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IMPROVING TIME ESTIMATION IN JKR PROJECT

MUHAMAD KHAIR BIN HASAN

A capstone project report submitted in partial fulfilment of the
requirements for the award of the degree of
Master Project Management

Faculty of Civil Engineering
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December 2010

I declare that this capstone project report entitled “*Improving Time Estimation in JKR Project*” is the result of my own research except as cited in the references. The capstone project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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To my beloved wife **Zubaidah Adnan**,
who has given me the ultimate support physically and morally
and prayed to Allah for my success to pursue my goals in treasury education.
I would like to wish her my sincere love for the support and
the sacrifice that she has given to me all these years.

And for my daughters **Nur Nafeesya and Nur Nadeeya**
and my only son **Muhamad Khaliss**,
I wish them the success in their lives and
follow what you father had done to fulfilled his target to
hold Master Degree at his golden age .

My love and prayers to Allah will always be with them.
To my mother, brothers, brothers in-law, sister and sisters in law,
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ABSTRACT

Accurate time estimation is very critical to ensure smooth operation and timely completion of any construction project delivery. In determining the time of the project completion the only known methodology currently used by JKR is based on prediction from the experience of completing past project. However evidently the project delay issues are very common for JKR projects. Many reasons contributed to this phenomenon. One of such reasons is that the time estimation process done by JKR might not be accurate. To understand further of such issue this study has been carried out with the aim to determine the cause of the delay that leads with the slippage time from the original estimate. This study has benefited from thousands of data available from JKR SKALA's database. Other methodologies adopted include the use of questionnaire survey distributed to JKR personnel and contractors. The findings of this study have determined the major factors that contributed to the delay. Comparisons were made for the findings from different sources. Factors that can contribute to improving JKR project time estimating process have also been identified. Various comparisons have been made on the trend of the delay with regard to time factor, project size and location. The information generated from this study can provide a very useful guide for JKR in planning the more reliable project duration in the future.

ABSTRAK

Ketepatan penentuan masa adalah kritikal dalam kelancaran operasi dan masa penyiapan sesuatu projek pembinaan. Kaedah penentuan masa penyiapan projek yang dilaksanakan oleh JKR sekarang ini adalah berdasarkan kepada pengalaman dan sejarah yang lalu. Walaubagaimana pun isu projek lewat adalah satu perkara yang sering berlaku dalam projek JKR. Banyak sebab yang mengakibatkan kelewatan ini. Salah satu sebab adalah proses anggaran tempoh yang dilaksanakan adalah tidak tepat. Untuk memahami lebih mendalam berkaitan isu ini satu kajian telah dilakukan untuk menentukan penyebab kepada berlakunya kelewatan yang menyebabkan menyimpang dari anggaran asal. Data daripada Sistem SKALA JKR telah memberi maklumat berguna dalam kajian ini. Selain daripada itu, pengagihan soalselidik kepada kakitangan JKR yang terbabit dengan dengan projek dan juga kontraktor menjadi cara lain untuk mendapatkan data. Penemuan faktor utama yang menyebabkan kelewatan telah diperolehi daripada kajian ini. Perbandingan penemuan telah dilakukan dengan sumber lain. Faktor yang boleh menyumbang kepada menambah baik anggaran masa bagi projek JKR juga telah dikenalpasti. Beberapa perbandingan telah dilakukan terhadap kecenderungan kelewatan terhadap faktor masa, saiz projek dan lokasi. Maklumat yang diperolehi daripada kajian ini boleh memberi panduan sangat berguna kepada JKR dalam merancang tempoh projek dengan lebih tepat dimasa hadapan.

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LIST OF A ABBREVIATIONS

CPM	-	Critical Path Method
JKR	-	Jabatan Kerja Raya
INTAN	-	Institut Tadbiran Awam Negara
GIS	-	Geographical Information System
EOT	-	Extension of time
HOPT	-	Head of Project Team
HODT	-	Head of Design Team
LOA	-	Letter of Acceptance
SKALA	-	Sistem Kawal, Selia dan Laport
SPK	-	Sistem Pengurusan Kualiti
SPSS	-	Statistical Package for Social Science
RII	-	Relative Importance Index
ICT	-	Information and Communication Technology
WBS	-	Work breakdown structure

CHAPTER 1

INTRODUCTION

1.1 Introduction

In project management delivering the project within the stipulated time in the contract is the upmost important factor to be focussed not only by the contractor but also by other responsible stakeholder such as project manager and developer. For major government agency like JKR, project delay will have negative implication to their reputation. Therefore accurate time estimation is critical to all JKR project.

