

PERPUSTAKAAN UMP



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**COMPARATIVE STUDY IN CONSTRUCTION SCHEDULING BY USING  
PRIMAVERA P6 AND MICROSOFT PROJECT**

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**Thesis submitted in fulfillment of the requirements for the award of the degree of  
B. Eng (Hons.) Civil Engineering**

**Faculty of Civil Engineering and Earth Resources**

**UNIVERSITI MALAYSIA PAHANG**

**18AS00**

**JUNE 2014**

## ABSTRACT

Construction industry has played a very important role in contributing to the development of infrastructure and economic in Malaysia since the past. In 1998, Malaysia grew rapidly when the pride of Malaysia's landmark which is known as Petronas Twin Tower or Kuala Lumpur Convention Centre (KLCC) was built. The process to build KLCC took 7 years. In this context, it emphasized that the larger and complex of a project, the bigger the need to plan appropriate plan. Therefore, it is clear that construction is one of the challenging industries. Effective project plan need to be done before construction begin. Understanding, skills, experience and knowledge are the important elements to ensure a project will be done smoothly. Besides that, project manager need to ensure that the parties involved play their roles and responsibilities for the success of a project. Planning techniques and software selection should be well selected in order to achieve the optimum project planning. Several of techniques in planning are Critical Path Method (CPM), Bar Chart, Line of Balance (LOB) and so on. Meanwhile, the software used to develop a schedule would be Primavera, Microsoft Project, Asta Power Project, Deltek Power Plan and SureTrak. Obviously, project manager is one of the main elements in the smoothness of a project planning. The purpose of this study is to compare the capability of two project management softwares namely Primavera P6 and Microsoft Project. Among the objectives to achieve this purpose are to identify feature and function of Primavera P6 and Microsoft Project and to develop scheduling by using both softwares. Besides that, interviews will be conducted with construction parties to identify their preference of scheduling software and the opinion to gain depth information related to Primavera P6 and Microsoft Project.

## ABSTRAK

Industri pembinaan telah memainkan peranan yang sangat penting dalam menyumbangkan pembangunan infrastruktur dan ekonomi di Malaysia sejak dahulu lagi. Pada tahun 1998, Malaysia berkembang dengan pesat apabila mercu tanda kebanggaan Malaysia iaitu Menara Berkembar Petronas yang dikenali sebagai *Kuala Lumpur Convention Centre* (KLCC) dibina. Proses Pembinaan KLCC yang mengambil masa selama 7 tahun dihabiskan untuk membina struktur pembinaan ini. Dalam konteks ini, ia menekankan bahawa semakin besar dan rumit sesuatu projek dilakukan, semakin perlu perancangan projek yang baik dilaksanakan. Jadi, jelaslah bahawa pembinaan merupakan salah satu industri yang mencabar. Perancangan projek yang berkesan perlu dilakukan sebelum pembinaan dijalankan. Pemahaman, kemahiran, pengalaman dan pengetahuan merupakan elemen-elemen yang penting untuk memastikan projek berjalan dengan lancar. Selain itu, pengurus projek perlu memastikan pihak yang terlibat memainkan peranan dan tanggungjawab masing-masing bagi menjayakan sesebuah projek. Teknik perancangan dan pemilihan perisian juga perlu dipilih dengan baik agar perancangan projek mencapai tahap optimum. Antara teknik perancangan yang digunakan adalah Kaedah Laluan Genting (CPM), Carta Bar, *Line of Balance* (LOB) dan banyak lagi. Manakala perisian untuk mewujudkan sebuah jadual adalah seperti Primavera, Microsoft Project, Asta Power Project, Deltek Power Plan dan SureTrak. Jelaslah bahawa pengurus projek merupakan salah satu elemen utama dalam perancangan projek yang lancar. Tujuan tesis ini dijalankan adalah untuk membandingkan keupayaan dua perisian penjadualan yang dinamakan Primavera P6 dan Microsoft Project. Antara objektif untuk mencapai tujuan ini adalah mengenalpasti ciri dan fungsi Primavera P6 dan Microsoft Project dan membina jadual projek berdasarkan kedua-dua perisian tersebut. Selain itu, temu bual juga diadakan untuk mengenalpasti perisian penjadualan yang menjadi keutamaan mereka dan pendapat untuk mendapatkan maklumat yang mendalam berkenaan Primavera P6 dan Microsoft Project.

