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ABSTRACT

Construction industry currently is facing with a lot of problems mainly associated to its inefficient work process. This phenomenon has been manifested by frequent news and critics about project delay and inferior quality. Therefore there is an urgent need for construction industry to improve this situation. Many efforts have been done to improve the performance of the construction industry reputation such as using alternative procurement system, adoption of tools and management philosophy from other industry and using to new technological advancement such as the used of modular construction in Malaysia. In view to these problems face by the industry, this study has been undertaken with the aim to determine the strategies to improve the efficiency in construction process. The methodologies adopted for this study are the interview with expert panels and the distribution of questionnaires survey. The findings from this study confirmed that the construction industry particularly in Malaysia need to be improved with regards to its efficiency. There are also a lot of problems associated to construction such as poor site management, redundancy of activities, project delay and lack of focus to customer/end users' requirement. The study also determined that the main strategies currently promoted to achieve the improvement are by using Industrialized Building System (IBS). Many organizations also integrate the quality management system such as ISO 9001 and Total Quality Management System (TQM) in their business process. The used of management tools and philosophies from other industry is not a popular strategy.

ABSTRAK

Industri pembinaan kini menghadapi pelbagai masalah yang berhubung kait dengan proses kerja yang tidak efisien. Fenomena yang seringkali dikhabarkan di dalam berita ialah mengenai kritikan kelewatan projek dan masalah kualiti. Sehubungan dengan itu, terdapat keperluan untuk memperbaiki perkara tersebut. Pelbagai usaha telah dijalankan bagi meningkatkan tahap prestasi dan reputasi di dalam industri pembinaan. Ini adalah termasuk mengenalkan sistem pemerolehan baru, kaedah dan filosofi daripada industri lain seperti perkilangan dan juga pemakaian teknologi baru seperti system modular di Malaysia. Oleh yang demikian, kertas kerja ini disediakan bertujuan untuk mengenalpasti strategi yang dapat meningkatkan tahap efisien di dalam pengurusan pembinaan. Dua kaedah yang telah digunapakai di dalam kertas kerja ini ialah temubual dengan panel pakar dan borang soal selidik. Hasil daripada kajian ini didapati industry pembinaan di Malaysia perlu ditingkatkan lagi tahap efisiennya. Terdapat juga pelbagai masalah yang berkaitan dengan pembinaan seperti masalah pengurusan tapak, aktiviti yang berlebihan, kelewatan projek dan kurang menitikberat kepuasan pelanggan. Kertas kerja ini juga telah mengenalpasti strategi kini yang telah digunakan untuk meningkatkan tahap efisien di dalam proses kerja oleh industri pembinaan di Malaysia adalah penggunaan sistem perindustrian pembinaan (IBS) serta pengurusan kualiti seperti ISO 9001 dan Total Quality Management System (TQM). Hasil kajian juga mendapati penggunaan sistem pengurusan baru yang telah digunapakai oleh industri lain kurang popular untuk diadaptasikan di dalam industri pembinaan.

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adopted by past experience or project. Furthermore there is no standard measurement in enhancing traditional construction process such as monitoring and controlling method for construction process. Contractor used their past experience in predicting the project time. In reality, they faced a lot of problem in engaging the project and project time will be behind the schedule. It is very important to improved the efficiencies of construction process. Generally by enhancing the efficiencies in construction process, project time will be reduced, improved construction quality, eliminated waste and saved cost.

1.2 Problem Statement

Many issues were raised in traditional construction process due to its efficiencies. People do aware about issues and problems in traditional construction process but do not try to find the right solutions. Traditional work process usually is associated with problem and limitation. A lot of implications that been outline in this study such as project delay, redundant work and activities, poor management, and communication breakdown. They also are related to abandoned projects. Current construction industry also was sometimes not achieved the expectation of end user and costumer. Problem of delay and low quality project seem to be happened in construction project. A serious actions need to be taken but there is no indicator can be measured towards the efficiencies of construction project. Many new strategies and methodologies were introduced to the industry but the practicality of the strategies still cannot be assured.

1.3 Objectives

The main aim of the study is to determine strategies to improve construction process.

