

Managing Information Technology in Construction Industry: The Indonesian Experience

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ABSTRACT

This paper presents findings of a research project, which explores the current use of information technology (IT) in the Indonesian construction Industry. The findings are based on a questionnaire survey taken during December 2002 and April 2003 among 250 construction companies registered in the National Construction Industry Development Board (CIDB). The CIDB listed and classified these companies as B group or large company. A total of 48 valid replies were received, representing a response rate of 44%. The survey includes IT environment and management, use of software, hardware, internet application and staff competency, Investment in IT, benefits gained and problems associated with its implementation, and an assessment of the exploitation of IT for business strategic purposes. Survey reveals that (1) Level of IT applications among contractors in the industry is relatively low in their core activity; (2) There is growing gap in managing IT, where high investment and expenditure on hardware and software on one hand with poor human resources development on other hand; (3) From strategic point of view, Indonesian construction industry is still in reactive mode of managing IT, and the industry has a limited understanding of the value and potential of IT. The paper also suggests a need to aggressively push relevant government initiatives that would increase strategic use and adoption of IT. Government and public agencies should consider policies, which encourage the use of IT in the construction industry thus making this industry sector more competitive.

Keywords

IT, Construction, Indonesia, Management, Strategic, Application.

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1. INTRODUCTION

The issue of technology exploitation, particularly in the field of information technology, is of significant importance in construction industry. Information technology (IT) has created fundamental impact on the way business processes are carried out. IT can no longer be viewed as an enhancement to traditional business procedures but rather as an innovation agent that enables new and different alternatives to operation of business organization. This new trend will color investment attitudes of business communities in the world towards utilization of IT in the coming years.

IT is already widely used in construction organizations and much more dramatic effects are anticipated for the years to come. Betts (1999) reported that the construction industries in many countries are starting to consider seriously the strategic use of IT. The use of IT in construction is extending beyond the stage of piecemeal application for improving the efficiency of discrete operations by individual organizations to advanced stage where IT is applied strategically in commercial enterprise, government agencies and professional institution. A pragmatist's strategic vision for IT in the construction industry must solve the economic issues (Macomber, 2003). From strategic point of view, IT has the potential to change the landscape of the construction industry.

2. INDONESIAN CONSTRUCTION INDUSTRY

The construction industry in Indonesia is a relatively young. However, it has grown significantly since the early 1970s. Its contribution to the GDP has increased from 3.86% in 1973 to 7.94% in 1996. It constitutes about 60% of gross fixed capital formation. The number of people employed in the industry has increased significantly, from about 413,000 in 1978 to about 3.796 million in 1996. Construction works in the period of 1996 to 1999 has been sharply reduced due to the recent economic crisis. After 1999, there is slow recovery. In contrast, number of construction companies has increased significantly during the period 1992 – 2002 (CIDB 2003).

Indonesia is an archipelago with more than one thousand islands. More than sixty percent of the construction works are in the island of Java, and more than half of this is in the capital city, Jakarta. Most of project planning and design is prepared in the national capital, Jakarta. Problems arise during construction where buildings or facilities could not be built as planned and designed, or could not be constructed efficiently. Many communication problems develop during the construction stage especially between designers and contractors. Communication in construction has been identified as a problem area (Ganah 2001). Information and Communication Technology (ICT) undoubtedly has a profound influence on how data and information is transmitted and used by parties involved in the construction industry. The Latham report has called for 30% cost saving in construction (Hamilton 1995). It said that many ways of achieving this saving will be found through the use of IT.

3. PREVIOUS WORKS

A number of research surveys concerning IT in the construction Industry have been reported in the literature. Many surveys were carried out in various countries such as: Australia (Love 1996, Stewart 1998, Marosszeky 2000, Thomas Ng. 2001), Canada (Rivard 2000), Hong Kong (Shen 1999, Fitcher 2000), Ireland (Thomas 1999), Malaysia (Mui 2002), New Zealand (Doherty 1997), Saudi Arabia (Sash 1996, O'Brien 1999), Scandinavia: Denmark, Finland, & Sweden (Howard 1998, Samuelson 2002), Singapore (BCA 2001, Swee-Lean 2003), South Africa (Arif 2003), Taiwan (Tan 1996), Turkey (Isikdag 2002), UK (O'Brien 1991, Ingirige 2001), and US (CFMA 2002), Toole (2003). With so much research being carried out on the use of IT in the construction industry, it is important to ensure that the results and findings can be compared and lessons learned be applied to gain a picture of the growth of IT use. However, the number of research surveys related to construction IT in developing countries appears to be limited. Above surveys certainly provide information of IT in construction industry in the developed

countries. Howard (2003) stated that IT products such as software are available worldwide, but may not fit into industries that are organised in a traditional way and do not have the same drive towards process improvement yet. Stewart (2002) reported that construction organisations operating in these countries face further distinctive difficulties, such as, scarcity of IT professionals, inadequate physical and information infrastructure, social and cultural diversity, and political barriers that modulate and distort competitive markets

4. RESEARCH OBJECTIVES AND METHODOLOGY

The research aims to investigate the current state of IT in the construction industry, to obtain an up-to-date and general view of the state of IT applications in Indonesia. The survey includes IT environment, such as hardware, software, networks, internet application, staff competency, IT investment and the resulting benefits and associated problems, and assessment of the exploitation of IT for business strategic purposes.