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**LIST OF ABBREVIATIONS**

AEC	Architectural/engineering/construction
AOA	Activity-on-arrow
AON	Activity-on-node
C&S	Civil and structural
CIDB	Lembaga Pembangunan Industri Pembinaan
CPM	Critical Path Method
EF	Early finish
EOT	Extension of time
EPM	Enterprise Project Management
EPS	Enterprise Project Structure
ERP	Enterprise Resource Planning
ES	Early start
FF	Finish-to-finish
FF	Free float
FS	Finish-to-start
HTML	Hyper Text Markup Language
ID	Identity
JKR	Jabatan Kerja Raya
LF	Late finish
LOB	Line of Balance
LS	Late start
M&E	Mechanical and electrical

MEP	Mechanical, electrical and plumbing
OBS	Organizational Breakdown Structure
PE	Professional engineer
PERT	Program Evaluation and Review Technique
PKK	Pusat Khidmat Kontraktor
QS	Quantity surveyor
SF	Start-to-finish
SS	Start-to-start
TF	Total float
VO	Variation order
WBS	Work Breakdown Structure

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background of Study**

A fundamental and challenging action in the management and implementation of construction projects is known as construction planning. It encompasses the selection of technology, the work tasks definition, the required resource estimation, individual tasks durations and the recognitions of any connections among the different tasks. However, poor estimates of schedules can simply result in large construction cost increases or delays. Moreover, inconsistent decisions regarding the appropriate technologies to use can have similar effects. Therefore, construction planning is vital to the eventual success of a project (Hendrickson, 2012).

Organization nowadays faces challenges regarding planning and controlling of a project. Many projects suffer from ineffective planning and control because of an inefficient flow of information and have not sufficient knowledge of the project management or its tools. In the most recent few years, there are complex and massive project whereby each project has many activities that cannot be managed by engineers and managers easily. The imported of engineering software that help engineers and project managers to manage the project is very useful. Hence, it is very important to use the project management software as the main tools of project management (Hendrickson, 2012).

In selecting techniques and technologies, it could be essential to formulate or develop a number of construction plans according to different methods and assumptions.

There are many ways in the construction industry to represent and create construction schedule techniques such as bar charts, Critical Path Method (CPM) and Line of Balance (LOB). Majority of organization in Malaysia prefer CPM scheduling as their construction schedule technique. The advances of the computer nowadays have made it possible to effectively use CPM scheduling on construction projects. Practically, all construction companies can benefit by using this technology on their projects.

According to Hinze (2012), the capabilities of computers make them as ideal tools for manipulating and creating project schedules. For very large projects with thousands of activities or for many different projects that are to be kept on file for future references, their large data storage capacities allow computers to calculate schedule information easily. The schedule from a previous project can be saved for future as a starting point to develop a schedule for a similar project. This capability eliminates the time required to create a schedule from scratch. Schedules from similar earlier projects are merely copied and then altered accordingly to reflect the current time frame of project, unique work activities and present availability of construction resources.

The researchers have been given a number of viewpoints to the practitioners for adopting this new technology for their own advantages. Nevertheless, there seems to be some hesitancy on the part of the practitioners for adopting this technology, which will have to be overcome by the researchers. It should not be applied to one particular phase of construction project. Indeed, many architectural/engineering/construction (AEC) firms hesitate to invest and adopt in sophisticated computer programs, because they do not have sufficient time to learn and analyze this technology (Sarang et al, 2012).

## **1.2 Problem Statement**

Many construction companies were finding success with Critical Path Method (CPM) scheduling in 1990s. However, a major problem that still protracted was that the manager needed to have computer skills and construction experience in order to make CPM scheduling achieve its management potential. Learning the basics of CPM and apply it

effectively is still a challenging issue for a project manager. To go one step further, learning the software to the level where the manager can efficiently analyze the updated project and produce the desired reports is detracting. Project managers are busy people and it is difficult for them to devote their time to become proficient with CPM and the computer. Thus, it takes persistence for managers to succeed in learning these newer management tools.

The difficulty of finding management people who is competent with computer skills is changing with the new generation of project management personnel who are graduating from major four-year accredited construction management programs in all over the country. Nowadays, there are many planning software package in the market where Primavera and Microsoft Project are the largest user base. The critical issue is not which software package is used, but to learn critical path method and are able to effectively use any one of the software packages available.

Briefly, to start a new project, a project managers need to have a proper planning. There is quote by Franklin says that “if you fail to plan, you are planning to fail”. Thus, it is very important for project managers to understand and use the appropriate project management software such as Primavera and Microsoft Project to develop the techniques of project management for example CPM, Gantt Chart and S-Curve to achieve a successful project plan.

Nevertheless, there are some elements and understanding in project management softwares and techniques that require by a project manager to know very well in order to create a proper project plan. Finally, what is the appropriate planning software that need to posses by project managers to reach its potential capabilities?