Below are the objectives of this study:

- To review the rationale and the need to improve the efficiency of the current construction process.
- To evaluate the methodology used in achieving efficiency in construction process

1.4 Scope of Study

The scope of this study was focused on the process of construction project in Peninsular Malaysia. It is limited on the construction stage/phase and time factor. Data analyzed were from the project manager, project management consultant (PMC), engineer and other construction players involve directly in construction process.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Construction processes include several activities. Construction processes are mapped onto the different construction stages that include feasibility and strategy, preconstruction planning and design, construction and completion and maintenance. Construction is a process that consists of the building or assembling of infrastructure. However current construction process faced a lot of problems and inefficiencies. This chapter elaborated the limitations and problems that associated with current construction practice.

2.2 Traditional Construction Process

Basically traditional construction process is a task or activity that viewed from only one perspective (generally time). It is useful in a restricted way and whereby conditions are stable, repetitive, predictable and certain. It is said not dependant on teamwork as the design and construction are separated. No integration between these two teams.

Traditional construction is part of the informal sector of the building industry, largely carried out without professional involvement by builders working with a vernacular that they have learned through some form of apprenticeship. While construction methods vary across the world all share some simple characteristics. They make use of local materials, had to evolve to cope with local conditions and said to be robust.

The building methods will have been developed to use the most economical materials available that will give adequate standards of performance. This performance includes both the satisfactory planning of the building to suit local patterns of use and a sufficient construction to provide adequate thermal performance

and resist the imposed loads. There are two main deficiencies: it is not recognized that there are also other phenomena in production than transformations; it is not recognized that it is not the transformation itself that makes the output valuable, but that the output conforms to the customer's requirements. The transformation view is instrumental in discovering which tasks are needed in a production undertaking and in getting they realized. However, the transformation view is not especially helpful in figuring out how not to use resources unnecessarily or how to ensure that the customer requirements are met in the best manner. Therefore, production, managed in the conventional method, tends to become inefficient and ineffective.

The traditional construction process is essentially linear, that is an input undergoes a transformation that results in an output. Thus the traditional view of process is that of a task or activity. Yet construction is not at any level a simple linear process brief in building out. What is required is a process that makes sense of the complex relationships in construction and responds to uncertainty and risk. What is required is a process that gets you from where you are to where you want to be.

2.3 Efficiency in Construction Process

Construction time has always been seen as one of the benchmarks for assessing the performance of a project and the efficiency of the project organization. Timely completion of a construction project is one goal of the client and contractor because each party tends to incur additional costs and lose potential revenues when completion is delayed Thomas et al (1995). Chan and Kumaraswamy (1996) opined that a project is usually regarded as successful if it is completed on time, within budget and to the level of quality standard specified by the client at the beginning of the project. Attempts to predict construction duration represent a problem of continual concern and interest to both researchers and project managers. Skitmore and Ng (2003) identified the use of detailed analysis of work to be carried out and resources available as well as limited budget and time available to the client as the common methods of estimating construction time in practice. However, to reduce subjectivity according to them, serious interest in construction time performance commenced with a pioneering investigation by Bromilow in 1969 in Australia Chan and Kumaraswamy (1999). His efforts yielded result in 1974 when he established a model for predicting project duration for building projects based on a time cost relationship. Efficiency in construction process can be defined as efficient construction site communication, managing time

efficiently, managing waste and avoid waste production. According to Preece *et al.* (1998) effective communication is one of the strategic tools available for gaining employee commitment, improving morale, increasing productivity, quality and safety and introducing new technologies. All parties involved in a construction project are producers, suppliers and consumers of information. Hence ,owners, designers, contractors, suppliers, and construction managers will benefit substantially from having the means to deliver and access to information wherever and whenever they need to Bakeren and Willems (1993).

2.4 Inefficiencies in Construction Process

There are many factors contributed to the inefficiencies of projects. These factors are presented as follows:

2.4.1 Poor Time Management

Time delay is the most widely held cause for construction disputes. In the past it was an accepted to have delays in construction projects completion time. However, today, with a client tight budget, delays became a very significant cost item. Delays in construction projects are frequently related to word "expensive", since there is usually a construction loan involved which charges interest, management staff dedicated to the project whose costs are time dependent, and ongoing inflation in wage and material prices. A lot of techniques are used to analyze delays. Some of these

methods have inherent weaknesses and should be avoided.

The most efficient management system is ultimately useless if the people who need to use it cannot. Here is an example of how the right materials management solution was implemented and then linked between buildings, various campuses and people, bringing the benefits of the system to everyone who needed them.

