GEOGRAPHICAL INFORMATION SYSTEM ON LOGISTICS MANAGEMENT FOR INDUSTRIALIZED BUILDING SYSTEM

MOHD AIZAT BIN MOHD HANIF

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University Malaysia Pahang

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ABSTRACT

Now the construction industry is facing challenges from several aspects, there are cost, quality and safety. Through the implementation of industrialized building system all challenges can be faced with ease. However, an effective management of supply for industrialized building system is crucial. The need for an accurate and timely information system is essential for providing information logistics management of industrialized building system. Logistic management process can be done quickly if the information can be obtained quickly. Geographical Information System (GIS) can be use to assist in providing information for logistics management. GIS is a computer based system designed to support geographical information storage, analysis, manipulation and spatial data presentation. This project discusses the potential of GIS in order to provide effective information that can assist in logistics management. For this purpose, the modeling step has been made. GIS model can be generated through the relevant data on industrial building system that needed for logistics management. The processing, analysis, presentation and inquiry of spatial data are performed using ArcGIS software so that a database and result of analysis can be stored and displayed in a digital form. With this application, the information required will be shown on the computer screen and this can be acquired easily and quickly.

ABSTRAK

Kini, industri pembinaan sedang menghadapi cabaran dari beberapa aspek antaranya kos, kualiti dan keselamatan. Melalui pelaksanaan sistem bangunan secara industri (IBS), semua cabaran dapat dihadapi dengan mudah. Namun demikian, pengurusan penghantaran yang berkesan untuk sistem bangunan secara industri (IBS) adalah penting. Keperluan sistem informasi yang tepat dan cepat adalah penting di dalam memberi maklumat untuk pengurusan logistik untuk sistem bangunan secara industry (IBS). Sistem maklumat geografi (GIS) boleh digunakan bagi membantu di dalam memberi maklumat yang diperlukan untuk pengurusan logistik. Proses pengurusan logistik boleh dilakukan dengan cepat sekiranya maklumat boleh didapati dengan cepat. GIS adalah sistem berasaskan komputer yang direkabentuk untuk menyokong simpanan, analisis dan memanipulasi data ruang untuk maklumat geografi. Projek ini telah membincangkan potensi GIS di dalam memberi maklumat yang efektif yang boleh membantu di dalam pengurusan logistik. Untuk tujuan tersebut, langkah pemodelan telah dilakukan. Model GIS boleh dihasilkan melalui data-data yang berkaitan sistem bangunan secara industri yang diperlukan untuk pengurusan logistik. Proses pertanyaan data atau maklumat, persembahan data ruang turut dilakukan melalui perisian ArcGis untuk memastikan satu pengkalan data dan hasilnya dapat disimpan dalam bentuk digital. Dengan aplikasi ini, maklumat yang dikehendaki dapat dipaparkan di skrin komputer dan diperolehi secara cepat dan mudah.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

GIS	-	Geographical Information System
IBS	-	Industrialized Building System

CHAPTER 1

INTRODUCTION

1.1 Introduction

The construction industry is an important option in the wheel propelling the Malaysian economy. The market size of the industry is RM43 billion based on the value of gross output in 2004. The industry then provides work for many ranging from professionals such as architects, engineers and surveyors to main contractors, sub contractors, suppliers and ultimately manual labourers who are employed by these contractors. It also opened many type of jobs opportunities to the Malaysian.

The construction industry put more emphasis on the aspects of time, cost, quality and safety. Other than that, there is another important thing in construction industry, it is logistic. Many industries attempt to integrate logistic process into logistic chains of suppliers and customers, starting with obtaining raw material, through manufacturing, distribution and final sale and service to the end users. Logistic processes, being crucial for successful completion of the project but in fact auxiliary, are often entrusted external

professionals specialized in logistic services, and this tendency is also observed in construction (Baumgartner, 1998).

In the field of construction, supply (ordering, transport and storage) and production dominate the logistic processes (Serra, 2003). Supply and production are often difficult to separate due not only to organizational but also technological reasons (considering as erection of in-situ concrete structures and ready-mixed concrete deliveries). Traditionally, contractors taking part in a project were responsible for their individual supply chains to provide materials and services required within their scope of works. At the present time of well-developed market for building materials and services, centralizing and outsourcing the project supply logistics is considered to be a more efficient solution facilitating the project control.

