

APPLICATION OF PLANNING SOFTWARE IN CONSTRUCTION INDUSTRIES:  
STUDY ON EFFECTIVENESS OF PLANNING SOFTWARE TOWARD PROJECT  
PLANNING

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## ABSTRACT

The construction industry is significant in the development of the Malaysian economy towards fully developed nation. To implement construction project, a proper planning and scheduling is of vital important in order for the project to be executed and run smoothly. The best schedule is not the schedule showing the project completed in the shortest time period, it is the schedule that meets the primary objectives of the total project. Those primary objectives are to create a quality project, completed on time, within budget, and in a safe work environment. Therefore, this is focus on research to study on effectiveness of planning software. To achieve the aimed of this study, the following objectives has been identified such as to study the scheduling technique used in developing planning and scheduling, to identify the factors that cause the importance of using planning software for contractors nowadays and to analyses level of the effectiveness of using planning software in delivering construction projects. This study involved contractor who have project in the area of peninsular Malaysia. This study is carried out by questionnaires. A total of 50 questionnaires were distributed and only 46 questionnaires were returned was answered. This study was found that type of constructions that most involved in planning and scheduling software in building construction. The technique that the most used in schedule and cost planning and control was using software for schedule management. The main factor of using planning software was to get budget and work time for each activity and aimed to achieving an effective project planning. Planning and scheduling software more effectiveness because of it would be easily to share information and stay up-to-date with project changes and also time saving of construction work can be improve from software planning.

## ABSTRAK

Industri pembinaan adalah penting dalam pembangunan ekonomi Malaysia ke arah negara maju. Untuk melaksanakan projek pembinaan, perancangan yang betul dan penjadualan adalah penting bagi membolehkan projek yang akan dilaksanakan akan berjalan dengan lancar. Jadual terbaik bukanlah jadual yang menunjukkan projek itu disiapkan dalam tempoh masa yang singkat, ia adalah jadual yang memenuhi objektif utama projek. Objektif utama adalah untuk mewujudkan satu projek yang berkualiti, tepat pada masanya, mengikut ukuran bajet yang betul, dan dalam persekitaran kerja yang selamat. Oleh itu, kajian ini ditumpukan untuk mengkaji keberkesanan perisian perancangan dalam pengurusan projek. Untuk mencapai matlamat kajian ini, objektif-objektif berikut telah dikenal pasti seperti mengkaji teknik penjadualan yang digunakan dalam pembangunan projek, untuk mengenal pasti faktor-faktor yang menyebabkan kepentingan menggunakan perisian perancangan untuk kontraktor pada masa kini dan untuk menganalisis tahap keberkesanan menggunakan perisian perancangan dalam menyampaikan projek-projek pembinaan. Kajian ini akan melibatkan projek di kawasan Semenanjung Malaysia sahaja. Kajian ini dijalankan dengan mengedarkan boring soal selidik. Sebanyak 50 borang soal selidik telah diedarkan dan hanya 46 telah dikembalikan dan dijawab. Kajian ini mendapati bahawa teknik pengurusan yang sering digunakan oleh mereka ialah jenis pengurusan penjadualan menggunakan perisian. Faktor utama menggunakan perisian perancangan adalah untuk mendapatkan bajet dan menyiapkan kerja tepat pada masa bagi setiap aktiviti dan juga bertujuan untuk mencapai perancangan projek yang berkesan. Perancangan dan penjadualan perisian lebih keberkesanan kerana ia akan menjadi mudah untuk berkongsi maklumat dan sentiasa peka dengan perubahan projek dan juga menjimatkan masa kerja, pembinaan boleh menjadi bertambah baik dengan menggunakan perancangan perisian.

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**LIST OF ABBREVIATIONS**

AI	Average Index
AON	Activity-On-Node
AOA	Activity-On-Arrow
EOT	Extension of Time
VO	Variation Order
CPM	Critical Path Method
ADM	Arrow Diagram Method

## **CHAPTER 1**

### **INTRODUCTION**

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

Planning can be thought of as determining "what" is going to be done, "how", "when" by "whom", and "when." In construction projects the "plans" (blueprints) and specifications for the project generally define both the end product and, often, the general time frame in which to complete the project. However, they normally do not specifically identify the individual steps, their order, and the timing followed to achieve the end product. Thus, when we discuss planning in the construction process, we must address the "how" and, therefore, the "what," "when," "where," and "who."

When we discuss scheduling, we are usually interested in some aspect of the time element of the plan. A schedule is a timetable of activities, such as of "what" will be done or "who" will be working. Such a timetable can be looked at in two ways: the first is focusing on an activity, such as determining "when" a certain task will be performed relative to other activities. The second is concentrating on a

specified time frame and then ascertaining "who" will be working (or needed) or "what" should be occurring at a particular time. All of us are involved in planning and scheduling on an ongoing basis. The degree to which we carry it out and the techniques we use vary depending upon the complexity of our, situations and our needs and objectives.

Planning and scheduling are basic to most things we, as humans, do. Planning is the way organizes and sequence the tasks needed to accomplish a goal. There are plans for meeting common goals, such as getting to work on time, and more formal plans, such as those used by companies (such as a strategic plan, business plan, financial plan, and ,marketing plan). The planning required to construct an office building requires the identification of the tasks needed to complete the building and then the sequencing of those tasks in their logical order. Scheduling is one component of the plan and aids in visualizing the plan.

The scheduling part of the construction plan requires that the tasks or activities are assigned a duration corresponding to the anticipated productivity of the crews doing the work. When tasks have durations and are put in their proper order by identifying the relationships they have with one another, a construction schedule is created. Scheduling is just one part of construction planning, which may also include plans for safety, community relations, material storage and handling, and environmental protection along with the schedule to create the overall construction plan.

The construction schedule has many uses, beginning with its representation of the initial construction plan. To be effective, plans must be monitored for progress. A comparison of the progressed, or update, schedule with the project baseline, or original, plan enables the manager to identify problems early. Adjustments can be made when needed, and the effect of proposed changes can be simulated in the schedule, so that the result can be assessed.

In 1917 Henry Gantt developed a method of relating a list of activities to a time scale in a very effective manner, by drawing a bar (or Gantt). Henry Gantt (1861- 1919) was a pioneer of management science who is almost as well known in

management sciences circles for his views on productivity and employee compensation as for the bar chart. He developed a means of depicting industrial tasks in a way that easily communicated the tasks, their durations, and their timing to each project participant.

Two companies, DuPont and Remington Rand, collaboratively developed the Critical Path Method (CPM) in the 1950s for the renovation, construction, and maintenance of chemical plants. "DuPont's goal was to optimize and balance the lost opportunity costs of a refinery's downtime with the increased costs of accelerating the renovation."

This critical path method evolved into what is known as the Arrow Diagramming Method (ADM) or Activity On Arrow (AOA) method. The ADM removed the statistical component from the PERT critical path method and replaced it with a deterministic method for assigning activity durations. Later, the precedence diagramming method (PDM) evolved replacing the single finish start-to-start relationship found in the ADM with multiple types of relationships. Each advance has given the planner and scheduler better tools for modelling reality.

John Fondahi, emeritus faculty at Stanford University and winner of the American of Civil Engineer's (ASCE) Peurifoy Construction Research Award in 1990, has been noted as the originator of the modern, deterministic CPM scheduling method. His work has helped constructors effectively model their projects in more flexible and less cumbersome ways than were previously available.

A manager schedules to achieve control of not only time, but also cost, quality, and safety. The schedule helps managers plan methods and procedures that will ensure that the project objectives are met. The management team schedules in order to accomplish activities in the most productive manner possible so that time is not wasted on the project. Then, the schedule becomes the primary tool to communicate that thinking and planning by the management team to all the shareholders in the project. In specifically, according to (J.S Newit, 2005) these are benefits of scheduling:

- i. Reduce total construction time
- ii. Reduce the costs of labour, overhead, interest on loans, and capital
- iii. Provide a more continuous work flow
- iv. Increase productivity
- V. Give employees and subcontractors a goal to work toward
- vi. Improve your company image - (professionalism)
- vii. Meet owner's requirements
- viii. Force detailed thinking and planning
- ix. Improve communication with everyone involved in the project.

Although, every planning and scheduling has been carried out perfectly and closely, this will not guarantee that the project will be completed successfully. A project will not be successful if monitoring and controlling process is not being executed according in the implementation of the project.

Nowadays, the construction industry in Malaysia is facing critical problem especially delays in the completion of project. And even though the project has already been completed, there still exist the problem of safety, quality and esthetic values.

For instances, construction delays in our country was reported by Zurairi, AR (2013), which Refinery and Petrochemical Integrated Development (RAPID) supposed to start operation in 2016 but can only operate in early 2017. The EOT given to the contractor which have delay problem not caused by lack of proper care or mistake by contractor, but its normally caused by force major such as defection in supplying construction materials, variation order (VO) by client and also nature disaster such as rainy season.

## **1.2 Problem Statement**

Nowadays, almost every construction industry in Malaysia is experiencing delay problem. The problem come from variety of reasons, the major sources is caused by construction activity which has been execute not according to planning and scheduling efficiently that has been fixed. Eventually, contractor will need time

extension to accomplish the project. The EOT will be given which the delay problem not caused by lack of proper care (incautious, unaware) and mistake by the contractor, but it's normally caused by force major such as defection in supplying construction materials, variation order (VO) by client and the nature disaster such as rainy season. Regarding to the extension of time in a project life, it will effect on cost increase to both parties, either the client or contractors.

The extension of time (EOT) given to the contractor is actually not caused incautious and mistake by the contractor, if the contractor facing that problem, therefore they should liable and bare the extra cost due the delay problem. As a consequence, the time will extent, cost will increase and for sure the quality of the project will be affected.

Furthermore, as the industry construction become more complex and increase in size, as a consequences it's is difficult to the project manager to monitor and control caused by ineffectively in scheduling and inadequacy of construction information. Accordingly planning and scheduling need to implement satisfactorily and carefully with the purpose of accomplish the project successfully within time, cost and quality required.

In addition, as the project increase in size, the construction's activities become more complex. As a sequence, the conflict in activities sequence occurred due to inefficient planning and scheduling. It is important to emphasis every aspect of construction activities before commencing its. The planning and scheduling efficiency depends on the methodology used. To conclude, the objective of a project will be meaningless if the method used is not appropriate.