Basically reducing time in construction could give effect and implication to other elements which are gave advantages to clients, consultants and contractor. "For example a rule of thumb for moderate-to high-technology firms is that a six-month delay in bringing a product to market can result in a gross profit or market share of about 30 percent. In these cases, high-technology firms typically assume that the time saving and avoidance of lost profits are worth any additional costs to reduce time without any formal analysis(Gray and Larson, 2000).

Other reasons of reducing construction time because it is been imposed. It is explain such as when a project that been instructed by president or government for a certain reason. The rationale of reducing construction time is also because the project is important for all users or other function. For example, construction of the highway or road. Highway and road is important as that will be used for all residents.

To measure the effectiveness of the material management process is needed in order to analyze problems, suggest solutions, and assess the impact of modifications to the process. Such measurement is also required for any benchmarking effort. Productivity is extremely important in the construction industry. Governments and other owners are investing significantly less money into capital works and preventative maintenance programs, even though these programs would help curb the deterioration of the infrastructure. One of the reasons for this lack of financial commitment towards construction projects is that productivity and quality in the construction industry has as much as in other industries, and construction is therefore

regarded as a poor investment. Inefficient use of allotted time

2.4.2 Construction Waste

Waste in construction is a result of inefficiency in project management strategy. It can also result in project failure or ability to get maximum profit for the contractor. It is also leads to environmental issues. The huge volume and various compositions of construction waste have made its disposal a serious problem because it leads to environmental impacts such as landfill space and resource depletion. A huge concern must be given to construction waste generation and management to reduce its burden to the environment. The most significant environmental aspect was disposal of paper-based packaging waste followed by disposal of inert waste and plastic-based packaging waste, and recycling of steel containers off-site. The most preferred sorting scheme was to sort at specific work area for different types of work tasks. On-site sorting should be encouraged to facilitate construction waste reuse and recycling. Specific guidelines for construction waste management should be formulated and enforced to ensure sustainable construction.

i. Types of construction waste

Patterson (1999) stated that construction waste were included materials from all categories, the main components (by weight) are typically:

