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# **STRATEGIC MANAGEMENT OF INFORMATION TECHNOLOGY IN CONSTRUCTION INDUSTRY: THE INDONESIAN PERSPECTIVES**

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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 survey taken between 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 38%. 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 IT implementation. An assessment of the exploitation of IT for business strategic purposes was also explored. Survey reveals that (1) Level of IT applications among contractors in the industry is relatively low in their core activity; (2) There is a growing gap in managing IT, where high investment and expenditure in 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 in managing IT indicating that the industry has a limited understanding of the value and potential of IT. The paper suggests a need to aggressively promote relevant government initiatives which would increase strategic use and adoption of IT. Government and public agencies should consider policies that encourage the use of IT in the construction industry thus making this industry sector more competitive.

**Keywords:** Construction, Indonesia, Investment, IT, Management, Strategic.

## **INTRODUCTION**

The issue of technology exploitation, particularly in the field of information technology, is of significant importance in construction industry. The paper discusses the finding of a survey of 250 construction companies registered in the National Construction Industry Development Board (CIDB). 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 in 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 industry in many countries is 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 an advanced stage where IT is applied strategically in commercial enterprise, government agencies and professional institution. From strategic point of view, IT has the potential to change the landscape of the construction industry.

## **INDONESIAN CONSTRUCTION INDUSTRY**

The construction industry in Indonesia is 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 these are 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.

## **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 Tang (1996), Turkey Isikdag (2002), UK O'Brien (1994) , 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 organized in a traditional way and do not have the same drive towards process improvement yet. [Stewart (2002)] reported that construction organizations 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

## **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, staff competency, and 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 are located in the Greater Jakarta area, (2) Most of the projects, especially public work projects, are planned and designed in Jakarta, and (3) Most of the construction participants - owners, designers and contractors - have their head offices or representatives in. There were approximately 247 organization listed in the mailing list representing all national companies which operate 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.

## **RESULTS & FINDINGS**

### **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)

<b>Number of Employees</b>	<b>1-10</b>	<b>11-50</b>	<b>51-100</b>	<b>101-200</b>	<b>&gt;200</b>
Percentage	2.1%	29.2%	12.5%	18.8%	37.5%

The respondent companies in terms of size (number of employees) are shown in Table 1. The data is 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

<b>Annual Revenue</b>	<b>&lt;US\$0.1M</b>	<b>US\$0.1-0.6M</b>	<b>US\$0.6-1.1M</b>	<b>&gt;US\$1.1M</b>
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.

## IT investments

This section will present IT environment within the following topics: General IT investment, IT related expenditures, and reasons toward investing on IT.

### General IT investment

The amount of company funds spent on IT investment has always been controversial. For many years it has been thought by some executives feel that too much has been spent and with insufficient return from this IT expenditure.

Table 3: Level of Spending on IT

<b>Level of Spending</b>	<b>&lt;5%</b>	<b>6-10%</b>	<b>11-20%</b>	<b>&gt;21%</b>
Percentage of respondents	52%	31%	8%	8%

In terms of spending on IT, by looking at the current picture, most firms (83%) spend less than 10% of their overall expenditure on investments in IT. 16 % of the companies surveyed spend more than 10% on IT.

### Budget on IT related aspects

With the scant budget for IT expenditure, the firms tend to spend it more on hardware and peripherals (98%). As more new IT products come out in more frequent cycles, the pressure to upgrade will only increase. Naturally, to operate the latest hardware and employ the necessary applications must be followed by an 88% budget in spending on Software.

Table 4: Budget on IT related aspects

Budget/Costs	Hardware	Software	Network	Training	Manpower	Others
Percentage	98%	88%	50%	40%	29%	6%

However, the proportion of training and manpower costs is well below under hardware, software, and networks management costs.

Interestingly, with the emphasis on upgrading the systems, IT manpower and training takes up the fourth and fifth budget priority. There is a disparity on having the latest in hardware and software without the necessary adequate and/or trained personnel to operate it.

### Reasons for Investing on IT

The motivation for investing in IT seems to be initially for proficient technical work, followed by management control and reporting, demand from employee (internal purposes). Innovation becomes least reason for investing on IT.

Table 5: Reasons for Investing on IT

Reasons	Responses
Desire to make technical work more efficient	81%
Demand for management control and reporting	67%
Demand from employees	60%
Desire to stay ahead of competition	58%
Demands from clients/customers	50%
Strategic decision from company management	42%
Desire to make administrative work more	33%
Demand for business sustainability	33%
Exploitation and Innovation of new and latest technology	29%

## LEVEL OF IT USE IN BUSINESS PROCESS

In the next, level of IT use in business processes is going to be set. With so many potential strategic applications for IT in business, it becomes important to find a means of classifying the role played within organizations business processes. To enable such classification, a self-assessment matrix categorizing IT use into one of level or quadrants is often utilized. Construct IT – University of Salford develops the following matrix.