In order to get proper planning, the use of planning software development projects are increasingly being used by a handful of contractors to manage projects quickly and accurately. Therefore whether use of the software design is important in an industry and what level of effectiveness of the scheme in order to get the project planning software easily and quickly



### 1.3 Objectives

The objective of this study would be:-

1. To study scheduling technique used in developing planning and scheduling
2. To identify the factors that cause of using planning software for contractors nowadays
3. To analyse the level of the effectiveness of using planning software in delivering construction project

### 1.4 Scopes of Study

The scope of study are briefly listed as below:

- Focus on Peninsular Malaysia
- All construction project

### 1.5 Research Methodology

In completing this study, there are two methods will be used to obtain data namely:

**Primary data:** We collect data by distributing questionnaires and interview session with planning or management contractor in the construction industry.

**Secondary data:** were obtained from external sources such as books, journals, internet and magazines. The collection of literature review will be based on the current scenario on of the construction industry today. Having the data collection on hand, it will then be analysed and results of the analysis will be based on the data collected through various channel. The final level will see the conclusions and recommendation by the author in enhancing the eligibility of the data collected

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter examines how the effectiveness of the planning software among contracting authorities in particular consultants and officers in general. This study was made through a survey using a questionnaire related to respondents at Peninsular Malaysia. The objective of this study was to investigate the use of planning software and what are the advantages of planning in the industrial building construction and receive feedback from the contractor about the effectiveness of the use of software in planning and scheduling. This study will also identify the percentage of skilled workers who handle planning software around Peninsula Malaysia.

#### **2.2 Project Management Planning**

Planning plays an important role in the construction sector. The appropriateness of the methods and selected working order to ensure that the project

can be completed with the most economic cost, but at the time specified and full fill the technical requirements

(Abdul Hakim Mohamad, 1990)

To complete the project, the time taken between the decision to build up the finished project usually takes many years. In that period, only one-third of the time spent on physical construction. The rest is used for planning and development approvals. Therefore, it is necessary to plan the amount of time the project (A.D Austern, 1994)

The success or failure of an organization depends on the quality of management . Errors in decision-making or expectations will definitely bring a lot of consequences and losses to an organization. It is important for a project manager who is ultimately responsible for the success or failure of an organization to equip themselves with knowledge and experience nowadays.

Nowadays the construction industry has changed a lot in terms of construction technology and management in ten or twenty years ago. In the past, project preparation period is rather long and not very complicated, nowadays within higher cost of construction project , it is necessary to make it faster in completion date for the project to get profit as soon as possible.

The previous management makes decisions based only on experience and estimation, estimation methods are not desirable if involving in big project, complex and high financing costs

Any error in decisions will give a bad impression and losses to all parties involved in the project. From that project planning method or technique of project planning is needed to address this issue. A design that starts from an idea or concept before being presented in the form of a plan or diagram to describe that planning more systematic.

To meet the challenges of today, it is very important to a project manager to ready and survive themselves with knowledge related to project planning techniques to handle big and complex project nowadays.

Project management planning is a balance in the planning fieldwork, job scheduling and resources. The general planning intention of designing, executing and controlling the activities to identify and schedule the resources of activities with certain planning design methods. The terms of reference aimed at achieving an effective project planning.

The designation indicates the time and sequence of activities for each area of work, as well as the proposed period for completion of the project. Source is labour and equipment needed for a fieldwork. Its basic source of cost, salaries, operating expenses which have to be focused. When the fieldwork scheduling and supplier are in balance, we just need to control the amount of resources related to events ongoing or before the completion of a project. When a manager to manage a project, they should ensure that the project would achieve the goals efficiently.

Good project management planning will help the success of a project manager. Everyone in the team will be able to improve the quality of cooperation and communication. This can make a team more efficient and faster, and provides a secure working because everything is under control and perfect management.

### **2.3 Project Planning**

The term 'Planning' can be defined as the establishment of a framework on paper for measuring, controlling and reporting a project with regard to time, methods and the resources (money, people, machinery, etc). It is quite different from 'Scheduling' which is primarily concerned with the process of converting an outline plan of a project into a time-based graphic representation, although the two terms often come hand-in-hand with each other.

The definition of ' planning ' was introduced by a previous researcher:

- Planning is deciding in advance what will be done, how to make it and who makes it . Planning is the process of determining the direction and actions of the action to be taken in the future based on objective facts and sound judgment (Richter,Ivr and Roy S. Mitchell, 1982)
- Design is a creative activity made to determine whether , when and by whom  
(Andrew N. Baldwin, 1993)
- Planning is a process of thought to get the things in the future  
(Abdul Hakim Mohamad, 1990)
- Planning is the process of identifying the problems that may occur as a result of the occurrence of an event of a work activity is being carried out , in addition to trying to control the direction of the nature of the change and to determine action deemed appropriate action to ensure that the objectives are achieved (David Cornican, 1985)

From that we can described that project planning is a process of thinking about the selection of the most appropriate construction methods and sequence of works will be followed for the construction and completion of the project with the most economical cost , within a specified time and meet the technical specification requirements or job specification.

To get an effective project planning, one must consider this matter:

- I. Identify scope of the project and who or what to do
- II. Get budget and work time for each activity particularly necessary information is obtained from individuals who are responsible for specific activities
- III. Identify process events as examples of ' A ' cannot be started while the ' B ' is not completed or some activities need to be completed in the same period and others
- IV. List the activities and problems such as determining whether a proposed activity on the specified date.

When a project starts, project planning becomes a factor that is very valuable in helping a project by listing the task so that a project manager can understand below:

- I. Specifies the progress of the project , comparing actual data with the initial budget
- II. Revisions to the source , scope and scheduling factors to give balance to the importance of the project
- III. Can identify problems that would result in the project is behind schedule
- IV. Analysis of resource requirements throughout the project is carried out
- V. Can make changes during construction to help the project to be completed early

With project planning system, a project manager will be able to analyse the project whether it follow specification of scheduling or not during the project. As soon as the project manager achieve project goals and criteria that show the project is complete, it is time for the termination of the project

Termination of the project as important as the beginning of the project, at this stage a project manager will be able to do this:

- I. Ready to make real-time comparisons with the planned period.
- II. Analyse the problem and identify a plan to reform to next project. Storage the project file.

## **2.4 Project Planning Objective**

Planning project objective :-

- made it clear how things work or activities will be carried out
- identify strategies and actions to overcome problems that might occur between the time a project is or ongoing project

- rescheduling and restructuring of existing resources ( eg materials of construction materials like cement , sand , steel and labour ), scheduling of resources
- coordination and control in terms of duration and scheduling of work activities including costs
- Collecting data in terms of the implementation of any work activity, number of workers, and so on . The aim is to use as a reference or guidelines hope to projects in the future

## **2.5 Characteristic of A Good Project Planning**

- The objective is simple, clear and to be implemented
- Follow the basis of project control standards
- Maximizing use of existing materials and labour at a time and place to be determined
- It shows a clearly set time ( phasing ) and the interaction between the work activities related activities
- Able to compare the progress of the work planned with actual progress

## **2.6 Benefit of Project Planning**

Efficient design provides advantages and benefits to all parties involved in the construction industry as follows :-

### 1) Contractor

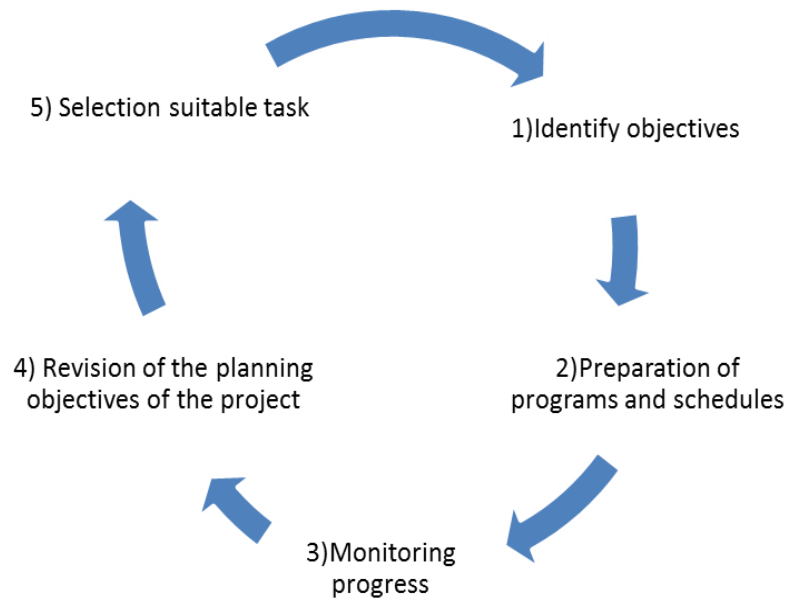
- Contractors can learn more about the works to be carried out. This can be seen in terms of changes and improvement of work with the help of an effective system of project organization
- The work plan prepared well in addition to taking into account the project cost control can reduce financial loss to the contractor, based on the information gathered from the work plan, the contractor can know in advance if additional financing is required
- The amount of labour required from week to week for each activity can be determined more quickly in the event of a work

- Scheduling a variety of materials (construction materials, plant and equipment and labour) can be produced from the work program . This is to facilitate the construction materials, equipment and labour can be delivered to the construction site on time.
- 2) Client
- clients can more accurately determine the tempo within the project . at the same time, the client financial capital not as productive as long as tied to the cost of project financing
- 3) Architect / Engineer
- program typically provided by the contractor with the help and guidance of architect
  - through this work program , the architect or engineer can expect the space of construction work and indirectly facilitate progress payments based on the progress of work completed
- 4) Other Parties
- program helps the other work involved, such as sub-contractors, consultants, suppliers and authorities to act in accordance with the tasks and responsibilities

## 2.7 Process Planning Cycle

Should be noted here that a process of planning ( planning of construction projects , financial planning and so on ) the cyclical nature for example in **Figure 3.1**