Rubble, concrete etc	40-45&
	20-25% concrete & cleanfill
	10-15% plasterboard

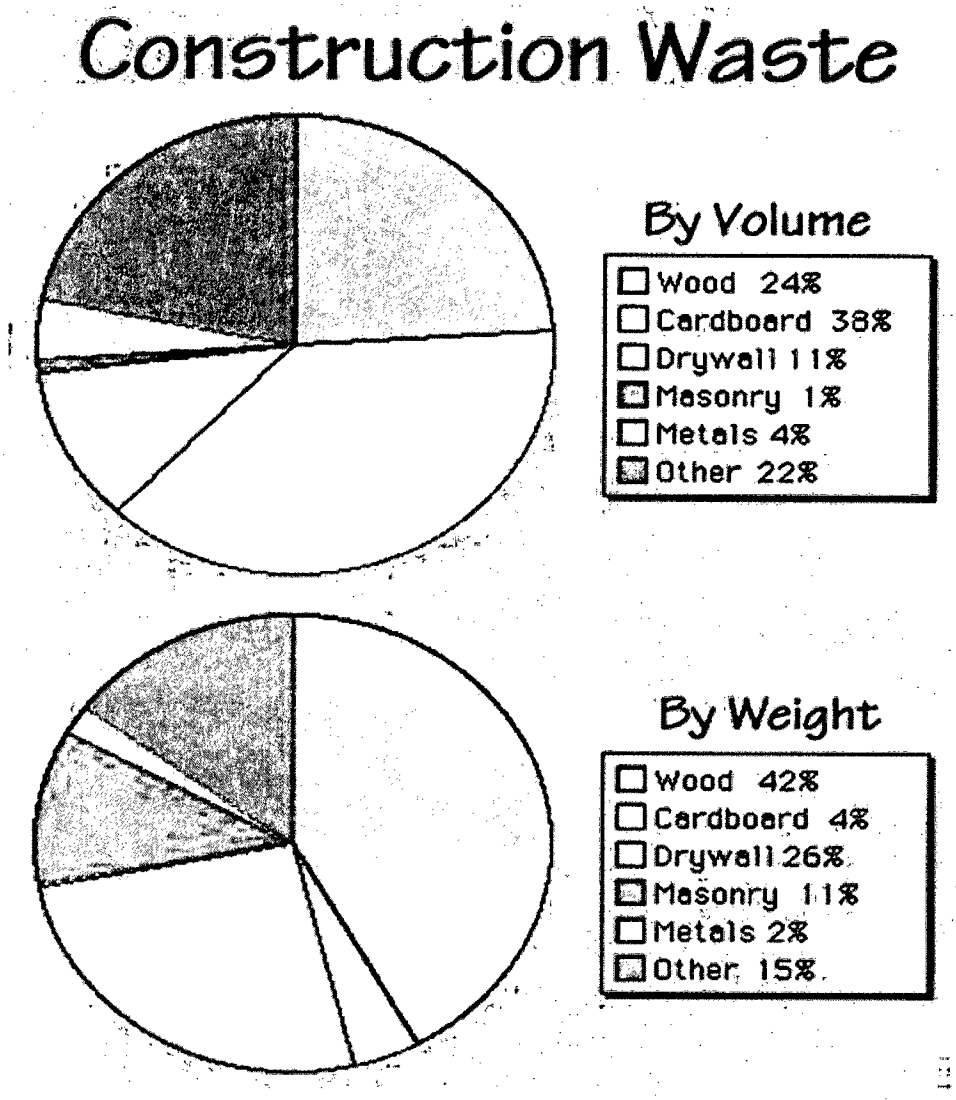

Figure 2.1: Construction Waste Percentage By Volume and Weight

Here are some important generalizations about residential construction waste.

- By weight or volume, wood, drywall and cardboard make up between 60 and 80percent of jobsite waste.
- Vinyl and metals are generated in small quantities, but have good recycling value.

- Cardboard waste is increasing on most jobsites as more components, such as windows, appliances, cabinets and siding, are shipped to builders over long distances.

- Most wood waste is "clean" -- unpainted, untreated and recyclable. This usually includes dimensional lumber, plywood, OSB and particle board without laminates.

- Brick, block and asphalt shingle waste are insignificant in volume, but can beimportant in terms of weight.

- For most builders, the largest share of waste that could be considered hazardous is generated from painting, sealing, staining and caulking.

- Drive-by contamination (waste placed in a container by a party other than the builder or subcontractor) can be as much as 30 percent of the total volume hauled from a site.

ii. Personnel involve in construction waste and management

Successful materials and waste management is like any successful project that relies on the skills of many professionals and personnel from the architect and designers through project management to the trade contractors.

Table I presents a list of personnel that are typically involved before the materials arrive on site, and their roles in achieving the effective materials management.

Table 2.2: Pre-Construction People Involved in Materials Management

Team Member	Role in Material Management
Architect	Design for best use of standard sizes, for multiple application and for their recyclability. Specifies material with recycled content, responsible packaging and from renewable resources.
Engineer	Ensures appropriate structural component dimension, quality and spacing for use of standard fasteners and material for multiple applications and recyclability. Specifies material with recycled content, responsible packaging and from renewable resources.
Estimator	Uses latest materials takeoff technologies and exercises accuracy in estimates. Reviews actual waste generation data and updates actual waste factor regularly.
Purchaser	Plans purchases and deliveries to reduce surplus and to balance material maintenance during on-site storage versus transportation energy consumption. Specifies recyclable and returnable packaging.

Source: American Institute of Architects Houston, 1994

Table 2.3 lists personnel directly involved in the use of the materials. They may participate in the planning process, since they know first-hand the actual site and working conditions.

For commercial buildings or multiple-housing projects, it may be prudent to employ a Site Materials Manager, a function that is not common in today's construction practice. Or the role may be given to one or more individuals as a part of their assignment on smaller projects.

Table 2.3: People Involved in Materials Management

Team Member	Role in Material Management
Site construction management	Applies the materials management plan to the site and oversees its implementation. Takes into consideration physical space available and ensures subcontractors are familiar with and committed to the plan.
Site material manager	Keeps track of new materials, cuts and used materials, organizes and stores them for availability by the various trades throughout the project in accordance with the materials management plan.
Subcontract management	Communicates with site management and Material Manager regarding the types of material they may be able use for various purposes, even if temporarily. Ensures trades follow the plan's practices
Trade workers	Use materials properly, store new materials properly, handle and cut them carefully for maximum use and minimum waste. Consider using cuts before new pieces.