Construction management decisions are made based on schedules that are developed during the early planning stage of projects, many possible scenarios should also be considered during construction. Construction programmes are the utmost importance for a successful timely delivery of buildings or infrastructure projects. A well developed project schedule model is a dynamic tool that can be used to predict the remaining project work that need to be completed and reasonably be expected to be accomplished.

There is no specific tool in determining the accurate time for project duration practices in JKR. Most of the project duration was based on previous durations of the project which were not of the same component for each project. By using the previous experiences it may not illustrate the correct duration for the project. This method has been used since the existence of JKR. So far, there has not been any specific method or guidelines produced to estimate the duration of the project.

It is important that the project implementation schedule is planned well so that there is no delay that could affect the other activities expected by the end-user. Good schedule will ensure the implementation of realistic given enough time for activities such design approval procurement, construction, tests the line and so on.

Scheduling that fails to take into account the important matters will result in projects having extension of time, or termination. This will affect the end user involve additional expenses, including financial liability, employee relocation and storage of equipment and problems inventory. Delays in the completion of an entire project due to poor scheduling can also create havoc for owners who are eager to start using the constructed facilities (Gomar *et al.*, 2002).

1.2 Problem Statement

Delivering the project on time as stated in the contract to the client is important to JKR as an implementer. The main problem in JKR's current practice is estimating accurate time in JKR project. Failing to deliver the project on time to the client will show the performance of JKR. One of JKR's objectives is to deliver the entire project in time as agreed with the client. Inaccurate time estimation will lead to late completion of the project. Inaccurate time estimation will cause the client additional operational cost.

Incorrect determination of the project duration will reflect on the capability of JKR as a technical department in government. This is one of the reasons for project to be given extension of time (EOT) besides other reason such as the contractor selected unable to provide full commitment to the project. Based on JKR's record, most of the project will have at least one EOT.

From the data provided by JKR Project Monitoring Unit, it shows that more than 50% of the projects in Ninth Malaysia Plan supervised by JKR are completed behind time. Some of these delays might be contributed by poor project estimation

time by JKR. Many important factors might be neglected and result in risk of project delay. Therefore this study has been undertaken to review such issues.

1.3 Aim and Objectives of the study

The main aim of this study is to determine the cause of the delay in the construction which may reflect weakness in time estimation process in JKR's project. In order to achieve this aim, the following objectives have been delineated

- i. To identify the factors that contribute to delays in JKR projects
- ii. To study the relationship between JKR's estimated times with the actual completion base on 5 years historical data
- iii. To identify factors to improve JKR time estimating.

1.4 Scope of the study

This study was focused on building project by JKR only. Historical data for this study rely on project that had been completed within past six (6) years (2004 to 2010). Data were taken from JKR project database module, SKALA (Sistem Kontrak, Selia dan Laporan). The data extracted from SKALA mainframe was analysed and segregate accordingly. The data were extracted into smaller item base on the nature of work. The data were comprise of all projects that supervised by JKR. From that database only data on building project was extracted and analysed. Besides document search uses data from SKALA, questionnaire distributed to get related data from the person who involved directly with JKR project. Questionnaire was distributed to all JKR District Engineers, Head of Project Team (HOPT), Head of Design Team (HODT) and contractors involved in JKR project. There is no any logical or mathematical process for sampling was employed in this study.

1.5 Brief Research Methodology

The methodology is divided into three stages.

1.5.1 Planning Stage

The planning stage is where the topic of study determines, aim and objective is set. Besides that literature search is done to accommodate literature review.

1.5.2 Data Collecting Stage

At this stage the methodology used in conducting this study is through literature search, data collection from JKR project database and questionnaires survey to JKR's staff who were involve in projects implementation and contractors.

Analysis of data using qualitative method is done through the document study of JKR SKALA's database and data generated from the questionnaire survey.