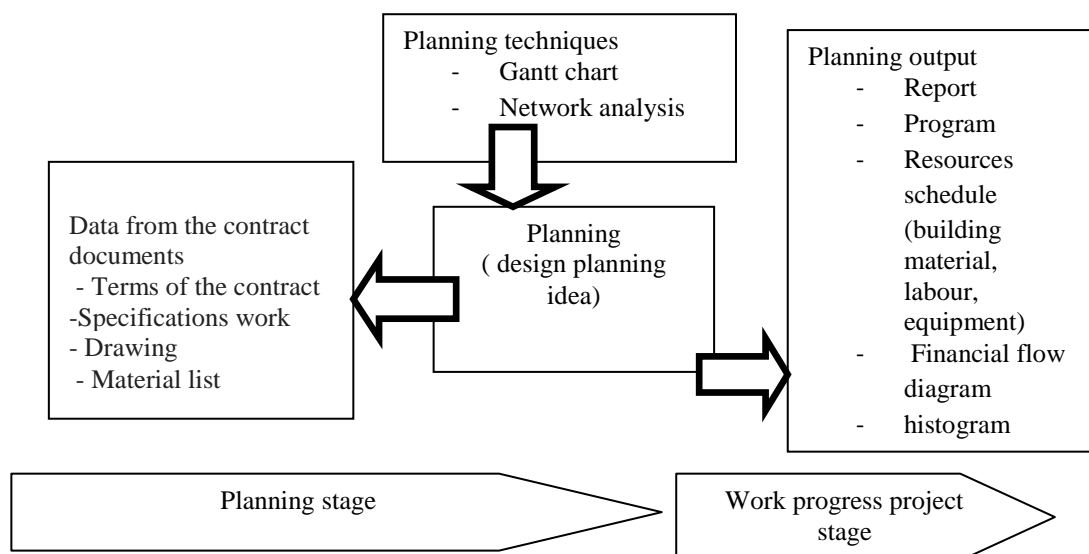


**Figure 2.1** Process Planning Cycle

This means that a planning cycle is not something that 'forward movement' it is also sometimes 'reverse movement' depending on the circumstances

**2.8 Process Project Planning**

In the figure 2.2 it is clear that a plan should begin with the idea before exhibited in the form of plans, reports and so on.



**Figure 2.2** Project Planning Process

Information gathered from the contract documents and site visits to determine the method or technique appropriate planning ( gantt chart , critical path method)

Finally, all the results or output be form of project planning reports, scheduling of resources ( building materials , plant / equipment and labour ) , and others are produced for the purpose of work progress and project control

## **2.9 Project Scheduling**

Scheduling is a process of converting an outline plan of a project into a time-based graphic representation, based on the available resources and time constraints.

Why we need scheduling in our project? It is because during the early stage of a project, it is very important for stakeholders to ensure that scheduling of the project is conducted and well taken care of. Scheduling is basically needed for the following reasons :

1. to establish a sequence of work and timeframe for the performance of construction activities.
2. To determine when to order and deliver materials and equipment
3. To show the impact of productivity-related problems on project completion (e.g., weather, strike, delays)
4. To provide a communication tool between consultants, contractors, owner and suppliers.
5. To meet contractual obligation

## **2.10 Planning Vs Scheduling**

Planning is the establishment of a framework on paper for measuring, controlling and reporting a project with regard to time, resources (inclusive of money) and methodologies. Therefore, planning is more about looking for answers to specific questions such as: What is going to be done? How is it going to be done? Where is the project located? Who is supposed to do the tasks? And general questions, for example: When will the project start and end?

Meanwhile, scheduling seeks answers about when things are exactly going to be done. For instance, on a more detailed level, scheduling will answer questions such as: When should we prepare the design? When should we call for tenders? When should we mobilize on site? When should we complete the building? and so on. Hence, planning and scheduling, although inter-related, are not the same thing.

## **2.11 General Procedure in Scheduling**

General procedures in scheduling can be summarized as follows:

1. Establish the project objectives that are to be achieved
2. Determine work activities and sequencing
3. Determine the activity durations.
4. Determine the logical relationships.
5. Prepare what-if scenarios.
6. Draw the logic network (for network method only)
7. Identify the critical path
8. Implement the schedule
9. Monitor and control the schedule
10. Implement resources scheduling, allocation and leveling.

## **2.12 Type of Scheduling**

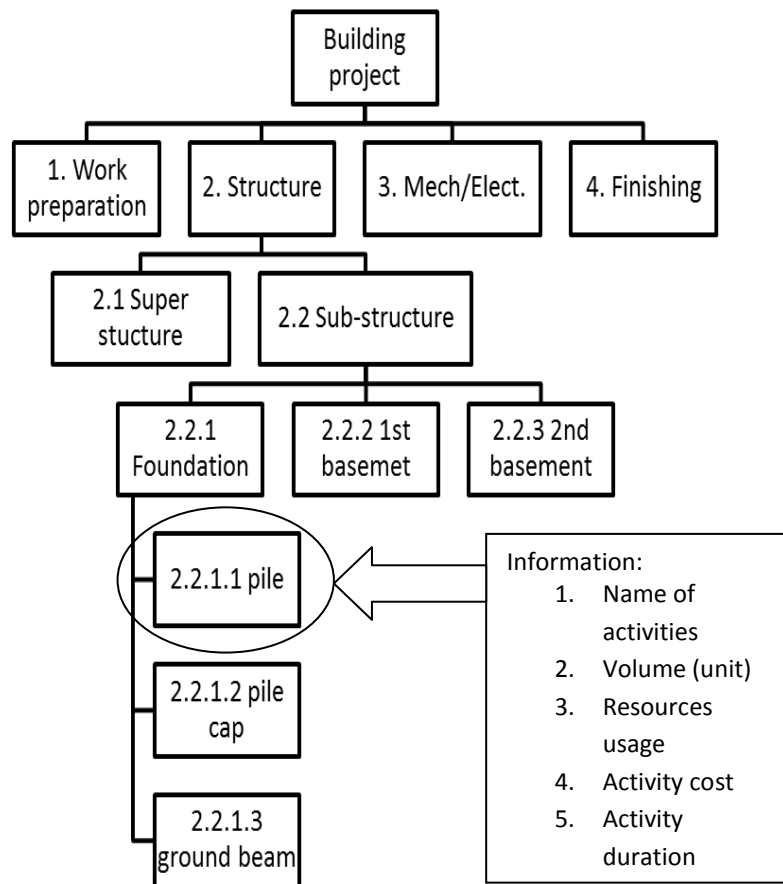
### **2.12.1 Bar Chart**

Bar Chart is a common type of schedule which is also known as Gantt Chart after the name of its creator Henry Gantt. It widely used, be it in business and management, manufacturing, design, engineering, construction or other sectors.

In Bar Chart, activities are represented by bars in proportion to their duration. An activity is a task whose performance contributes to the completion of the overall project. The good thing about bar chart is that it is easy to construct and understand.

Based on the requirement, other information may be added to the basic bar chart; for instance if a bar chart includes the of the activity, it will known as “cost-loaded Schedule”. Other generics are “man-loaded schedule” which details the number of

labours required for each activity and “resources-loaded schedule” which details the materials required for each activity.



**Figure 2.3** An Example of A Bar Chart Used in Construction Sector with Various Information Included at Level 5

Three basic step to construct a bar chart as follows :

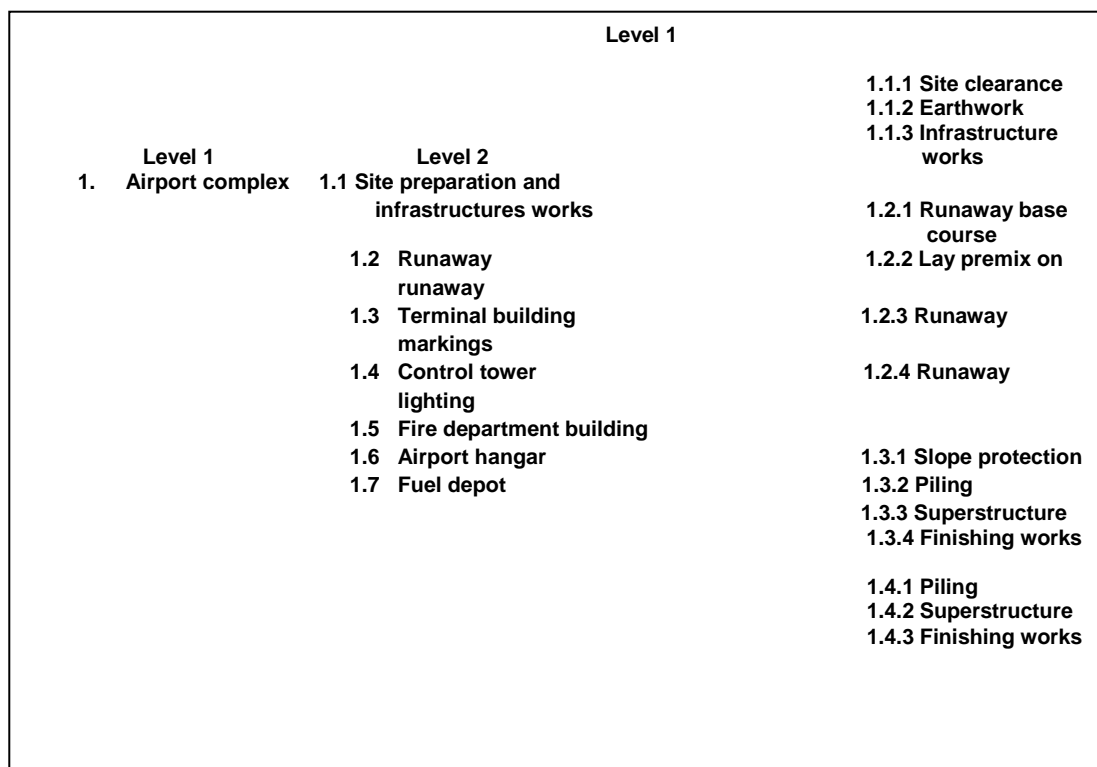
#### 2.12.1.1 Break the Job Down Into Activities

- List important activities related to the project but restrict the number for simplicity of the schedule
- May use the work breakdown structure WBS for the project (usually prepared during project costing or estimation).
- If based on WBS, the level 2 or 3 component are normally sufficient to create a practical bar chart.

### ***Work Breakdown Structure (WBS)***

WBS is a technique for defining and organizing the total scope of a project, using a hierarchical tree structure. The first two level of the WBS ( name level 1 and level 2) define a set of planned outcomes that collectively and exclusively represent 100% of the project scope.

