finally IT impact on the humans involved in the delivery of the construction project (Sommerville, 2006). Also IT supports the optimization of a projects design from the perspective of multiple disciplines (Fischer & Kunz, 2004). Kjeld and Per (2006) argued the important role of IT in construction firms if Implementing IT systems to capture the usage of time and materials on projects, recording data on time consumption as well as use of materials and equipment, have a daily efficient reporting of time, material and equipment use on each project. In the late 1990's, some parties at construction organizations are increasingly aware of IT role and its value-adding potential and are appreciating the strategic opportunities it provides. Construction firms can use IT for process improvement, innovative approaches to engineering and construction problems, client satisfaction, management of competitors, and new contract and procurement systems (Betts et al. 1991).

4. Questionnaire Organization

A number of researches recently argued IT implementation in construction industry but they didn't test the need for it (e.g. Kanoglu, 2006, Tucker et al. 2001; Peansupap, 2004; Kjeld & Per, 2006). By considering these researches the questionnaire has been developed. The questionnaire contains three parts, part one is aimed to collect general information about respondents and construction firms including; job, academic degree, working experience, and the availability of IT department in the firm. Part two contains questions to test the compatibility rate of the respondents with problems availability in the construction firms. Part three is to gage the response of the firm's managers and project supervisors to apply IT systems that can play an important role in the construction firm. This part also tests the need for these systems by their view.

5. Collecting Data

Combination of postal mail and delivered by hand were chosen as methods to disseminate questionnaire and collecting data. The targeted respondents were Project Managers, members of Project Management team or site engineers. One hundred and fifty questionnaires were sent to large size contractors under grade seven (G7) classified by Construction Industry Development board (CIDB) Malaysia. Only 30 completed questionnaires were returned and the respond rate is 20% which is acceptable.

6. Method of Data Analysis

Mean comparison of data by using SPSS software and spider charts were used to analyze and compare the results. For analyzing requirements, the problems of construction firms divided into two groups, group one is the project management issues and group two is the construction firm issues as shown in Table 1. Also, five of IT roles and its reductions are in Table 2.

Table 1. *Two groups of construction firm problems with reduction words for each problem.*

Firm issues	Project management issues	Reduction in chart
1- In huge projects there are problems in up to date documentation of data and exchanging the information especially if the project is shared among a number of firms.		Exchanging information
	2- It is experienced that some workers often waited until Friday to fill in reports of the week and thus had problems to remember details on e.g. equipment use on different projects. This could result in errors or missing records on invoices to the customers.	Project record update
3- In most of the world economies the construction industry has suffered from poor productivity and recently also from poor profitability.		Profitability and productivity
	4- The construction firms have some problems with effectiveness and efficiency of their work flows.	Work flow effectiveness
5- There is a need to strengthen the industry's innovation e.g. by increased use of information technology and increased collaboration with education and research institutes.		Industries innovation
	6- Difficult to keep the engineers and the craftsmen up to date on changes in projects and tasks.	Flow project change
7- Difficult to give engineers and craftsmen access to internal and external information sources.		Access to information resources
8- There is a time delay after activities were actually performed until registered in the management system since paper based notes from the craftsmen should first be collected at the office and then be keyed in by a secretary.		Register activity delay
9- Difficult to follow existing procedures to ensure that all consumptions of time, materials and equipment were actually accounted to the correct project.		Project resources allocation

Table 2. *Group of some IT roles in construction firm with reduction words for each role.*

IT roles	Reduction in chart
1- Using the computer software systems (digital based) to collect and transfer the information is better than the traditional method (paper based).	Digital based
2- Online connection to mobile devices carried by all craftsmen or team leaders.	Online connection
3- Barcode readers integrated with mobile phones for easy data input of e.g. materials and equipment.	Web access
4- Real-time connection to the firm's general management systems.	Real time connection
5- Web access so engineers and craftsmen could check and update registered data from any computer, e.g. at home.	Barcode readers

7. Data Analysis and Discussion

The collected data were analyzed and discussed two times with and without considering the influences of respondents' qualifications and IT experiments of IT implementations in the selected large construction firms.

a) Overall statement of construction firms' problems and IT roles

The comparison of the results for each group has been carried in the spider chart format to visually explain the differences between these results and the maximum values depending on the mean. Table 3 shows the average mean and standard deviation of each group (groups of project management, construction firm and IT roles). The details of the mean values for each item of the groups as gated by SPSS and the comparison between them are clearly shown in figures 1, 2 and 3. These results neglected the effects of respondent's and firm's specifications.