Source: American Institute of Architects Houston, 1994

People not employed by the owner, contractor or subcontractor are a part of the materials management team as well. Suppliers, haulers and recyclers each play a role in the successful reduction of waste and optimum utilization of materials. Refer to Table2.4

Table 2.4: Off-Site People Involved in Construction Materials Management

Team Member	Role in Materials Management
Suppliers	Use recyclable packaging and returned containers and pallets, and accept the returned containers and pallets or informs the site of others who will accept them.
Recyclers & Haulers	Provide containers for convenient materials storage and retrieval if appropriate. Instruct the site personnel in separation and quality requirements.

Source: American Institute of Architects Houston, 1994

Construction Safety and Hazardous Materials

Waste minimization is the best way to curb your hazardous waste generation and reduce potential liability. Minimizing waste involves good housekeeping practices, employee training, process modifications, or substitution of a non-hazardous material for a hazardous one. Examples include:

- Minimizing your supply of raw materials to prevent overstocking
- Adopting a "first-in, first-out" inventory policy
- Labeling waste containers properly to avoid mixing incompatible wastes or contaminating clean materials
- Controlling access to storage areas and routinely inspecting containers (received containers that are leaking or damaged should be rejected)
- Maintaining vehicles and equipment at a central location, preferably in a garage or maintenance facility--not on the construction site

2.4.3 Communication Breakdown

Communication within project based environments presents special challenges. This is especially true within the construction industry, where interaction tends to be characterized by unfamiliar groups of people coming together for short periods before disbanding to work on other endeavors

Organizations undertaking multiple building projects or even single, highly complex project can face communications inefficiencies that create unnecessary and costly delays and disputes. Even as some organizations successfully streamline the communication of project information internally, they still struggle to communicate effectively with their external project team.

Recognizing the impact of poor communication on project results, many companies involved in building design and construction have sought to optimize their internal processes and project controls. Some companies may even have a centralized repository for creating, managing, and storing project documents and information but they have no way to track and manage information created, revised, or reviewed externally. With the massive amount of information passed back and forth between companies at each stage of the design and construction process, this lack of centralized, streamlined communication represents a significant risk. Poor communication and collaboration is pervasive and impacts each phase of the construction process as well as everyone involved in the process from owners and construction managers to architects, engineers, and contractors. Building projects suffer from lack of accountability, poor information sharing, and not enough time to resolve problems that arise.

Communication plays a critical role in a project's success. Poor communication can lead to schedule problems, scope increases, excessive change orders, quality

problems, and cost overruns for projects in any of these categories

Below are the time impacts regarding communication problem in construction:-

i. Delays in document turnarounds between companies
ii. Need to recreate data between companies
iii. Need to update multiple logs, creating redundant data
iv. Unnecessary travel

2.4.4 Lack of Project Control and Monitor

Any control system needs an objective against which performance can be measured. If the control system is to have beneficial effects by keeping the project orientated towards a meaningful result, then the objective needs to be framed in terms which relate to the task environment.

2.4.4.1 Cost Control

The application of ideas from control theory is easy and obvious when applied to something like cost control. The cost plan must be framed by reference to the financial environment of the project. (In its turn, the financial environment must be understood with reference to the wider economic situation.) Cost control is the activity which compares cost performance against the cost plan, adjusting one or the other dynamically

by reference to the changing circumstances in the project's financial environment. These are the basic tenets of systems theory, applied to objectives, control and feedback. What is not so readily understood, but is implied by the foregoing analysis, is that the other four facets of the environment also have corresponding needs for control.

2.4.4.2 Time Control

The policy environment of the project is the major influence around the timing of the project. Timing is influenced by many environmental factors, but the client's attitude to the timing of the project is an issue of policy. Therefore, when considering time, the policy of the client needs to be unambiguous.

2.4.4.3 Functional Control

The physical environment dictates the technology which is available. Technology includes the physical resources being utilized in the provisions of the built facility. This also ties in the ecological issues about the effect that the construction project has upon the physical environment. In terms of a control system, it is functional control which forms the strongest link here. The function of the building, and its parts, is a direct result of the technological task environment. This environmental factor is concerned not only with the technology of construction, but also the technology of the client's organization. Therefore, the function of the building, and the way in which the client's requirements are achieved, are essential elements of functional control.