Element in the WBS are to be numbered sequentially to reveal the hierarchical structure. For example 1.3, 1.3.2, 1.3.2.3, etc, as shown in Figure 3.3



**Figure 2.4** An Example of Bar Chart Used in Construction Sector

#### **2.12.1.2 Establish the Sequence of Work**

- Sequencing needs to take into account the relationships between activities
- Basis of sequencing :
  - a) Process or physical logic

When undertaking sequencing, an understanding must be established that there are many activities that cannot start until another activity is partially or totally

complete. It is also important to note that in many sectors like manufacturing, production and construction, the execution process is a bottom-up activity while the design process is a top-down activity.

	Time				
	June	July	August	September	October
<b>Excavation &amp; Backfill</b>		█	Backfill		
<b>Piling</b>		█			
<b>Abutment No. 1</b>		█			
<b>Abutment No. 2</b>		█	█		
<b>Steel girders</b>			█		
<b>Concrete deck</b>				█	
<b>Finishing operations</b>					█

**Figure 2.5** An Example the Bar Chart of Bridge Construction

a) Structural requirement

In the engineering and construction sectors, due to structural stability requirement, one activity cannot start until certain amount of another activity has been completed. For instance, in construction of building, before the erection of precast beam on columns (pillars) can be made, there must be at least three rows of the columns already constructed to ensure stability and safety.

b) Resources / economic constraint

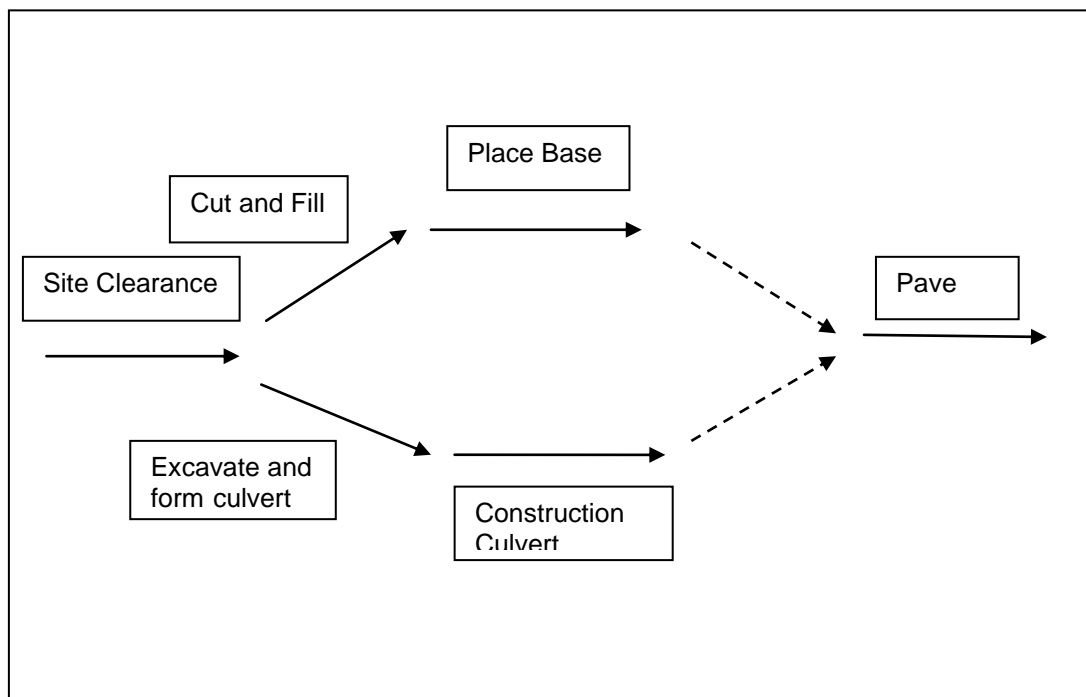
Due to limited resources, two activities may not be able to use a resources at the same time. For example, in the construction of a building, a crane cannot be used for two activities simultaneously, like pouring concrete over a floor slab and at the same time erecting steel sections.

### 2.12.2 Network Diagram

Network diagram is a network that consists of two basic element, which are nodes and arrows (or links) between these nodes. A network diagram can be categorized into two distinct types as follows :

#### 2.12.2.1 Arrow diagram

- Arrow diagram is also known as activity-on-arrow (AoA) diagram. In an arrow diagram, activities are represented by two nodes and one like are commonly used critical path method (CPM) and program evaluation and review technique (PERT).
- Figure 3.5 illustrate the arrow diagram where descriptions of the activities (or tasks) are labelled at the arrow between the nodes.



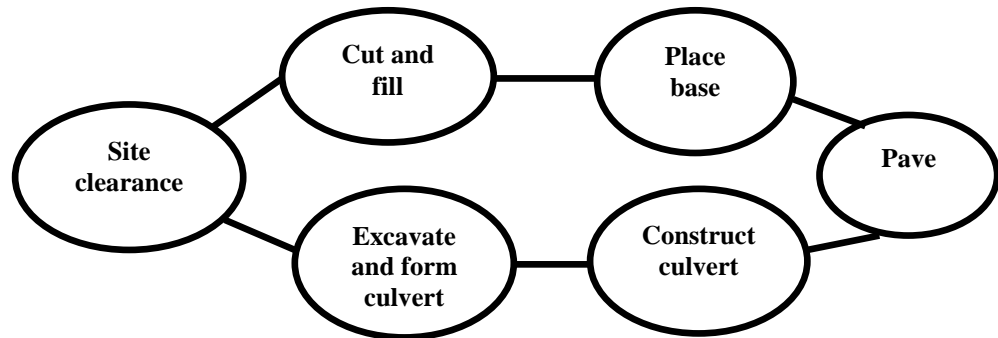
**Figure 2.6** Example of an Activity-On-Arrow Diagram

#### 2.12.2.2 Precedence diagram

- Precedence diagram is also referred to as activity-on-node (AoN) diagram. In precedence diagram, activities are represented by nodes and arrows (or links)

represent the relationship between the nodes. The precedence diagram is used in the precedence diagram method (PDM) to show the precedence and progression of activities in a project.

- Figure 3.6 shows an example of the precedence diagram where descriptions of the activities or tasks were labelled on the nodes instead of on the arrows.



**Figure 2.7** Example of an Activity-On-Arrow Diagram

### *Critical path method*

By definition, critical path is the longest series of all the activities in a project and hence sets the project completion time. Critical path must be carried out exactly on time, otherwise this may cause project delay. Any activity along the critical path is called a critical activity. Technically, a critical activity on critical path has zero float, where float is the allowance of time between the end of a precedent activity and starting time of a following activity.

Each critical activity must be carried out immediately after a precedent activity in order to avoid delay. Some of the most likely critical activities in building construction are piling works, constructions of pile caps, construction of superstructure element like columns and floor beams, etc.



## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

Detailed description on study of planning software in construction deliveries had been briefly discussed in chapter 1 and 2. That information discussed by literature review to gather data about research topic and reinforce the knowledge about the main goal of the research. It is also obtained by article in journals, internet, books and some other published research works. The references taken from secondary information are all listed in the appendix.

In this research we should take into consideration of implementation for these methods or strategies in theory to the actual used in the current construction industries practices. Theory and practical have correlation that should be reviewed and clarified so that the knowledge gained can be put into practice and executed when faced with the actual circumstances.

Moreover, primary information was also important to be collected to achieve the objectives of the research and also to identify the actual strategies which have been implemented, practiced, and the most used technique by the contractor nowadays in planning and scheduling of project construction. A questionnaire survey was also conducted to obtain feedback from the construction industry and finally we can established framework of this research.

### **3.2 Method of Surveying**

The general methodology we are focused on the survey questionnaire, which were collected from the building contractor companies around peninsular Malaysia by email and personnel meeting. Also, some interviews with industrial practitioners were conducted to contributed questionnaire and gather information on the planning and scheduling software.

### **3.3 Questionnaire Survey**

A questionnaire survey was conducted to gather information from professionalism who are involved in planning scheduling software in project deliveries. This method was aimed to collect the opinions, suggestions and also view from experiences respondents, to support and increase our knowledge and understanding to the all technique of planning and scheduling that was presented in construction industries nowadays. In general, the content of the questionnaire are summarized as below :

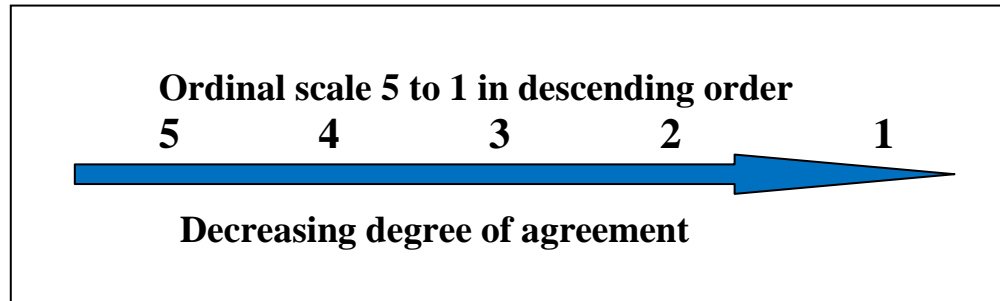
- I. General information
- II. Management technique in schedule, planning and control
- III. Causes of using planning and scheduling software
- IV. Effectiveness of using planning and scheduling software

### **3.4 Questionnaire Structure**

The questionnaire was developed into four parts. Part one was an introduction which are regarding to the profile of the respondent and their type of company involved in construction work. In part two of questionnaire respondent were asked to give a score for each type of management technique identified by research. Moreover respondent also were asked to give a score about causes of using planning software and also effectiveness of using planning software. Their respondent was scaled from 1 (low importance) to 5 (high importance).

These questionnaire to obtain the level of agreement from the respondents and its importance according to the ordinal scale numbering from 1 to 5. The respondent need to choose one of the ordinance scale based on him or her understanding and acceptance

to the particular question and statement. Generally, the questionnaire are based on Likert's scale of ordinal measure of agreement toward each statement as in Figure 3.1 :



**Figure 3.1** Five Ordinal Measure Of Agreement Of Likert's Scale

Each scale represents the following rating

Ordinal Scale	Level of Agreement
1	Very low degree of agreement/importance
2	Low degree of agreement/importance
3	Neutral in agreement/importance
4	High degree of agreement/importance
5	Very high degree of agreement/importance

### **3.5 Data Analysis and Documentation**

In order to achieve the research objective, data analysis of the relevant information gathered was carried out. Preliminary analysis conducted on data about respondent background which is general information where the detailed analysis involved of the data that related of the purpose in reaching the research objectives. The data was collected from questionnaire survey was analyzed using "Average Index" (AI) technique by using formula AI. This AI technique has been use by Al-Hammad et al.