Postal transmission of questionnaire was selected as the main information gathering research process. This method is widely used for collecting data and opinions from target groups. Some personal interviews have also been undertaken to supplement some limitations of the postal questionnaire. The mailing list for the survey distribution was obtained from the National Construction Industry Development Board (LPJKN/CIDB). The survey recipients were mainly in the capital, Jakarta area for the following reasons: (1) About 30 percent of construction projects in Indonesia were located in the Greater Jakarta area, (2) Most of the projects, especially public work projects, were planned and designed in Jakarta, and (3) Most of the construction participants - owners, designers and contractors - have their head offices or representatives in Jakarta. There were approximately 247 organization addresses in the mailing list representing all national company which operating throughout Indonesia. A group of 130 randomly selected construction companies were sent the questionnaire. Of these 20 were returned undelivered and or declined to participate. 48 organizations (44 % of those delivered) returned the questionnaire. The questionnaire responses were entered into a spreadsheet for collation and analysis.

5. RESULTS & FINDINGS

5.1 Characteristics of Respondents

The companies represented in the survey had a workforce that varied from one employee to over 200 employees in average. Under half of the respondents have over 200 employees.

TABLE 1.
Company size (Number of employees)

Number of Employees	1-10	11-50	51-100	101-200	>200
Percentage	2.1%	29.2%	12.5%	18.8%	37.5%

The respondent companies with respect in terms of employees are shown in Table 1. The data are derived from Construction Industry Development Board (CIDB) of Indonesia. Most of the companies are involved in civil, electrical and mechanical construction works. Over 90% of all local companies are involved in civil construction business. Of all international respondent companies 64% have engineering business (Electrical and Mechanical Engineering), and 59% of them compete with the local firms in civil construction

TABLE 2.
Respondent Organization's Annual Revenues

Annual Revenue	<US\$0.1M	US\$0.1-0.6M	US\$0.6-1.1M	>US\$1.1M
Percentage	12.5%	25.0%	18.8%	43.8%

Thirty organizations had annual revenue of more than US\$666,667. Twelve (25%) organizations had an annual turnover between US\$111,111 – 555,556 and 6 organizations had an annual turnover of less than US\$111,111. In the highest category of revenues there are 45% of all multinational companies and 42% of all local companies had turnover of more than US\$1.1 m annually.

5.2 Current Usage of IT

This section will present IT environment within the following topics: Computing Environment, Machines or hardware, Numbers of PC, and attitude toward buying and purchasing hardware.

5.2.1 Hardware

In terms of hardware profile, Table 3 (base on partial response to this question) shows that majority of the respondents have networked computers. Only 5 companies (10%) indicated that they did not have networking, but stand-alone computing. All of the companies have at least one personal computer (PC) and printer. More than 50% of respondent have CDROM, CD Writer and Scanner facilities, LAN/WAN, and Intra/Extranet at their workplaces. This means that they are at least starting use of IT. When assessed as to whether they have all of the listed machines, there are only 13% of respondents have a full range of hardware.

TABLE 3.
Hardware Profile

Profile	Stand Alone	Networking
Percentage	13%	21%

Table 4 indicates number of PCs owned by all the companies surveyed. It varies from 1 to more than 500 PCs. 17% of them have 1-10 PCs, the lowest ratio. The Biggest ratio (i.e. more than 500 PCs) is owned by 8% of all firms. In addition, 62% of Local companies own more than 50 PCs, while a half multinational firms have less than 100 PCs. Almost all of the PCs are running with Pentium (III or IV) Intel processors. A significant number of company use AMD processor based PCs, which are less expensive. Refer to Table 1 discussion as well.

TABLE 4.
Number of PCs Owned

Number of Computers	1-10	11-50	51-100	101-200	200-500	>500
Percentage	17%	30%	17%	19%	10%	8%

5.2.2 Software

This survey also looked at the types of application software used in the industry. This is to evaluate the extent of computerization of some business process within respondent companies.