Figures 1, 2 and 3 show the gap between the results and the maximum limits according to the mean values and ignoring the affects of firm and respondent characteristics. The research found that construction firms' problems (i.e. the Project Management issues and firm's issues) are existed because the mean values exceed 3, except the difficulties to give engineers and craftsmen access to internal and external information sources, because 2.5 does not give high indication about the availability of this difficulty as explained in figure 2. This is means that it is not very difficult to let the engineers and craftsmen in some construction projects access to the information resources of the firm.

Regarding to IT roles in the construction firm, the respondents did not agree so much with these roles as shown in figure 3, especially the role of IT in the online connection to mobile devices carried by all craftsmen or team leaders. This is maybe because most of the respondents do not have sufficient information and knowledge about these roles.

Table 3. *Average Means of Project Management Issues, Construction Firm Issues and IT Roles by neglecting any specification.*

Group Name	Number of respondents	Avg. Minimum Mean	Avg. Maximum Mean	Avg. Mean	Avg. Std. Deviation
Project Management Issues	30	1.8	4.00	3.1933	0.6505
Construction Firm Issues	30	1.5	4.00	3.0499	0.6647
IT Roles	30	1.6	3.6	2.606	0.6379

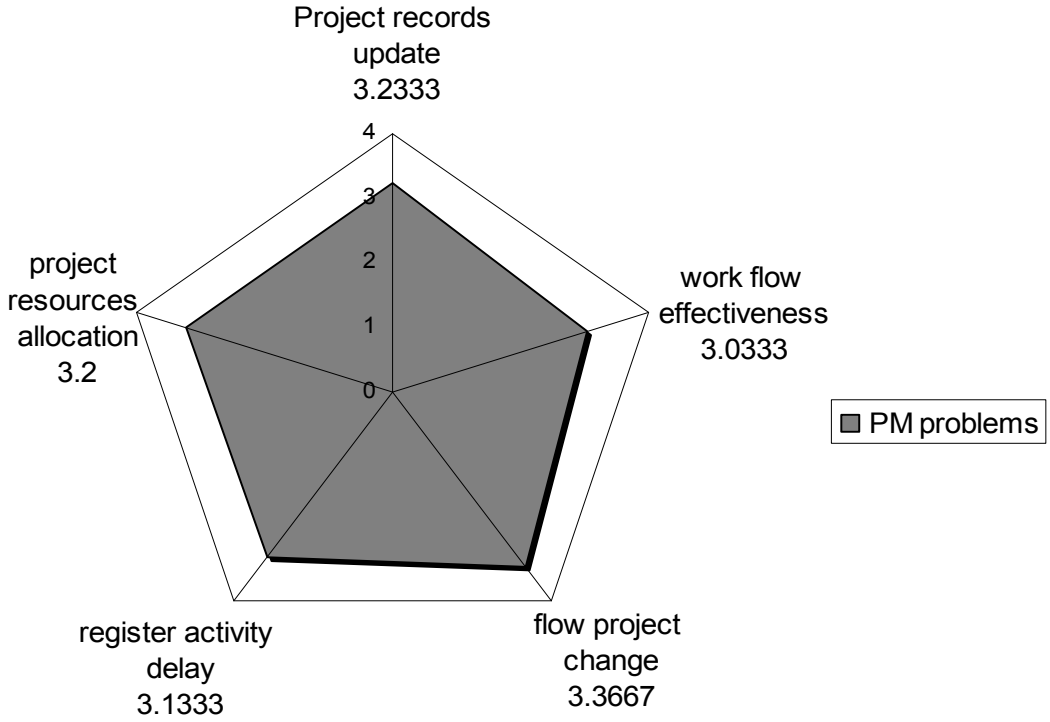

Figure 1. *Project Management issues of construction firm problems.*

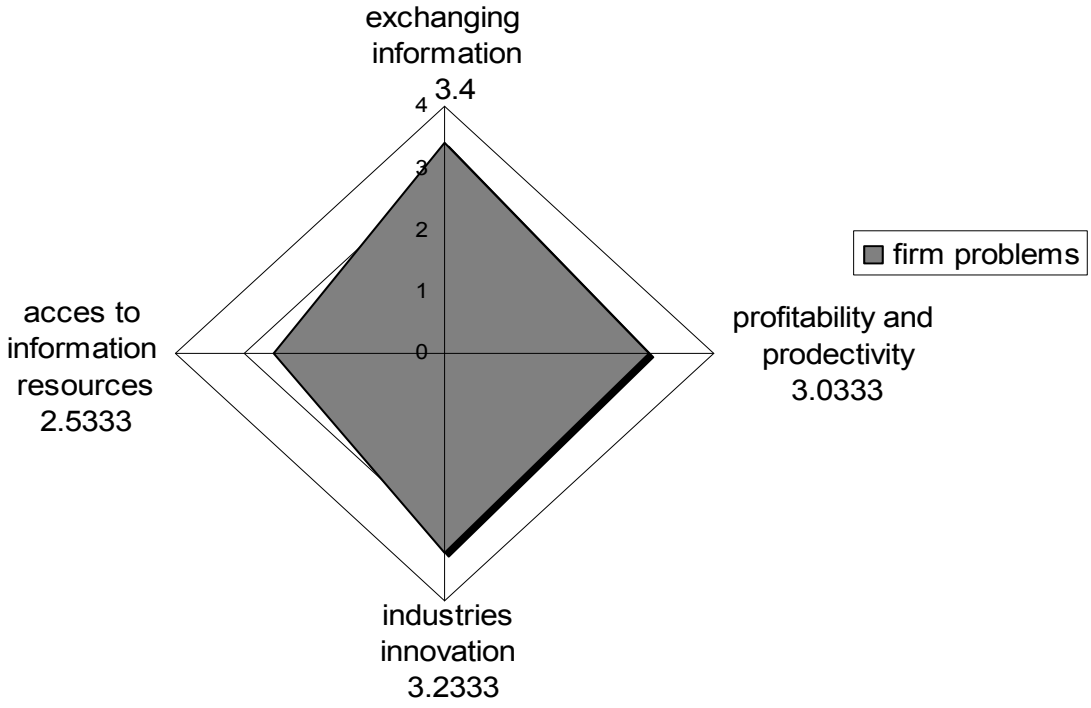

Figure 2. *Firm issues of construction firms.*

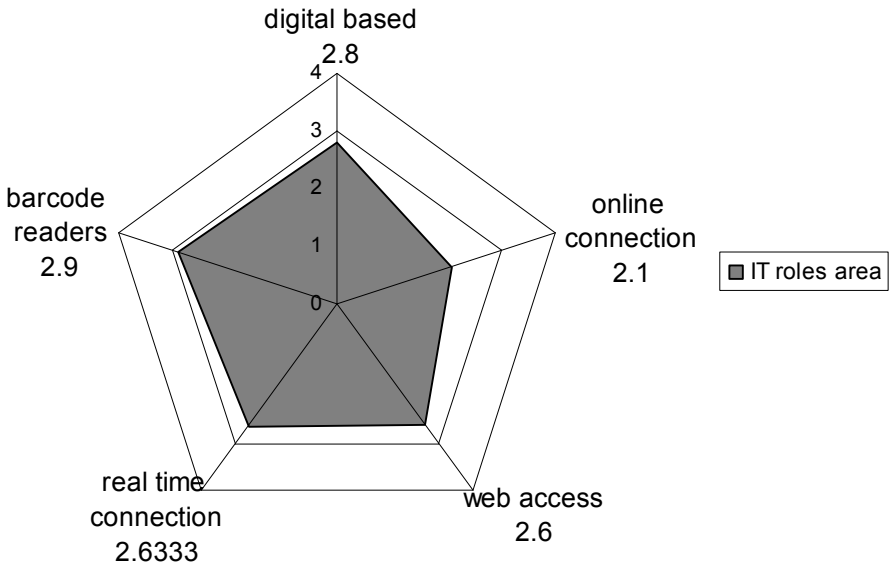

Figure 3. *IT roles of in construction firms.*

b) Construction firms problems and IT roles by firm and respondent characteristics