(1997) in the same context of application. AI was calculated using the following formula Figure 3.2:

$$\text{Average Index} = \left[ \frac{\sum_{i=1}^5 a_i x_i}{\sum_{i=1}^5 x_i} \right] \text{ for five scale rating}$$

**Figure 3.2:** The application of the AI technique

- a = constant expressing the weight given to i  
 x = variable expressing the frequency of the response for;  
 i = 1, 2,3,4,5 and illustrated as follows:  
 $x_1$  = frequency of the ‘strongly disagree’ response and corresponding to  $a_1 = 1$   
 $x_2$  = frequency of the ‘disagree’ response and corresponding to  $a_1 = 2$   
 $x_3$  = frequency of the ‘neutral’ response and corresponding to  $a_1 = 3$   
 $x_4$  = frequency of the ‘agree’ response and corresponding to  $a_1 = 4$   
 $x_5$  = frequency of the ‘strongly agree’ response and corresponding to  $a_1 = 5$

At the end of the study, the analyzed data result will be summarized and recommendations based on the result of the analysis will also be provided for future guidance.

### 3.6 Conclusion

Overall, this chapter was discussed about data collection and data analysis of the objective study. Generally, the using of methodology in this study is given below :

- Study on literature review to understand planning and scheduling that related in construction industries
- Preparation of questionnaire
- Contribute questionnaire survey by email and meeting some personal who in-charge contribute questionnaire and collect the data
- Analyzing questionnaire
- Recommendation and suggestion for future study

## **CHAPTER 4**

### **DATA ANALYSIS AND RESULTS**

#### **4.1 Introduction**

This chapter presented the analysis of collected data throughout the contribution questionnaire survey to obtain the objective of this study. Questionnaire survey divided in four part which is part A was about general information, part B management technique, part C causes of using planning software and part D was about causes effectiveness of using planning and scheduling software. Each part of questionnaire survey is important because it was related with each objective of this project and full fill the requirement needed.

#### **4.2 Responses to Questionnaire**

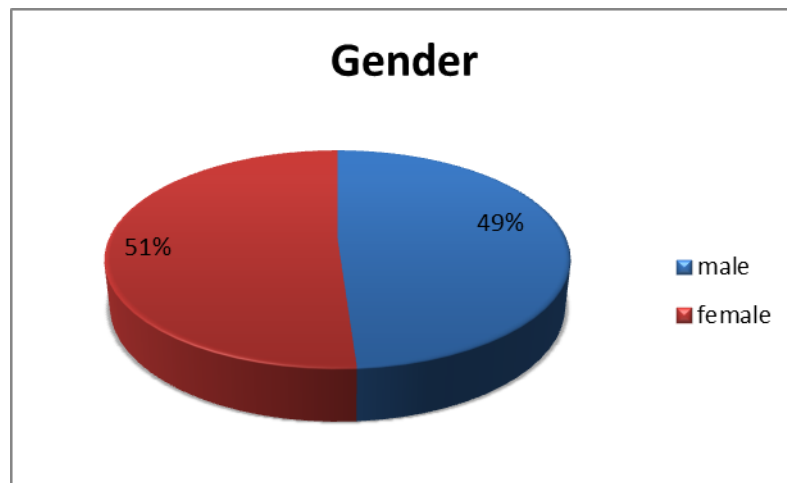
Questionnaire survey was formed based on data obtained from literature review. The final questionnaire form was presented in appendix. From Table 3.1 below it shown that the number of questionnaire survey distributed is totally 50, out of the 50 questionnaire distributed, 46 of the questionnaire sheets were returned after has been completed and another 4 sheets is considered lost in action. It is also shown percentage was 92%.

**Table 4.1** Questionnaire Distributed Among Respondent

Categories of respondent	Number distributed	Number of respondent	percentage
contractor	50	46	92%

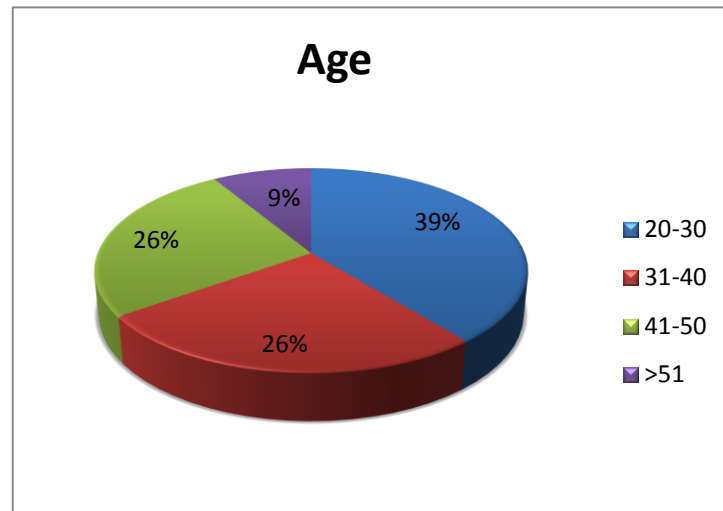
### 4.3 Initial Analysis of Background Information

This part of analysis is to obtain the background information of the respondent. From the analysis, male's respondent is 49% and female's is 51%. Most respondent consist of female, because as we know, in consultant field female worker are more than male worker. This is because male worker are more suitable in construction field.

**Figure 4.1** The gender of respondent

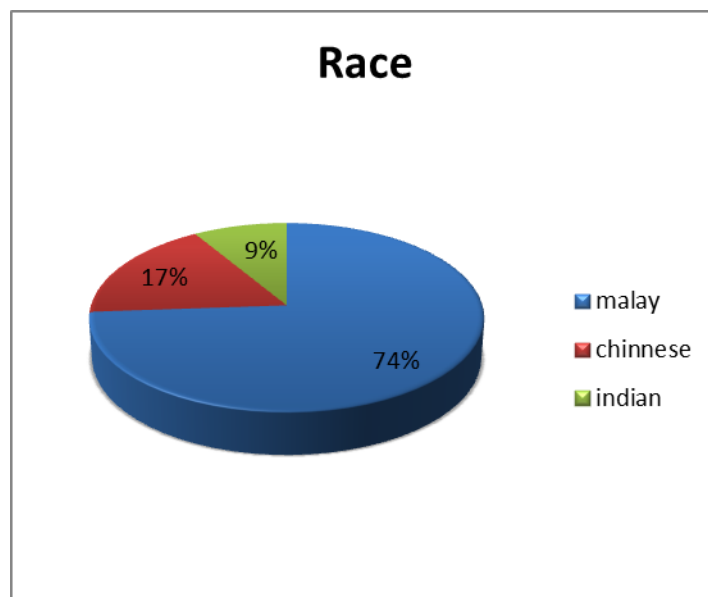
For age part, most of respondent at 20 to 30 years old because they have more practices skill in using planning software than the age above them. Only few of them,

9% in range > 50 because usually at that age they don't really involve in management work. And 26% percent of them in range 31 to 40 and 41 to 50, this is because they are actually training fresh graduate without any experience.



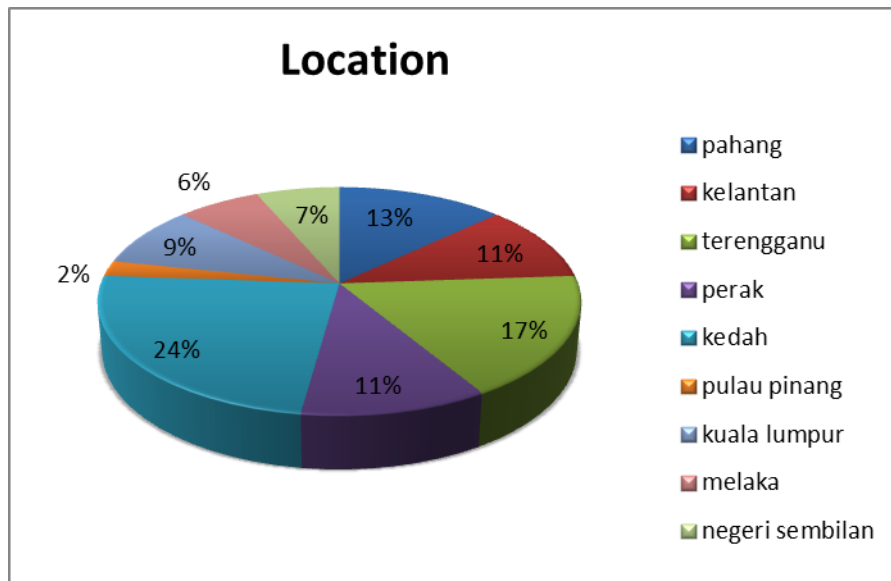
**Figure 4.2** The age of respondent

For the race of respondent, 74% is Malay and only 17% is Chinese and only few of them about 9% is Indian



**Figure 4.3** Race of respondent

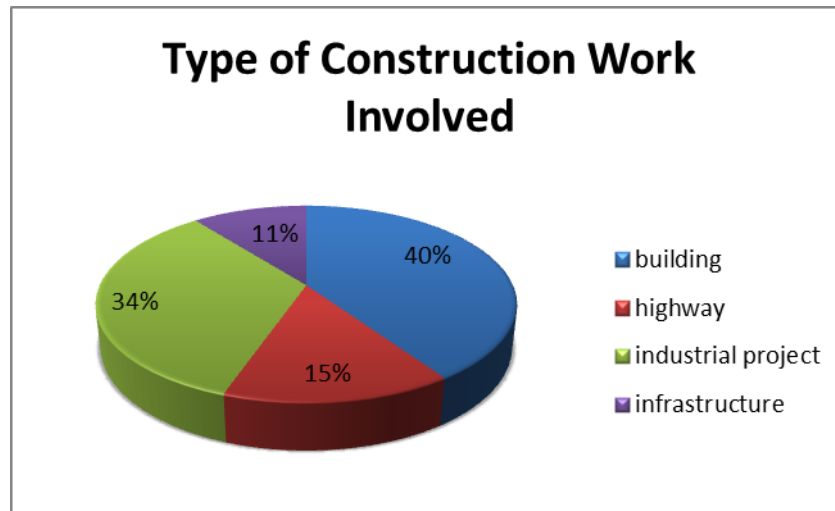
For the location of work of respondent, mostly are from Kedah which is 24%, then following from Terengganu and Pahang which is 17% and 13%. Kelantan and Perak are same range which is 11% and below than that which is Kuala Lumpur, Negeri Sembilan, Melaka and Pulau Pinang.