### **1.3 Aim and Objectives**

The aim of this study is to compare the capability of Primavera P6 and Microsoft Project. To achieve this aim, the following objectives have been identified:



- (i) To identify feature and function of Primavera P6 and Microsoft Project.
- (ii) To develop scheduling using Primavera P6 and Microsoft Project.

#### **1.4 Research Scope and Limitation**

To achieve the objectives of the study, the scopes of the study was limited in five ways:

- (i) **The Feature of Primavera P6**  
The study has undertaken P6 version of primavera to be put into study. It was based on its characteristics and features, which was listed in the literature review of the study. The information generated by Primavera will be based on hypothetical project created for this project. This study is confined to Primavera P6 Version 7, which will be used in this study in attempts to develop a planning by using this software. This study also is limited to the duration of a project plan.
- (ii) **The Feature of Microsoft Project**  
This study has been using Microsoft Project which is extremely popular project management software. Similarly with P6, Microsoft Project highlights the characteristics and features from the literature review and experience in making a plan related to the study. This study is limited to Microsoft Project Standard 2007, which will be used in this study in developing a planning by using this software. This study also is limited to the duration of a project plan.
- (iii) **Time**  
The time frame of this research was based to the one stipulated by the taught time table course of Bachelor's Degree program by Universiti Malaysia Pahang (UMP). It was spread over two semesters.

(iv) Location

The study was focused to uncover the potential of Primavera P6 and Microsoft Project in construction industries in which selected organizations in Kuantan were chosen.

(v) Data Collection

The data were collected at Jabatan Kerja Raya Kuantan by utilizing the feedback obtained from a group of parties in the construction industries. The interview used to compare the capability of Primavera P6 and Microsoft Project was suitable for use of the groups in the selected companies only.

### **1.5 Significance of the Study**

The importance in this study is to compare capability and efficiency of two scheduling software namely Primavera P6 and Microsoft Project as the preferable alternative on making a project plan. Thus, having an interview with construction parties about their scheduling software selection and the opinion related to Primavera P6 and Microsoft Project.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Every new construction project in market whether it is small or big project, it still has their uniqueness due to its characteristics which is one time set event (Smith, 2002). Construction project consists of complex activity due to numerous activities inside it such as site clearing, earthworks, structural work, architectural work and so on. Several parties that involves in construction project are developers/client, architect, consultant, contractor, and suppliers. In order to get work done, they need to have a good relationship and communicate well.

#### **2.2 Construction Planning**

In the modern world nowadays, there are many complicated, complex and larger projects in terms of cost and its size. There will be a numerous parties involved that can be categorized in a project. In the context of construction project, the management principles apply properly to any project. Even though the objectives are not similar, but the implementation of project management in the construction, manufacturing and any kind of work will be the same. However, the details vary according to the type of construction project.

Any type of construction project such as building, highway and bridge requires different knowledge and skills but the planning, scheduling, costing, monitoring of these

projects utilize the same techniques to achieve their time, cost and quality. Generally, the scope of a project in a construction project can be described as building for example school, shopping complex that are categorize as a commercial building, residential, industrial such as refineries and processing plants and heavy construction for example bridges, tunnels and harbors.

Usually the success or failure of an organization depends on the quality of management. Errors in decision-making will led to destructive and loss to an organization. To avoid any problems in the construction industry, the project manager must equip themselves with the skills and current knowledge. Construction industry in Malaysia experienced a change in building technology and management from year to year. In the past, project preparation period is quite long and not complicated. Now, with the presence of a large project and have higher construction costs, project completion date need to be fast in order to get a profitable return of capital.

Normally, construction management in the past make a decisions based on their experience and estimates that by using the 'Rule of Thumb'. Any error in the results is very detrimental to all parties involved in the project. Then, the technique of proper planning is necessary to overcome this problem. Ideas and concepts to be presented clearly for better planning.

### ***2.2.1 Definition of Project***

In this stage, the authorities will decide the type of project that will be executed and as a planner of the project, the decision that made describe the overall project. As a planner, they need to know the important things in their project. The important things that should be considered by a project manager are:

- (i) Defining the field or the purpose of the project

A planner must know what goal that needs to be achieved, which task is more important and how many tasks are needed to success in their project.

- (ii) **Determining the resources**  
A planner must know what are the resources, labor and equipment that are needed during the execution of the project.
  
- (iii) **Determining the schedule limits**  
A planner must know how long the duration of the project which including the milestones and the deadline.

A planner must analyze the data to plan the project as soon as the goal and its framework were determined.