Table 6. IT Self-Assessment Matrix

IT Level	Characteristics
<b>5 Integrated</b>	IT plays a vital role in your business activities and is integrated with your clients and business partners IT systems
<b>4 Strategic</b>	Your business employs IT as part of overall business strategy. IT used to analyse and improve business activities
<b>3 Planned</b>	Your business has a program for IT investment and implementation. The application support business activities and tend to be working satisfactorily
<b>2 Responsive</b>	Competitors or software vendors govern IT implementation. IT is used primarily when asked by clients and partners
<b>1 Occasional</b>	Your business has limited understanding of value and potential of IT. It is dependent on individuals buying hardware and software for their own needs
<b>0 Not Used</b>	Your business does not use IT to support its activities

In this case, business processes have been defined as processes that cut through the entire organization to exist as a business entity. [Betts (1999)] outlines a definition of generic business processes in construction enterprises as shown below:

*Business Planning:* refers to strategic management of the organization, deciding on new business ventures, and other senior management functions.

*Marketing:* refers to market selection, public relation activities, market intelligence, and generating new business.

*Information management:* refers to communications links between parts and locations of the business and external organizations, information achieving and distribution, and activities in information processing. It also includes information strategy and system planning.

*Procurement:* refers to all activities associated with the involvement of the organization in the procurement activities of the client or customer and to the activities associated with procuring the services and activities of other participants to the organization's input to the project. *Finance:* refers to activities associated with financial management and transaction processing on projects and at head office within organization

*Client Management:* refers to activities associated with managing relationships with customers, both on specific projects and in longer-term relationships.

*Design*: refers to those activities concerned with obtaining a brief, conducting feasibility studies, and sketch and detailed design activities undertaken on projects.

*Construction*: refers to those activities associated with production support on projects and extends into commissioning.

*Occupation and maintenance*: refers to activities associated with the use and occupancy, and maintenance phases of buildings and projects.

*Human Resources*: refers to activities within the organization and on its projects that concern the management of people.

The Porter's Value chain models [Porter (1980)] can also to be adapted to the construction industry, where business processes divide into two categories:

*Core activities*: refers to processes associated with business planning include design, construction operations include planning & scheduling, Operation executions and client services follow-up include client management.

*Supporting activities*: refers to processes associated with human resources, procurement, finance, IT and other technology application and development, and marketing.

The following sequences describe the methodology adopted in assessing the level of IT use in different business processes in construction organizations.

Use questionnaire results related to three typical benefits gained in the previous section would to find out the role played within construction organizations. [Betts (1999)] provided a useful checklist of typical benefits in relation to business processes.

Rank business processes and the classify into core activities and supporting activities

Use the self-assessment matrix to assess the level of IT use.

The results of the above assessment are shown in Table 7

Table 7: IT use in Business Processes

<b>Business Processes</b>	<b>Total Score</b>
Business Planning	4.58
Marketing	4.00
Information Management	3.67
Procurement	3.67
Finance	3.19
Client Management	2.90
Design	2.75
Construction	2.60
Occupation & Maintenance	1.44
Human Resources	0.73

Table 7 shows construction organizations in Indonesia use IT mostly in processes related to information management, occupation and maintenance management, and business planning. IT has made little difference in business human resources and marketing process. Overall, IT has been employed in core activities rather than supporting activities within business process. However, the level of usage is still very below. From this evidence, it may be concluded that Indonesian construction companies are not yet in the strategic position in the exploitation of IT. It can be said to be in planned level where the applications support business activities.



## **COMPARISON OF IT INVESTMENT IN INDONESIA WITH OTHER COUNTRY**

Looking at IT use in Singapore construction industry [Technowledge, (2002)] that could be as best figures of recent pattern in developing country, in particular Asia. Other similar surveys that have been carried out in the past about information technology in the construction industry include the following:

A Survey on the impact of information technology on Canadian architecture, engineering and construction industry [Hugues Rivard (2000)

IT-Barometer (2000)]: The use of IT in the Nordic construction industry [ Olle Samuelson (2002)].

The barometer survey has been applied to a number of different countries over last five years. However, there is a limit to the extent of comparison that can be made between these different surveys, as there is a variation in both the questions asked and the classification of individuals and firms that supplied answers. Although a direct and exact comparison is not possible, the following general comments can be made in relation to the past and current use of information technology by the construction firms in Singapore, Canada and Nordic Countries:

The motivation for investing in IT stems first internally in Indonesia and Singapore (demand from employees), followed by demands from client and desire to make more administrative work. In contrast, firms in Canada and Nordic Countries, where desire to stay ahead of competition and make administrative works become leading motivations, and then followed by desire to make technical work more efficient.

## **CONCLUSION & RECOMMENDATION**

Survey shows that Indonesian construction industry was having investment for acquiring 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.

If above areas of IT applications are strengthened the Indonesian construction industry will reap greater benefits.

Since the level of IT use is prevalent at lower level, top management of construction organizations should have strong commitment to develop strategic management of IT in their business processes. 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. Thirdly, 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.

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