**Figure 4.4** Location work of respondent

Last question at section A is types of construction work involved in company. Mostly respondent are come from building constructions. The others was from industrial project, highway and infrastructure constructions.





**Figure 4.5** Type of construction work involved

#### **4.4 Management Technique in Scheduling and Planning**

On this part respondent were asked about what of management technique that there are most related in their work in planning and scheduling. From the analysis, I can obtained what important technique management that need to know in management. All question has been asked on this part consist 12 question that divided into two part which is they been ask from cost planning and control side and second part is schedule planning and control.

The entire question has been created in frequency scale by using this scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree so that respondent can state which level that there are always faced in management work.

Average point view on the question are shown in Table 4.2, the highest value of AI Ranks showed the highest frequency. Therefore, the small value of AI Ranks is the lowest technique that they used in daily life.

**Table 4.2** AI Ranking of Using Techniques Management

	Cost Planning and Control	Respondent	AI Ranks	Rank
1	Cost Estimation	46	4.02	8
2	Integrated Cost Breakdown and Work Breakdown Structure	46	4.00	9
3	Cost Baseline	46	4.02	8
4	Performance Report	46	4.15	6
5	Earned value Method (EVM)	46	4.20	4
6	Cost Management Software	46	4.22	3
	Schedule Planning and Control	Respondent	AI Ranks	Rank
7	Work Breakdown Structure (WBS)	46	3.78	11
8	Critical Path Method (CPM)	46	3.96	10
9	Method for crashing scheduling	46	4.04	7
10	Reports for works performance	46	4.24	2
11	Measure work performance	46	4.17	5
12	Software of schedule management	46	4.48	1

From the table, it produces the bar graph of average of this part.



**Figure 4.6** Management Techniques in Schedule and Planning

After this survey conducted, answer from respondent was showed that they are always using management technique before start the project. From the average index analysis, all responders have well known about the planning and scheduling technique in construction work. Based on the Figure 4.6, the highest AI rank is about using software for schedule management which is 4.28. And the lowest AI rank is on using WBS for scheduling and planning which is 3.78 average index.

From the observation and based on questionnaire, planning software are the most wanted in management work. But for the overall analysis, all management technique also important to responders because each AI rank not different much.

#### 4.5 Causes of Using Planning Software in Construction Work

On this part, respondent has been asked about reason that they are using planning software. All 12 question based on journal, books and also internet.

The entire question has been stated in questionnaire survey, so that all the answer of respondent can analysis. The frequency scale for this part is by using this scale; 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

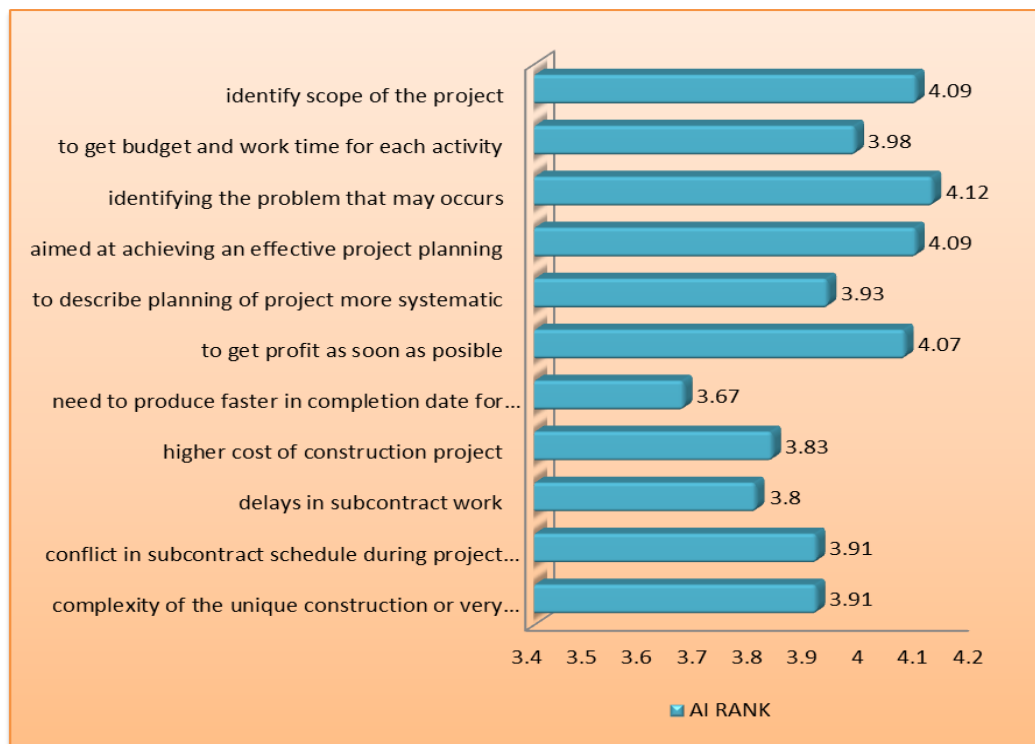
Average pint value for all causes are shown in table 4.3, the average value of the highest point showed the highest frequency. Therefore, the small average value is the lowest rank of their understanding.

**Table 4.3** AI Ranking Causes of Using Planning and Scheduling Software

	Causes of Using Planning Software	Respondent	AI Rank	Rank
1	Complexity of the unique construction or very high technology	46	3.91	5
2	Conflict in subcontract schedule during project execution	46	3.91	5
3	Delays in subcontract work	46	3.80	7
4	Change site condition and unforeseen site condition	46	3.83	6
5	Higher cost of construction project	46	3.67	

6	Need to produce faster in completion date for the project	46	4.07	4
7	To get profit as soon as possible	46	3.93	
8	To describe planning of project more systematic	46	4.09	3
9	Aimed at achieving an effective project planning	46	4.12	2
10	Identifying the problem that may occurs	46	3.98	5
11	To get budget and work time for each activity	46	4.20	1
12	Identify scope of the project	46	4.09	3

From this table, we come out with bar graph to show the average index pattern for each question asked.



**Figure 4.7** Causes of Using Planning and Scheduling Software

From average index analysis, the pattern of respondent answers are analysed. Respondent have well known knowledge about planning software and this is because its show by their answer in questionnaire. The highest average index is on question *identifying the problem that may occurs* about 4.12 average index. And the lowest is question need to produce faster in completion date for the project about 3.67 average index. For overall question was answer with high understanding about planning software and practicing of the software.

#### **4.6 Causes of Effectiveness of Using Planning and Scheduling Software**

On this part respondent been asked about planning and scheduling software. All question has been asked in this part obtain about causes of effectiveness of using planning and scheduling software. All question also based on journal, books magazine and internet.

This question have been divided into three part which causes of using planning and scheduling software based on quality, second part based on cost and also based on time. The entire question has been stated in the questionnaire survey, so that all the answer and opinion of respondent important to know the level of their understanding. The frequency scale for this part is by using this scale; 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

Average pit value of all causes on using planning and scheduling are shown in table 4.4, the average value of the highest point showed the highest frequency. Therefore, the small average value is the lowest rank of their face planning and scheduling software.

**Table 4.4** AI Ranking Causes of Effectiveness of Using Planning and Scheduling Software

	Effectiveness of Using Planning Scheduling Software (Quality)	Respondent	AI Rank	Rank
1	To describes the construction and condition of the property on the date of the inspection	46	4.15	4
2	To identify any problems that need urgent attention or are serious	46	4.17	3
3	To identify that need to be investigated further to prevent serious damage	46	4.00	11
4	To tell you about problems that may be hazardous	46	3.91	13
5	To show up potential issues and defects before any transaction takes place	46	4.04	10
6	To establish how the property is built, what materials are used and how these will perform in future	46	4.11	7
	Effectiveness of Using Planning Scheduling Software (Cost)	Respondent	AI Rank	Rank
7	To help you prepare a budget for any repairs or restoration	46	4.04	10
8	To advice you in the amount ongoing maintenance requirement	46	4.07	9
9	Ability to manage risks, forecasting, and budgets	46	4.17	3
10	To help manage project costs	46	4.13	5
	Effectiveness of Using Planning Scheduling Software (Time)	Respondent	AI Rank	Rank

11	To outline the repair options and give you a repair timeline	46	4.09	8
12	Time saving improvement from software planning	46	4.18	2
13	Provide a “roadmap” that is easily followed and lead to project completion date	46	3.00	14
14	Project can be done on time	46	3.91	
15	Allows project managers to break large projects into smaller, achievable projects, tasks, and activities	46	3.91	13
16	Due dates on subsequent task are automatically updates	46	3.98	12
17	Help in viewing details such as the task start date, projected end date, percent complete and who is responsible for completing it	46	4.12	6
18	Allowing you to easily share information and stay up-to-date with project changes	46	4.37	1

From this table for part causes of effectiveness of using planning and scheduling software, we come out with bar graph to show the average index pattern for each question asked.





**Figure 4.8** Causes of Effectiveness of Using Planning and Scheduling Software

From the average index analysis, the pattern of respondent answers still in satisfied condition. Respondent have well known knowledge about causes of benefit of using planning and scheduling software. The highest average index is on question *provide a "roadmap" that is easily followed and lead to project completion date* about average 4.18 average indexes. And the lowest index is on question *project can be done on time* about average 3.00 average index. For overall, respondent answered question with a highly information about benefit of using planning and scheduling software and also based on their experience in work.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATION

#### 5.1 Introduction

The result from the survey questionnaire can achieve all the objectives regarding from this research. All the result that are achieved from this research can contribute and can be reference for the future uses. In summary, the study of effectiveness of using planning scheduling software was achieved using the questionnaire. All the important part has been obtained during this research. Furthermore, some research limitations will also be discussed, together with suggestion and recommendations that can be guide in future.