### **2.2.2 *Planning a Project***

Project planning is the main of a project management system. It combines scope, resources and schedules. This allows the project managers to keep all these factors in balance. A proper project planning can provide accurate information such as how much activity need to do, who is responsible in each activity, budgeted cost and overall cost of the project according to the duration and completion date. There are many definition of planning presented by the scholars. Some of them are:

- (i) Planning is a creative activity in determining what is going to do, when and whom (Baldwin, 1993).
- (ii) Planning is a process to identify problems that will be happened during the progress of an activity, besides controlling the changing and determining the appropriate action to make sure the objective is achieve (Cormican, 1985).
- (iii) Planning is a thinking process to perform a thing in the future (Abdul Hakim, 1990).

In the context of construction, planning can be defined as a thinking process in selecting the most appropriate method and sequence of activity that will be followed for the construction and completion of project with the most economical cost according to the time given and meet the requirement to fulfill the technical and specification of work.

### **2.2.3 Significance of Planning**

One of the important aspects in planning is discipline. Nevertheless, discipline always been ignored by related parties in the construction. Without discipline, a proper planning cannot be achieved. Therefore, to ensure the planning is successfully implement, parties that involve in the project must have commitment. Construction planning becomes so important due to several factors. Some of the factors are:

i) **The large and complex project**

Normally, the bigger and more complex of the construction project, more proper planning need to do since it is related with many parties.

ii) **Limits the schedule duration**

Owner or client are eager to minimize its loan burden and want to get its return capital immediately.

iii) **Fix allocation cost**

Any delays and loss in the project should be avoided to ensure that the cost of the project will not exceed the fixed amount in contract.

### **2.2.4 Objectives of Planning**

There are many objectives to plan a project. Some of them are:

- (i) To state clearly how the works will be carried out.
- (ii) To identify the strategy and appropriate action to overcome problem that may arise during the project execution.
- (iii) To schedule the resources; construction material such as cement, sand, rebar and labor.
- (iv) To control and coordinate in terms of date, duration, scheduling of activity as well as the cost of activity.

- (v) To collect data in terms of duration for each activity, the number of labor and so on. The purpose is to make as a future references.

## **2.3 Scheduling Techniques in Construction Project**

Several scheduling techniques for construction project are as follow:

- (i) Gantt Charts/Bar Charts
- (ii) Critical Path Method (CPM)
- (iii) Precedence Logic Diagram

### **2.3.1 Gantt Charts/Bar Charts**

Gantt Charts/Bar Charts which were popular in the mid-nineteenth century by Henry L. Gantt and Frederick W. Taylor were the fundamental for today's bar charts and graph. Even though their work was originally aimed at scheduling of production, it was acceptable for planning and recording the progress of construction. The bar graph still remains as an excellent graphical representation of work task because the easiness to read and understood by all levels of supervision and management. However, the bar graph is limited in some information it can retain.

Normally, the project managers are influenced necessarily by the completion dates which are often working backward in preparing a bar chart. During the preparation of the bar graph, the scheduler will undergo the same thinking process as the Critical Path Method (CPM) project managers. However, the bar graph cannot record the interdependencies that control the progress of project. At last, it will be harder for the scheduler to explain their activity in the plan by using the bar graph. Usually, the main contractor prepares the construction plan which is sensible because the schedules of the other sub-contractors depend on the main contractor's schedule.

### **2.3.2 Critical Path Method (CPM)**

Critical Path Method (CPM) was once noted as a technique in the process of planning and scheduling. Before we use the computer to perform the route calculations, we must plan firstly to generate the schedule and read the output with knowledge of the assumptions, skills and tolerances involved. But now, we can get and purchase software that includes a Wizard to simplify the need for planning, perform the calculations to generate the correct or desired result and provide graphics and reports to display the schedule result. It means that, we need to learn CPM properly and not merely the features and benefits on how to use the technology in performing those tasks. In another word, the process of planning and scheduling by means of the CPM of analysis.

### **2.3.3 Background of Critical Path Method (CPM)**

In the 1950s, defense projects and large industrial managers became concerned with deadlines and competency. The techniques that would later develop into Critical Path Method (CPM) were realized at the same time in Great Britain and the United States during this moment. The energy sector in Great Britain carry out a research during the process of building a power plant to discover the certain tasks that were had a critical impact on the timing deadlines while other tasks would not delay the progression. Meanwhile, the U.S. Navy was working on the Polaris missile project. The complexity of the project led to the development of the Program Evaluation and Review Technique (PERT) which is a mathematical project-scheduling model that is similar to CPM.

Researchers at DuPont and Remington Rand developed the basis for the modern Critical Path Method was in the 1950s. Then, DuPont implemented the CPM techniques in the late 1950s to track project management for the construction of chemical plants project across the United States, thus, saving \$1 million of the company within the first year of implementation. The CPM technique is often used in concomitant with PERT diagrams, but is performed with other flowchart models as well. Nowadays, the original CPM program