The overall sequence of study process undertaken is shown in figure 3.1

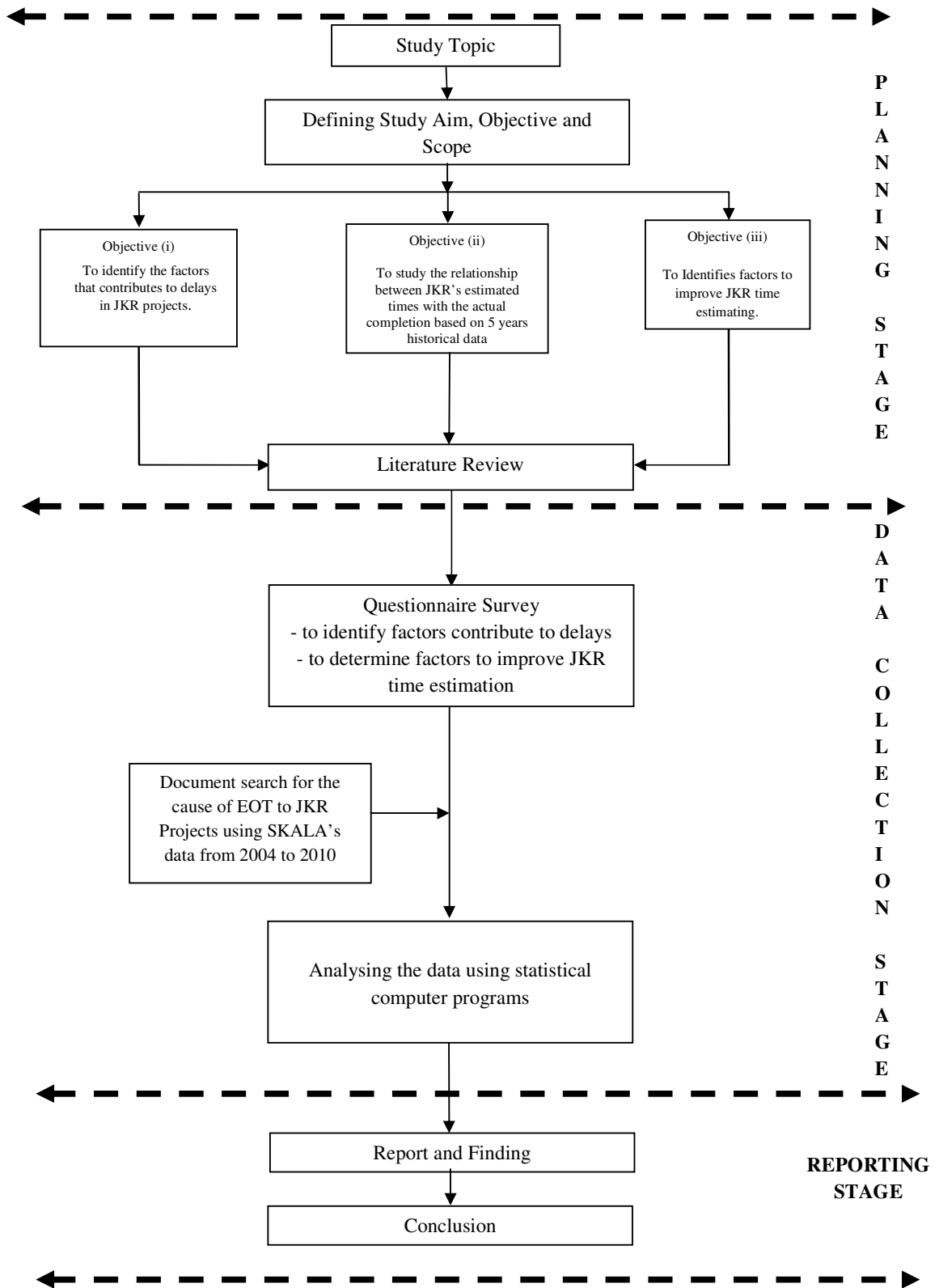


Figure 1.1 Research Methodology Process

CHAPTER 2

TIME ESTIMATION PROCESS FOR PROJECT SCHEDULE

2.1 Introduction

It is important to make time estimation as input into other techniques used to organise and structure all projects. People always neglected or underestimate the needed time to implement project. It may reduce large project to a series of smaller project if a good time estimation technique is being used. The unexpected and unscheduled should take into account when carried out estimation. These factors would give an impact on estimation.

Two reasons needed to get right time estimation:

- i. Time estimates drive the setting of deadlines for delivery and planning of projects,
- ii. Time estimates often determine the pricing of contracts and hence the profitability of the contract/project in commercial terms.

Project scheduling could be planned using computer software such as Microsoft Project and Primavera Project Planner. Using this software would speed up in preparing the schedule and monitoring the progress of the project.

Each and every project is unique in nature and thus the characteristics of every project vary that causes a major obstruction in the process of consistency of construction projects, also affecting project scheduling and monitoring of projects. (V. Ahuja and V. Thiruvengadam, 2004)

2.2 Common Scheduling Technique

Various methods for scheduling projects are used. Yamin & Harmelink (2001) identified four planning techniques currently in use in the world wide construction industry, namely, bar charts, network scheduling technique (activity on arrow and activity on node) and line of balance (linear scheduling).