#### 5.2 Conclusion

Overall, the three objectives of this study has been successfully achieved. The findings can be summarized as follows.

#### **Objective number 1 : To study scheduling technique used in developing planning and scheduling**

From the study, the result has been calculated to know and improve the technique management used in developing and scheduling are as follows :

- ✓ Past experience in handling management before start the project
- ✓ The most used is software of schedule management
- ✓ Mitigates Availability Conflicts
- ✓ Saves Labour Hours

- ✓ Type of project (building)
- ✓ Skill practices in management project
- ✓ Experience similar with project type

**Objective no 2 : To identify the factors that cause of using planning software for contractors nowadays**

- ✓ Get budget and work time for each activity
- ✓ Achieving an effective project planning
- ✓ Identifying scope of the work in project
- ✓ Produce faster in completion date for the project
- ✓ Identifying the problem that may occurs
- ✓ Control change site condition and unforeseen site condition

**Objective number 3 : to analyse the level of the effectiveness of using planning software in delivering construction project**

- ✓ Easily share information and stay up-to-date with project changes
- ✓ Time saving improvement from software planning
- ✓ Managing risks, forecasting, and budgets
- ✓ Describing the construction and condition of the property on the date of the inspection
- ✓ Helping in manage project costs
- ✓ Helping in viewing details such as the task start date, projected end date, percent complete and who is responsible for completing it

### **5.3 Research Limitations'**

The area under study is only in Peninsular Malaysia. It will be interesting idea to collect the data if the area of study is far bit until Sabah and Sarawak. Thus, it will produce a better result when combining all the state in Malaysia.

#### **5.4 Recommendation for Future Studies**

After all study I found the main factors of using planning and scheduling software which is to get budget and work time for each activity and the main reasons of using planning and scheduling software are more effective than others is because this software be able to allowing users easily share information and stay up-to-date with project changes. Here some recommendations can be considered by all parties involved on this field of work to improve on the skill practices of using planning and scheduling software such as;

- I. For the storage, all parties involved need to expand the knowledge and practising skill about using planning and scheduling software to help many construction to reduce delay in work.
- II. Since area of this study is on Peninsular Malaysia only, it proposed that further study can be conducted in whole Malaysia include Sabah and Sarawak or other states. With this, it proposed that the quantity of data collection must raised as well and all parties involved should meet up and sharing and exchange to gain more knowledge skill in planning and scheduling software. It will produce a better result compare with current result.
- III. Research can be conducted using different procurement such as handling complexity project using planning and scheduling software, differences of software management and manual management to a complexity project, and benefit of skill practice in scheduling and planning software. The result can become more realistic and specific for the future references.

#### **5.5 Summary**

Overall, this study has been completed regarding to the information and result that has been calculated. This research provide an overview on the using planning and scheduling software was better and more helpful. Perhaps this can contribute and should be future reference for all parties in constructions industries. Furthermore, the recommendation that has been stated above can provide a better result.

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## APPENDICES

### Section A

#### Frequencies

##### gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid male	22	48.9	48.9	48.9
Valid female	24	51.1	51.1	100.0
Total	46	100.0	100.0	

##### age

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 20-30	18	39.1	39.1	39.1
Valid 31-40	12	26.1	26.1	65.2
Valid 41-50	12	26.1	26.1	91.3
Valid >51	4	8.7	8.7	100.0
Total	46	100.0	100.0	

##### race

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid malay	34	73.9	73.9	73.9
Valid chinnese	8	17.4	17.4	91.3
Valid indian	4	8.7	8.7	100.0
Total	46	100.0	100.0	



**location**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid pahang	6	13.0	13.0	13.0
kelantan	5	10.9	10.9	23.9
terengganu	8	17.4	17.4	41.3
perak	5	10.9	10.9	52.2
kedah	11	23.9	23.9	76.1
pulau pinang	1	2.2	2.2	78.3
kuala lumpur	4	8.7	8.7	87.0
melaka	3	6.5	6.5	93.5
negeri sembilan	3	6.5	6.5	100.0
Total	46	100.0	100.0	

**type of construction work involved**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid building	19	40.4	40.4	40.4
highway	6	14.9	14.9	55.3
industrial project	16	34.0	34.0	89.4
infrastructure	5	10.6	10.6	100.0
Total	46	100.0	100.0	

**Section B****Frequencies****Statistics**

		use WBS for schedule planning	use the CPM for schedule planning	the method for crashing scheduling	report for works performance	measure works performance
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		use software for schedule management	cost estimation	integrated cost breakdown and work breakdown structure	cost baseline	performance report
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		earned value method (EVM)	used cost management software
N	Valid	46	46
	Missing	0	0

**Frequency Table****use WBS for schedule planning**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	1	2.1	2.1	2.1
	disagree	1	2.1	2.1	4.3
	neutral	14	29.8	29.8	34.0
	agree	18	38.3	38.3	72.3
	strongly agree	14	27.7	27.7	100.0
	Total	46	100.0	100.0	

**use the CPM for schedue planning**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
strongly disagree	1	2.1	2.1	2.1
disagree	2	4.3	4.3	6.4
neutral	11	23.4	23.4	29.8
agree	17	36.2	36.2	66.0
strongly agree	15	34.0	34.0	100.0
Total	46	100.0	100.0	

**the method for crashing scheduling**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
strongly disagree	1	2.1	2.1	2.1
disagree	1	2.1	2.1	4.3
neutral	9	19.1	19.1	23.4
agree	20	42.6	42.6	66.0
strongly agree	15	34.0	34.0	100.0
Total	46	100.0	100.0	

**report for works performance**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
strongly disagree	1	2.1	2.1	2.1
disagree	2	4.3	4.3	6.4
neutral	6	12.8	12.8	19.1
agree	14	29.8	29.8	48.9
strongly agree	23	51.1	51.1	100.0
Total	46	100.0	100.0	

**measure works performance**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	1	2.1	2.1	2.1
neutral	8	17.0	17.0	19.1
Valid agree	21	44.7	44.7	63.8
strongly agree	16	36.2	36.2	100.0
Total	46	100.0	100.0	

**use software for schedule management**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.4	6.4	6.4
neutral	5	10.6	10.6	17.0
Valid agree	15	31.9	31.9	48.9
strongly agree	23	51.1	51.1	100.0
Total	46	100.0	100.0	

**cost estimation**

	Frequency	Percent	Valid Percent	Cumulative Percent
strongly disagree	1	2.1	2.1	2.1
disagree	2	4.3	4.3	6.4
Valid neutral	10	21.3	21.3	27.7
agree	16	34.0	34.0	61.7
strongly agree	17	38.3	38.3	100.0
Total	46	100.0	100.0	

**integrated cost breakdown and work breakdown structure**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	2	4.3	4.3	4.3
neutral	9	19.1	19.1	23.4
Valid agree	23	48.9	48.9	72.3
strongly agree	12	27.7	27.7	100.0
Total	46	100.0	100.0	

**cost baseline**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	2	4.3	4.3	4.3
neutral	10	21.3	21.3	25.5
Valid agree	20	42.6	42.6	68.1
strongly agree	14	31.9	31.9	100.0
Total	46	100.0	100.0	

**performance report**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	2	4.3	4.3	4.3
neutral	10	21.3	21.3	25.5
Valid agree	14	29.8	29.8	55.3
strongly agree	20	44.7	44.7	100.0
Total	46	100.0	100.0	

**earned value method (EVM)**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	1	2.1	2.1	2.1
neutral	6	12.8	12.8	14.9
Valid agree	23	48.9	48.9	63.8
strongly agree	16	36.2	36.2	100.0
Total	46	100.0	100.0	

## used cost management software

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.4	6.4	6.4
neutral	6	12.8	12.8	19.1
Valid agree	16	34.0	34.0	53.2
strongly agree	21	46.8	46.8	100.0
Total	46	100.0	100.0	

Section C**Frequencies****Statistics**

		complexity of the unique construction or very high technology	conflict in subcontract schedule during project execution	delays in subcontract work	change site condition and unforeseen site condition	higher cost of construction project
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		need to produce faster in completion date for the project	to get profit as soon as possible	to describe planning of project more systematic	aimed at achieving an effective project planning	identifying the problem that may occurs
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		to get budget and work time for each activity	identify scope of the project
N	Valid	46	46
	Missing	0	0

## Frequency Table

**complexity of the unique construction or very high technology**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.5	6.5	6.5
neutral	11	23.9	23.9	30.4
Valid agree	19	41.3	41.3	71.7
strongly agree	13	28.3	28.3	100.0
Total	46	100.0	100.0	

**conflict in subcontract schedule during project execution**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.5	6.5	6.5
neutral	9	19.6	19.6	26.1
Valid agree	23	50.0	50.0	76.1
strongly agree	11	23.9	23.9	100.0
Total	46	100.0	100.0	

**delays in subcontract work**

	Frequency	Percent	Valid Percent	Cumulative Percent
strongly disagree	1	2.2	2.2	2.2
disagree	4	8.7	8.7	10.9
Valid neutral	9	19.6	19.6	30.4
agree	21	45.7	45.7	76.1
strongly agree	11	23.9	23.9	100.0
Total	46	100.0	100.0	



**change site condition and unforeseen site condition**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.5	6.5	6.5
neutral	12	26.1	26.1	32.6
Valid agree	21	45.7	45.7	78.3
strongly agree	10	21.7	21.7	100.0
Total	46	100.0	100.0	

**higher cost of construction project**

	Frequency	Percent	Valid Percent	Cumulative Percent
strongly disagree	1	2.2	2.2	2.2
disagree	5	10.9	10.9	13.0
Valid neutral	13	28.3	28.3	41.3
agree	16	34.8	34.8	76.1
strongly agree	11	23.9	23.9	100.0
Total	46	100.0	100.0	

**need to produce faster in completion date for the project**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	1	2.2	2.2	2.2
neutral	7	15.2	15.2	17.4
Valid agree	26	56.5	56.5	73.9
strongly agree	12	26.1	26.1	100.0
Total	46	100.0	100.0	

**to get profit as soon as possible**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	2.2	2.2	2.2
disagree	2	4.3	4.3	6.5
neutral	10	21.7	21.7	28.3
agree	19	41.3	41.3	69.6
strongly agree	14	30.4	30.4	100.0
Total	46	100.0	100.0	