Many types of systems and strategies of logistics are used by companies. The choice of a logistic model implemented in a project should be based on careful analysis of the supplier's market limitations, structure of material consumption, accuracy of consumption planning and logistic cost minimization. Deciding on project logistics and supplier logistics requires a wide of knowledge about building materials, distances, cost, quality and times. These depend on current market conditions such as cost of capital, material and transport prices, storage costs and possibilities, safety and environment protection law (Sobotka, 2000).

These study discuss about aspects of logistics with regard to a construction process as an organization and as a participant in a construction project that using Industrialized Building System(IBS). Logistics management plays an important role in Industrialized Building System construction to ensure the construction progress run effectively.

In the past, most data is stored in the file cabinet and stacked in an orderly manners. But, the disadvantages of this method is related to missing files, broken so forth. Present, important data related to work can be saved based on using computer application. Geographical Information System has been introduced. This system can collect, store, manage and analyze data to produce information that can be used in decision making. Geographical Information System can also help in the process of inquiries and update data quickly and effectively.

The speed in the process of searching for information in an effort to minimize the loss of time in searching for information about delivery of cost. Besides, the role of Geographical Information System or GIS play an important role to make the logistics management more efficient.

1.2 Problem Statement

Nowadays, the demands for building such as shops and houses are increased year by year. The method of construction is still conventional method. The progress for conventional method is quite slow. This caused a lot of construction cannot be completed within the period have been set and the contractor incurred substantial losses due to late finish of the construction.

Other method that can shorten the construction period is using Industrialized Building System(IBS). However, there are some problems by using IBS. For example, cost of delivery of IBS components at construction site. It will affect the delivery process for IBS component. The less information about cost of delivery can disturb the progress of logistic management. So, all the problems will occurs if no proper planning and information for logistics management for IBS.

Therefore, a technology or system that facilitates the work of information management should be introduced. As a result, the study of Geographical Information System of GIS have been carried out and developed for particular data management and analysis of geographical data with structured, concise, accurate, complete and easy.

1.3 Objectives

The objectives of this project are:

- To study Geographical Information System (GIS) as information in logistics management.
- To determine the cost and distance of delivery at certain areas.

1.4 Scope of Study

The scope of this study is focused on logistics management for delivering of IBS components. The IBS component will be delivered from manufacturer in Kuantan, Pahang to the location in Kuantan area. This study also focused on delivery cost and the distance of delivery.

Besides, this study provide a map visualization and any important things related to this study by using Geographical Information System. All data and information are handled by ArcGIS software.

1.5 Significant of the Study

Rapid development in the country makes the construction industry facing many challenge, there are cost, quality and safety. It is too important to have a great information system or method to be used in this industry. In this study, the Geographical Information System software will be introduces on logistic management for Industrialized Building System(IBS).

Other than that, this study will be a model for the IBS components and IBS manufacture as a guidelines or ideas in order to know how to provide an information for logistics management by using Geographical Information System for delivery process and delivering cost. The idea of this study of may help to prevent unnecessary problems that might be arise during the logistics management process.

In addition, the progress of construction at site will not be affected because of information problem in delivery in terms of cost and distance. It is because good information for delivering process is important in logistic management.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition of Industrialization, Industrialized Construction and Building System

Currently, there is a wide definition on Industrialization. It is therefore necessary to clarify exactly what is meant by industrialization. Dictionaries give a variety of descriptions but little consensus is found. The International Council for Research and Innovation in Building and Construction (CIB) in its latest report on industrialized construction linked industrialization with the use of mechanical power and tools, the use of computerized steering system and tools, production in continues process, continues improvement of efficiency, standardization of products, prefabrication, rationalization, modularization and mass production.

However, industrialization means industrial method employed with reference to mechanization, standardization and prefabrication. In the perspective of construction, industrialization is a part of a wider modernization process through the development of

modern methods of production and technology system, production operations are mechanized and are focused on mass production and mainly factory production where work is centrally organized. Warszawski highlighted that an industrialization process is an investment in equipments, facilities and the technology with the objective of maximizing production output, improving quality and minimizing labor resources.