2.2.1 Bar chart

The bar chart was developed in the 1900's by Mr Henry L. Gantt and is the simplest of all scheduling techniques (Eggleston 1997). The bar chart consists of a horizontal (time) and a vertical (activity) axis. Each activity within a project is represented by a horizontal bar with its duration represented by the length of the bar. The logical sequence of the work, as decided by the planner, is indicated by lines linking the activity bars. The main advantage of the bar chart is its simple visualisation of a project and its activities. In order to derive such visualisation the sole use of the bar chart technique tends to be unsuitable. Here the bar chart can be combined with network scheduling. This technique allows a better planning of interconnected and inter-dependent activities.

A typical bar chart form with is a list of activities specifying the start date, duration and finish of each activity shown as a bar plotted to a project time scale. The level of detail of the activities depends on the intended use of the schedule.

Bar chart were linked the activities and subsequent items with arrows and lines, specifying the sequence and order of preceding activities. The previous

activities are linked one to another to demonstrate that one activity must be completed before the other activity can start.

The bar charts are also useful for detecting the amount of resources needed for one particular project. Resource aggregation was developed by adding resource to each activity and totals them vertically. The purpose of this aggregation is to estimate the work production and establishing estimates for man-hour and equipment needed.

2.2.2 Critical Path Method (Network Scheduling Technique)

Critical path method (CPM) has been used since the 1950s and the construction industry benefit from its use in some area such as the planning and controlling the projects and communication plans.

Stevens (1990) defined network scheduling as: “... *a method of scheduling activities by joining them in a series of interconnected links which reflect relationships of activities as assigned by the planner*”

This method was made up of number of individual activities that linked and took the longest time to complete the project. It use network analysis to identify those tasks which are on the critical path. For the activities that started only after other to finish would make the project become complex web activities. Using CPM will help planner to figure out how long the project would take to complete. Critical activities had to commence on time otherwise the project would take longer time to complete. The CPM is ideally suited to projects consisting of numerous activities that interact in a complex manner. The detailed estimation of construction activities usually relies on the estimators’ experience and judgement to correctly interpret project and site information and make the best possible decisions. (Alfred, 1988)

Commercial project management software base on critical path analysis such as Primavera Project Planner (P3) or Microsoft Project, which are based on heuristic methods to plan and control schedule (Liberatore et al. 2001; Kelleher, 2004; Karaca

and Onargan, 2007). It is argued that CPM was not effective when applied to projects that include repetitive activities (Birrell, 1980; Johnston, 1981; Russell and Wong, 1993; Selinger, 1980). It shows that the network methods' inability to preserve the continuity of work for resources from one stage of an activity to another (Reda, 1990).

The critical path is the sequence of project network tasks with the longest overall duration which determines the shortest completion time of a project. Using CPM would help identify tasks which must be completed on time for the whole of project to be completed on time. It also identifies tasks that can be delayed for a while if resource needs to be reallocated to catch up on missed tasks. CPM helps to identify the minimum length of time needed to complete a project.

From one research investigation, labour productivity was improve 6% when resources were considered in CPM schedules and an additional 4 – 6% improvement was obtained when using computerised system (Perdomo-Rivera, 2004). Effort had been made to intergrades Computer-Aided Drafting, Primavera software and Geographical Information System (GIS) to generate three-dimensional (3D) drawing which would lead to faster and better conceptualisation of project that were useful in scheduling, planning, controlling and decision making processes.

2.2.3 Lines of Balance

The line of Balance is a planning technique for repetitive work. The principles employed are taken from the planning and control of manufacturing processes greatly modified by E. G. Trimble. The basis of the technique is to find the required resources for each stage or operation so that the following stages are not interfered with and the target output can be achieved. The line of balance technique has been applied in construction work mainly to house building and to a lesser extent to jetty work and in conjunction with networks to road works

2.3 Development Process of Project Schedule

Following the definition of project activities, the activities are associated with time to create a project schedule. The project schedule provides a graphical representation of predicted tasks, milestones, dependencies, resource requirements, task duration, and deadlines. The project's master schedule interrelates all tasks on a common time scale. The project schedule should be detailed enough to show each WBS task to be performed, the name of the person responsible for completing the task, the start and end date of each task, and the expected duration of the task.

Like the development each of the project plan components, developing a schedule is an iterative process. Milestones may suggest additional tasks, tasks may require additional resources, and task completion may be measured by additional milestones. For large, complex projects, detailed sub-schedules may be required to show an adequate level of detail for each task.

During the life of the project, actual progress is frequently compared with the original schedule. This allows for evaluation of development activities. The accuracy of the planning process can also be assessed.

An overall project schedule is required to determine complete project timescale, resource requirements and costs. A more detailed schedule is required to manage and control the project. This more detailed schedule is developed progressively through the project by producing a schedule for the next stage during Project Initiation and towards the end of subsequent project stages. Project scheduling has been identified in various studies as a major factor in predicting project success or failure (Fortune and White, 2006).