Many SPSS tables and spider charts to find the results by considering all effects of respondent and firm specifications one by one. The analysis of all these results as the following:-

1. Project Managers are the most agreed with the project management issues of construction firm's problems, the mean of their agreement up to 3.5. This result is normal because the Project Managers are the most people who know the management problems. Also Project Management team and supervisor engineers gave good agreement with these problems, mean values not less than 2.9 when the maximum limit of the mean is 4. The maximum value of mean for all respondents. This is 3.7 had been given to the difficulties of following the existing works to ensure that all consumptions of time, materials and equipments were accounted to the right project. This difficulty appears strongly in the firms that not use IT. Any way all the respondents agree with the availability of the Project Management problems, but the problems are strongly available in the firms that do not have IT.
2. Whatever the academic achievement of the respondent, all agree with the availability of Project Management problems because the mean values of their answers not less than 3. Generally, there is a similarity between the respondents verifications of the Project Management problems whatever their construction experience because minimum mean is 3, but the agreement of the respondents that have experience between 5 to 10 years is more in the problem of the time delay after activities were actually performed until registered in the management system, this maybe because they are more contact with this problem.
3. The respondents that are not working in IT department or there is no IT department in their firms agreed strongly with the availability of the Project Management issues, this maybe because they do not utilizes from the benefits of IT so the problems are bigger, but in general, the results show that problems are exist because the mean values of the respondents that working in IT department of the construction firm not less than 2.67. The Project Managers agree with the firm's issues by mean up to 3.75 for the problem of exchanging information, so the Project Managers agree strongly with availability of firm's problems that can be solved by using IT.
4. The firms that do not use IT have stronger problems of firm's issues, and this gave an indication about the need of using IT in these firms. There is a poor agreement by the respondents that work in firms have IT department with the difficulty of giving engineers and craftsmen access to internal and external information sources, that is match with the result that gated before, this prove that using IT can reduce this difficulty. The respondents that not working in IT department or there is no using for IT in their firms agree with the availability of the problems more than the others that working in IT departments. Generally, the mean values of the respondents according to the experience of IT are not high.
5. According to the academic degree of respondents, the difficulty of exchanging the information is big. The mean value is 3.5 by the respondents that achieve B.Sc. degree. Anyway, the results prove the availability of all firm issues problems except the difficulty of access to information sources. Not high values according to the work experience by the respondents with the difficulty of giving engineers and craftsmen access to internal and external information sources, and this like the most results that gated before.
6. Differs than construction firms problems, the supervisor engineers gave more agreement with IT roles than Project Managers although the Project Managers were the most agree with the firms problems that can be solved by IT, this is because the supervisor engineers are contact with

the utilization that can be gated by IT roles. The respondents that working in the construction firms that have IT department agreed with IT roles more than others because they touched the important roles of IT practically, in spite of this, the mean values that gated is not sufficient to agree strongly with these IT roles.

7. The respondents that are not working in construction firms that using IT agree with any new technology may develop the procedure of the work, so when IT not available the agreement is more, but generally, the mean values not so high and this prove that all the respondent did not agree strongly with IT roles. Whatever the academic degree that achieved by the respondent, analyzing the results by considering the academic degree give low mean values that is not sufficient to prove the interesting of IT roles in construction firms. Except the mean value 3.25 that gated from the answers of the respondents that have experience more than 10 years about the role of using barcode reader for materials and equipments, the mean values is not big enough to say that these roles is needed.

8. Summary of Results

Table 4 shows the mean values of all Project Management problems as one group of these problems by taking in the consideration each one of the respondent/firm specifications. Figure 4 illustrates the size of these problems in the construction firm. Also the mean values of firm issues without the details of each one of its problems separately are shown in table 5 and figure 5. By table 6 the mean values of IT roles in general are not high and this appear clearly in figure 6 by recognizing the size of IT roles in the construction firm.

The results of prove the availability of difficulties and problems in the construction firms. All these difficulties / problems can be reduced / solved by implementing IT. The percentages of agreeing with these problems is differs from problem to another depending on the specifications of the respondent and firm. The less values of mean by analyzing the problems according to each one of specifications gated in the difficulty of giving engineers and craftsmen access to internal and external information sources, so this difficulty is not so big and the engineers / craftsmen in some construction projects can access to internal and external information sources of their construction firm.