TABLE 5.
Applications in Business Processes

Software Applications	Percentages
General Administration	100%
Design/Drawing	92%
Scheduling & Resource Planning	75%
Book Keeping	71%
Project Management	69%
Costing/Budgeting	65%
Invoicing/Claims	60%
Tender Preparation & Bidding	58%
Technical Calculations	56%
Bill of Quantities	56%
Material Control & Purchasing	56%
Office Supplies Purchasing	52%
Engineering Analysis	48%
Specification Writing	35%
Document Tracking & Management	29%
Facilities Management	19%
Economic & Risk Analysis	8%

Table 5 reveals the extent of software applications of some business processes. The answers provided by the respondents were classified into three distinct categories: (1) Highly computerized applications i.e. from 60 to 100%; (2) Moderate use as 30 to 60%; and (3) Low use as under 30%. Findings show that, all respondents use computer for general administration works, and drawings, scheduling, bookkeeping, costing, invoicing and project management are highly computerized. Many functions such as tender preparation, bill of quantities, material control, technical calculation and engineering analysis, and spec writing are moderately computerized. Economic and risk analysis, the prime tool in business planning process is not used very much.

Most of the firms (96%) have access to the Internet. Only 4% of companies have no internet access. 60% of the companies currently have a web site, and 40% do not have a company web site. Few companies have E-commerce applications (10%), which is not surprising since Indonesian government only launched e-procurement system into construction industry last year.

5.2.3 Staff Competency

It is important to explore staff competency among companies surveyed in order to know how well the staff is supported by the company.

TABLE 6.
Proportion of Staff that has computer training

Proportion of Trained Staff	1-10%	11-20%	21-50%	51-80%	81-100%

Total Responses	6	10	13	12	7
Percentage	13%	21%	27%	25%	15%

In terms of training, only 40% of all firms have (over 50%) of their staffs undergo some form of formal computer training. Only 15% of firms appear to have the highest level of computer competence. These figures indicate insufficient support from companies for human resource development.

5.3 IT Barriers & Benefits

The survey reveals following as hindering the use of IT: (1) The rapid changes in technology, and integration or compatibility problems; (2) The main human factors are lack of knowledge or awareness of availability of IT, and inadequate training; and (3) Lack of available funding and finance.

TABLE 7.
Overall barriers experienced

Responses	Barriers/Obstacles
65%	Lack of knowledge / awareness of available IT
63%	Lack of available funding
56%	Inadequate training
52%	Rapid changes in technology
48%	Integration / compatibility problems
46%	Difficulty in proving that the benefits of IT
33%	Software problems
29%	Reliability / breakdown problems
27%	Hardware problems
21%	Security not guaranteed
21%	Poor management
19%	Poor teamwork
17%	High Cost
13%	Fear / mistrust of technology
13%	Poor leadership

The survey asked contractors to identify benefits from the investment of information technology (Betts 1999).

TABLE 8.
Selected Most Benefits Gained

Effectiveness Benefits	Responses
Quicker responses on current project progress	77%
Overcoming obsolescence	75%
Ability to handle more enquiries	67%
Faster delivery of services	65%
Ease of capture of meaningful information	63%

Introduction of IT in the industry has raised the benefits for firms; track current project progress, improve ability to handle more inquiries, and reduced paper works. They have also credited IT for the improvement in reducing communication cost and time. In terms of measuring effectiveness of benefits gained are: (1) faster delivery services, (2) reducing lead times for financial reporting, (3) easier international links, and (4) better control of cash flow. In performance, IT has overcome

obsolescence, facilitated retrieval of meaningful information and improved filtering information. These were perceived to be the dominant benefits to organizations. Looking at effect on strategic business, survey indicated that 29% of the firms surveyed credit IT as strategic competitive advantage.

6. CONCLUSION & RECOMMENDATION

Survey shows that Indonesian construction industry has the latest in hardware and software, but does not have adequate and trained personnel to utilize the same. It can be surmised that IT is used mostly in administration and other supporting area, but not in strategic core and business enhancement processes. Technical and project use of IT is increasing and the benefits are recognized by the companies. If above areas of IT applications are strengthened the Indonesian construction industry will reap greater benefits.

Use of IT is prevalent at lower level, however top management of construction organisations should have strong commitment to develop strategic management of IT in their business processes at all level. The hardware, software and their applications should be utilized to enhance both core and supporting activities to gain competitive advantage in today highly global business environment. Secondly, The firm's management should give greater attention to IT support and training, by making sure that there is sufficient trained staff for the implementation of IT, and making greater effort in training staff on the correct and efficient use of IT in the organization. The authors feel that Government and public agencies should consider policies that encourage the use of IT in the construction industry thus making this industry sector more competitive, and encourage industry to make greater use of information system.

FURTHER WORKS

The survey was confined to only one sub-sector (large contractors) of the Indonesia construction sector in particular Jakarta. Other sub-sectors such as small and medium firms should be a part of future surveys. This being the first published survey of this type in Indonesia, a full study in greater breath and depth would be highly recommended for this important field. The result of such a study and the adoption of its recommendations would be of immense value to the construction industry in Indonesia and the national economy. Further studies should compare responses from multinational companies with those from Indonesian firms.

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