In the perspective of construction, CIB defined industrialized construction as a generic process of standardization and rationalization of the work processes in the industry to reach cost efficiency, higher productivity and quality. More elaborate definition for industrialized construction is a change of thinking and practices to improve the production of construction to produce a high quality, customized built environment, through an integrated process, optimizing standardization, organization, cost, value, mechanization and automation. One of the efforts towards construction industrialization in construction is through the introduction of Industrialized Building System (IBS). With this regard, the term building system is defined by
Warszawski as a set of inter connected elements that joint together to enable the designated performance of building. It is also characterized as a set of interrelated elements that act together to enable designated performance of building. In wider sense, it may include several procedures (managerial and technological) for the production and installation of these elements for this purpose.

2.2 Industrialized Building System

A building system can be defined as a set of interrelated elements that act together to enable the designated performance of a building (Abraham Warszawski, 1999). In an industrialized building system, all the buildings elements are prefabricated offsite, which is in a central facility. Then, the components of the buildings are sent to the site from the prefabrication yard.

Other than that, by using the industrialized building systems, the erection works at site can be reduced to the minimum. The jointing and finishing work on site can also be minimizing.

Besides, the design, production and on site of the buildings components such as beam, column, wall and so on are strongly interrelated. In this case, those components must be planned and coordinated accordingly as they are viewed as parts of an integrated process.

2.3 Advantages of Industrialized Building Systems

There are many advantages of implementing industrialized building systems. One of the advantages is making the construction process faster. It means that the projects can be completed much earlier than before, which used the conventional method. Faster completion of works can bring a lot of benefits especially in the housing projects. The houses can be built within a short time and handover to the owners. It is

quite crucial when the population increase and demands of houses are quite high. The construction time that be reduced due to that system has an economic value both to the owner and the contractor.

In addition, there is a big saving in the aspect of labours. According to Abraham Warszawski (1999), the labour savings in prefabricated elements may amount to about 80% of their conventional requirement, or to about 40%-60% of the total labours on site. It is due to the savings of the labours in the masonry, plastering, painting, carpentry, formwork, tiling and pipe laying (electrical and water supply) at site. Therefore, it faster for the turnover of working capital and also save in the lifecycle costs of the finished buildings. In fact, the economic value of labour saving due to the prefabrication depends on the total labours saved in this manner and the prevailing cost of the labour. Besides, it is also depends on the wage difference between work done on site and in the plant. The work in plant is usually given lower wages as it is usually done in the better conditions compared to the works done on site.

Compared to the conventional method, which is cast-in-situ, the quality of the building components prefabricated in the plant is much better. It may due to the strict and well organized quality control at the prefabrication yard. Moreover, it is much easier to control the quality at the prefabrication yard than casting at site. The using of advanced technology of production tools also allow the producing of high quality products in the batching and casting process. It means that every component is designed in the view of the particular technology and know how employed by the plant. In addition, in the large volume of production, it enables more careful choice of materials and materials suppliers if compared to single construction site.

The prefabricated components of building usually have the longer economic service life. A higher quality of the components will serve longer before having to be replaced. Other than that, good quality ensures that less defects such as spots, cracks or blemishes. There is also lower input of finish works such as screed, plaster, sand mortar and stucco due to the tighter tolerances in the execution of wall surfaces and the top and bottom surfaces of floor slabs. Furthermore, it also helps to reduce the maintenance expenses. It is because prefabricated components require less repair and preventive maintenance.

2.4 Logistics

Council of Logistics Management (1991) defined that logistics is part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements.

2.5 Interrelationship Between Transportation and Logistics

Without well developed transportation systems, logistics could not bring its advantages into full play. Besides, a good transport system in logistics activities could provide better logistics efficiency, reduce operation cost, and promote service quality. The improvement of transportation systems needs the effort from both public and private sectors. A well-operated logistics system could increase both the competitiveness of the government and enterprises.

2.6 Basic Features of Construction Logistics

Logistics is often defined as managing the supply chains, the latter being a network of organizations linked by material and information flows bounded with a product (project) life cycle (from the procurement of raw materials through processing and handling the products and the final product, distribution and sales to the end-user and finally, to waste utilisation). All the processes and relations concerning the above flows form a logistic system. A company, being a member of a larger supply chain of suppliers and customers, has its own system of internal logistics also in the form of supply chains. Figure 2.0 show a building contractor within a supply chain of materials and participant of a project.