Generally, the respondents did not agree strongly with the roles of IT that can be utilized by implementing new management resource and time systems by implementing IT in their firms because most of them, even the respondents that working in IT department, have not enough knowledge about these roles.

Table 4. *Mean of Project Management problems by considering respondent/firm specifications.*

specifications		Minimum	Maximum	Mean	Std. Deviation
Respondent job	Supervisor engineer	2.91	3.45	3.1454	.21892
	Member in Project Management team	3.00	3.36	3.1454	.13786
	Project Manager	3.12	3.50	3.3250	.16771
IT availability in the construction firm	IT available	2.90	3.35	3.1100	.20433
	IT not available	3.00	3.70	3.3600	.33615
Academic degree of the respondent	Bachelor degree	3.04	3.39	3.1913	.13611
	Master degree	3.00	3.57	3.2000	.23903
Work experience	Between 5 -10 years	3.00	3.39	3.2222	.14164
	More than 10 years	2.92	3.33	3.1500	.16028
IT experience	IT experience available	2.67	3.00	2.9000	.14906
	IT experience not available	3.04	3.46	3.2667	.16560

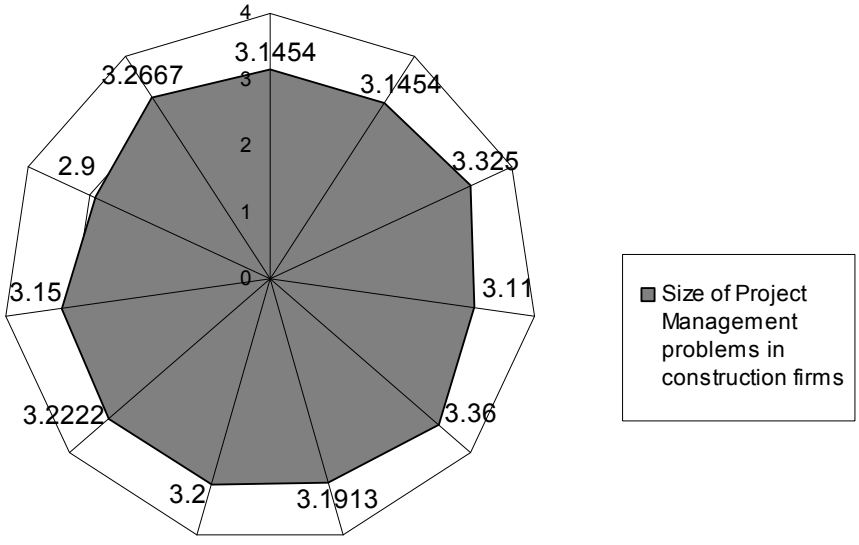

Figure 4. *Project Management issues of construction firms by considering firm/respondent specifications.*

Table 5. *Mean of firm issues by considering respondent/firm specifications.*

specifications		Minimum	Maximum	Mean	Std. Deviation
Respondent job	Supervisor engineer	2.55	3.29	3.0038	.28489
	Member in Project Management team	2.36	3.55	3.0947	.45199
	Project Manager	2.75	3.75	3.2333	.35916
IT availability in the construction firm	IT available	2.35	3.35	3.0383	.41465
	IT not available	2.90	3.50	3.2183	.21606
Academic degree of the respondent	Bachelor degree	2.52	3.52	3.1192	.38179
	Master degree	2.57	3.29	3.0298	.27622
Work experience	Between 5 -10 years	2.50	3.39	3.0806	.35470
	More than 10 years	2.58	3.42	3.1250	.32545
IT experience	IT experience available	2.00	3.50	2.8583	.58601
	IT experience not available	2.67	3.38	3.1583	.29959

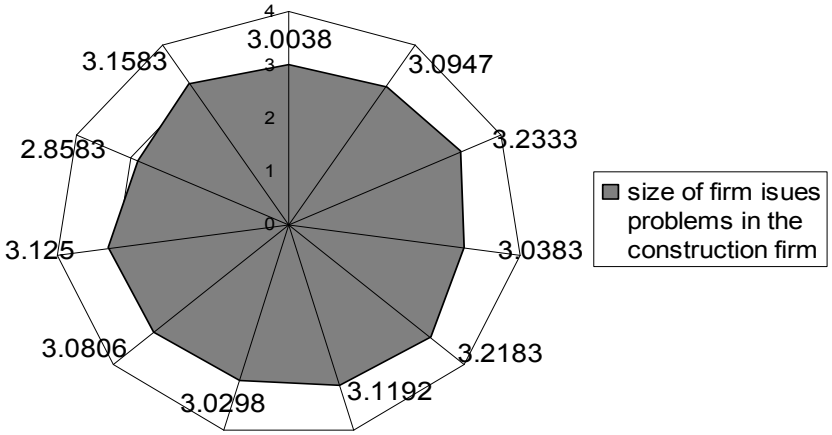

Figure 5. *Firm issues of construction firms by considering firm/respondent specifications.*

Table 6. *Mean of IT roles by taking in the consideration each one of the respondent/firm specifications.*

specifications		Minimum	Maximum	Mean	Std. Deviation
Respondent job	Supervisor engineer	2.18	3.09	2.7273	.34618
	Member in Project Management team	2.00	2.91	2.4909	.33772
	Project Manager	2.12	2.88	2.6000	.28504
IT availability in the construction firm	IT available	2.20	2.95	2.6300	.27973
	IT not available	1.90	3.30	2.5600	.50794
Academic degree of the respondent	Bachelor degree	2.09	2.96	2.6000	.32592
	Master degree	2.14	2.86	2.6286	.29620
Work experience	Between 5 -10 years	2.00	2.78	2.5889	.33241
	More than 10 years	2.25	3.25	2.6333	.40653
IT experience	IT experience available	2.17	2.83	2.5000	.26351
	IT experience not available	2.08	2.92	2.6333	.32730

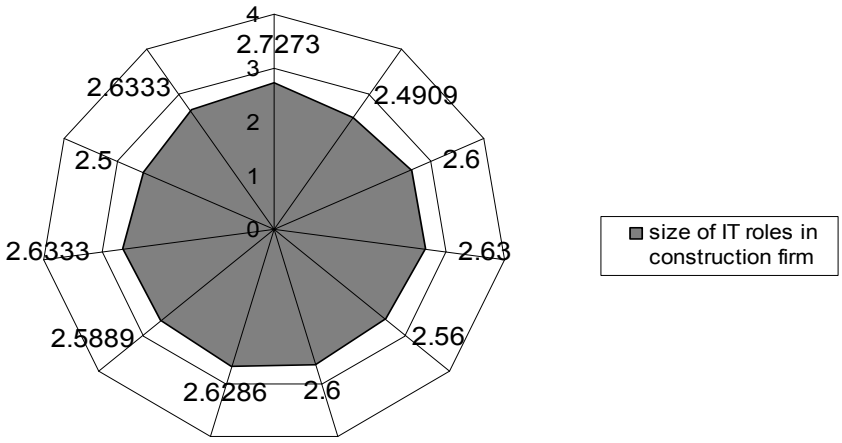

Figure 6. *IT roles in construction firm.*

9. Conclusion

1. The respondents' number of this study was small but so far it is accepted. The findings showed the existing of project management problem related to the flow of information and this may retarded the workflow/output in the construction firms.
2. The firms were reported to have problem in documentation and they suffering from poor productivity and profitability. Whatever the state of IT implementation in construction firm, no clear roles of IT recognized and reported by the respondents in the construction firms of Malaysia. This is possibly because of either the complex nature of the construction work or the ignorance of construction parties in these firms.
3. By taking in the consideration the results of this study, it can be concluded that the construction manager has to make a number of decisions regarding to construction firm issues that can cause difficulties and problems in the work flow and output and benefits from IT applications by changing the mindset about the roles of IT in solving many problems in construction firms.
4. This study recommended establishing a knowledge base of IT in the construction firms to make all construction professionals aware of IT because IT is a tool shared by all parties of constriction work and it is important to remove the misunderstanding of IT roles and increase the knowledge of IT benefits and qualify the end users of IT applications.

Future Study

Future study is developing an evaluation model for managing, measuring and evaluating the benefits that come out form implementing IT across larger samples covering large areas in different countries.

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