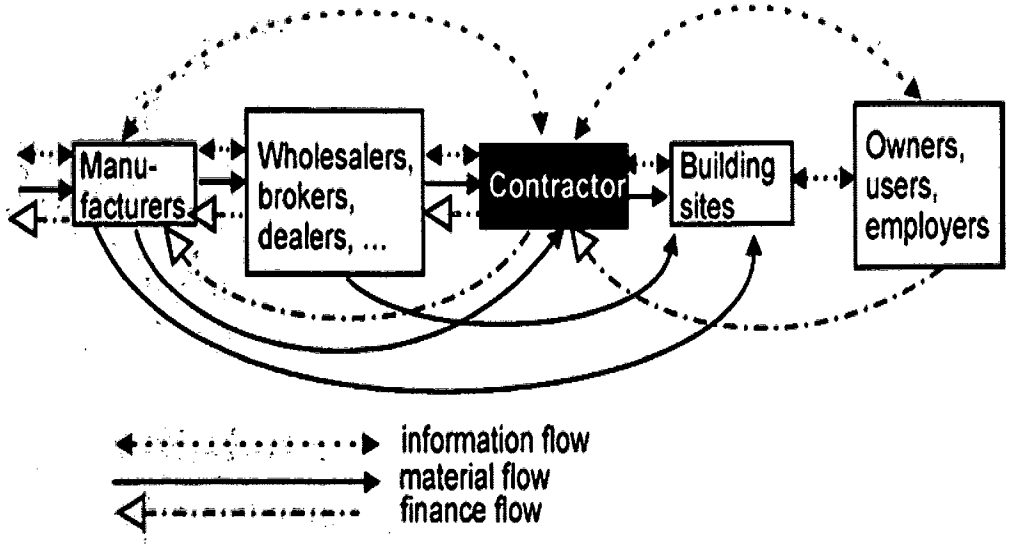

Figure 2.0 A Building Contractor Within a Supply Chain of Materials and Participants of a Project

Logistic processes are present in various fields of activity within a company (purchase, production and sale). Isolating and integrating logistic tasks performed by all organizational units of a company results in creating logistics departments that co-ordinate all the flows.

2.7 Logistics Management

Logistics management research can be classified into three broad perspectives: competitive strategy, firm focused tactics and operational efficiencies. Competitive strategy issues have a long-term impact on the firm. Firms that focus upon tactical issues operate in a shorter time frame. Operational efficiencies involve day-to-day decisions that can be altered quickly (Ganeshan et al. 1999).

The construction industry is greatly concerned with aspects of daily operations, which are typically operational decisions, reflecting day-to-day operations up to 2 weeks ahead. The construction industry attempts to optimize daily operations of facilities through careful planning, organizing, directing, and controlling activities before and during the construction. In terms of construction logistics, multidisciplinary processes are categorized as follows: material supply, storage, processing and handling; manpower supply; schedule control; site infrastructure and equipment location; site material flow management on a job site; and management of information related to all physical and services flows. Although implementation and operational service management are significant aspects of construction logistics that affect day-to-day operations, one must keep in mind that logistics is rooted in senior-level decision making.

2.8 Geographical Information System

According to Huxhold (1991), Geographical Information System (GIS) may include manual systems, however it usually refers to a computerised database system for capture, storage, retrieval, analysis and display of spatial data.

GIS is capable of assisting the storage, retrieval and manipulation of spatially referenced data such as street address or a census tract (Nedovic-Budic, 1999). Other definition about GIS is most useful when used to perform data analysis (Lee and Wong, 2001, viii).

A geographic information system (GIS) is a computer-based software tool that facilitates the mapping and analysis of information within a geographical area. It has similar functions as a map but with the extensive features that increase it flexibility, speed and ease of use because of its ability to perform statistical analysis, geographic analysis or the analysis of vehicle routes. Although map making and geographic analysis can be performed via manual methods, it is far easier and faster using GIS.

There are two primary types of geographic models used in the geographic information systems: the vector model and the raster model. The vector model is designed to store and encode information as a collection of coordinates. For example, it describes the position of a bore hole as a point with single coordinate, while the position of the river or road can be encoded as a linear feature and stored as a collection of point coordinates. Areas, for example, sales territories, may be recorded as a closed loop of coordinates.

The vector model is only especially useful for describing discrete and static geographic features. The raster model can describe continuous varying features such as the accessibility costs for hospitals or the soil type. The raster model will encode the image into a collection of multiple grid cells.