**to describe planning of project more systematic**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	2.2	2.2	2.2
disagree	1	2.2	2.2	4.3
neutral	9	19.6	19.6	23.9
agree	17	37.0	37.0	60.9
strongly agree	18	39.1	39.1	100.0
Total	46	100.0	100.0	

**aimed at achieving an effective project planning**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	3	6.5	6.5	6.5
neutral	7	15.2	15.2	21.7
agree	18	39.1	39.1	60.9
strongly agree	18	39.1	39.1	100.0
Total	46	100.0	100.0	

**identifying the problem that may occurs**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	2	4.3	4.3	4.3
disagree	3	6.5	6.5	10.9
neutral	5	10.9	10.9	21.7
agree	20	43.5	43.5	65.2
strongly agree	16	34.8	34.8	100.0
Total	46	100.0	100.0	

**to get budget and work time for each activity**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	2	4.3	4.3	4.3
neutral	5	10.9	10.9	15.2
agree	22	47.8	47.8	63.0
strongly agree	17	37.0	37.0	100.0
Total	46	100.0	100.0	

**identify scope of the project**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	2.2	2.2	2.2
disagree	1	2.2	2.2	4.3
neutral	8	17.4	17.4	21.7
agree	19	41.3	41.3	63.0
strongly agree	17	37.0	37.0	100.0
Total	46	100.0	100.0	

Section D**Frequencies****Statistics**

		to describe the construction and condition of the property on the date of the inspection	to identify any problem that need urgent attention or are serious	to identify that need to be investigated further to prevent serious damage	to tell you about the problem that may be hazardous	to show up potential issues and defects before any transaction takes place
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		to establish how the property is built, what materials are used and how these will perform in future	to help you prepare a budget for any repairs or restoration	to advce you in the amount ongoing maintenance requirement	ability to manage risks, forecasting, and budgets	to help manage project costs
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		to outline the repair options and give you a repair timeline	time saving improvement from software planning	provide a 'roadmap' that is easily followed and lead to project completion date	project can be done on time	allows project managers to break large projects into smaller, achievable project, tasks, and activities

N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0

**Statistics**

		due dates on subsequent task are automatically updates	help in viewing details such as the task start date, projected end date, percent complete and who is responsible for completing it	allowing you to easily share information and stay up-to-date with the project changes
N	Valid	46	46	46
	Missing	0	0	0

### Frequency Table

**to describe the construction and condition of the property on the date of the inspection**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	1	2.2	2.2
	disagree	1	2.2	4.3
	neutral	8	17.4	21.7
	agree	16	34.8	56.5
	strongly agree	20	43.5	100.0
	Total	46	100.0	100.0

**to identify any problem that need urgent attention or are serious**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	2.2	2.2	2.2
disagree	2	4.3	4.3	6.5
neutral	4	8.7	8.7	15.2
agree	20	43.5	43.5	58.7
strongly agree	19	41.3	41.3	100.0
Total	46	100.0	100.0	

**to identify that need to be investigated further to prevent serious damage**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid neutral	13	28.3	28.3	28.3
agree	20	43.5	43.5	71.7
strongly agree	13	28.3	28.3	100.0
Total	46	100.0	100.0	

**to tell you about the problem that may be hazardous**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	2	4.3	4.3	4.3
neutral	8	17.4	17.4	21.7
agree	28	60.9	60.9	82.6
strongly agree	8	17.4	17.4	100.0
Total	46	100.0	100.0	

**to show up potential issues and defects before any transaction takes place**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid neutral	12	26.1	26.1	26.1
Valid agree	20	43.5	43.5	69.6
Valid strongly agree	14	30.4	30.4	100.0
Total	46	100.0	100.0	

**to establish how the property is built, what materials are used and how these will perform in future**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	1	2.2	2.2	2.2
Valid neutral	10	21.7	21.7	23.9
Valid agree	18	39.1	39.1	63.0
Valid strongly agree	17	37.0	37.0	100.0
Total	46	100.0	100.0	

**to help you prepare a budget for any repairs or restoration**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	2	4.3	4.3	4.3
Valid neutral	9	19.6	19.6	23.9
Valid agree	20	43.5	43.5	67.4
Valid strongly agree	15	32.6	32.6	100.0
Total	46	100.0	100.0	

**to advce you in the amount ongoing maintenance requirement**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	2	4.3	4.3	4.3
Valid neutral	10	21.7	21.7	26.1
Valid agree	17	37.0	37.0	63.0
Valid strongly agree	17	37.0	37.0	100.0
Total	46	100.0	100.0	

**ability to manage risks, forecasting, and budgets**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid neutral	7	15.2	15.2	15.2
Valid agree	24	52.2	52.2	67.4
Valid strongly agree	15	32.6	32.6	100.0
Total	46	100.0	100.0	

**to help manage project costs**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	1	2.2	2.2	2.2
Valid neutral	10	21.7	21.7	23.9
Valid agree	17	37.0	37.0	60.9
Valid strongly agree	18	39.1	39.1	100.0
Total	46	100.0	100.0	

**to outline the repair options and give you a repair timeline**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	2.2	2.2	2.2
Valid disagree	1	2.2	2.2	4.3
Valid neutral	8	17.4	17.4	21.7
Valid agree	19	41.3	41.3	63.0
Valid strongly agree	17	37.0	37.0	100.0
Total	46	100.0	100.0	



**time saving improvement from software planning**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.5	6.5	6.5
neutral	4	8.7	8.7	15.2
Valid agree	21	45.7	45.7	60.9
strongly agree	18	39.1	39.1	100.0
Total	46	100.0	100.0	

**provide a 'roadmap' that is easily followed and lead to project completion date**

	Frequency	Percent	Valid Percent	Cumulative Percent
strongly disagree	1	2.2	2.2	2.2
disagree	1	2.2	2.2	4.3
Valid neutral	10	21.7	21.7	26.1
agree	15	32.6	32.6	58.7
strongly agree	19	41.3	41.3	100.0
Total	46	100.0	100.0	

**project can be done on time**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	1	2.2	2.2	2.2
neutral	14	30.4	30.4	32.6
Valid agree	19	41.3	41.3	73.9
strongly agree	12	26.1	26.1	100.0
Total	46	100.0	100.0	

**allows project managers to break large projects into smaller, achievable project, tasks, and activities**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	3	6.5	6.5	6.5
neutral	10	21.7	21.7	28.3
Valid agree	21	45.7	45.7	73.9
strongly agree	12	26.1	26.1	100.0
Total	46	100.0	100.0	

**due dates on subsequent task are automatically updates**

	Frequency	Percent	Valid Percent	Cumulative Percent
strongly disagree	1	2.2	2.2	2.2
disagree	2	4.3	4.3	6.5
Valid neutral	11	23.9	23.9	30.4
agree	15	32.6	32.6	63.0
strongly agree	17	37.0	37.0	100.0
Total	46	100.0	100.0	

**help in viewing details such as the task start date, projected end date, percent complete and who is responsible for completing it**

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	2	4.3	4.3	4.3
neutral	7	15.2	15.2	19.6
Valid agree	21	45.7	45.7	65.2
strongly agree	16	34.8	34.8	100.0
Total	46	100.0	100.0	

allowing you to easily share information and stay up-to-date with the project changes

	Frequency	Percent	Valid Percent	Cumulative Percent
disagree	1	2.2	2.2	2.2
neutral	6	13.0	13.0	15.2
Valid agree	14	30.4	30.4	45.7
strongly agree	25	54.3	54.3	100.0
Total	46	100.0	100.0	

## QUESTIONNAIRE

### APPLICATION OF PLANNING SOFTWARE IN CONSTRUCTION INDUSTRIES:

#### Study on Effectiveness of Planning Software Toward Project Deliveries.

#### SECTION A General information

*\*\*Please tick (√) on the appropriate choices that best suit with you*

1) Location (tick one )

Kelantan	<input type="checkbox"/>	Johor	<input type="checkbox"/>
Terengganu	<input type="checkbox"/>	Malacca	<input type="checkbox"/>
Kuala Lumpur	<input type="checkbox"/>	Perak	<input type="checkbox"/>
Kedah	<input type="checkbox"/>	Perlis	<input type="checkbox"/>
Negeri Sembilan	<input type="checkbox"/>	Selangor	<input type="checkbox"/>
Pulau Pinang	<input type="checkbox"/>		
Pahang	<input type="checkbox"/>		

2) Age

20 – 30

41 - 50

31 – 40

> 50

3) Race

Malay

India

Chinese

4) Type if construction work involved (tick more than one )

<input type="checkbox"/>	Building	<input type="checkbox"/>	Industrial project
<input type="checkbox"/>	Highway	<input type="checkbox"/>	Infrastructure
<input type="checkbox"/>	Other, please specify .....		

**SECTION B Management technique in schedule /cost planning and control**

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

*\*\*Please tick (√) on the appropriate choices that best suit with you*

<b>Schedule Planning and Control</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Use Work Breakdown Structure (WBS) for scheduling planning					
Use the Critical Path Method (CPM) for schedule planning					
The Method for crashing scheduling					
Reports for works performance					
Measure works performance					
Use software for schedule management					

<b>Cost Planning and Control</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Cost Estimation					
Integrated Cost Breakdown and Work Breakdown Structure					
Cost Baseline					
Performance Report					
Earned Value Method (EVM)					
Used Cost Management Software					

### SECTION C Planning and Scheduling Software

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

*\*\*Please tick (√) on the appropriate choices that best suit with you*

<b>Causes of Using Planning Software</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Complexity of the unique construction or very high technology					
Conflict in subcontract schedule during project execution					
Delays in subcontract work					
Change site condition and unforeseen site condition					
Higher cost of construction project					
Need to produce faster in completion date for the project					
To get profit as soon as possible					
To describe planning of project more systematic					
Aimed at achieving an effective project planning					
Identifying the problem that may occurs					
To get budget and work time for each activity					
Identify scope of the project					

### SECTION D Planning and Scheduling Software

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

<b>Effectiveness of using planning and scheduling software (Quality)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
To describes the construction and condition of the					

property on the date of the inspection					
To identify any problems that need urgent attention or are serious					
To identify that need to be investigated further to prevent serious damage					
To tell you about problems that may be hazardous					
To show up potential issues and defects before any transaction takes place					
To establish how the property is built, what materials are used and how these will perform in future					
<b>Effectiveness of using planning and scheduling software (Cost)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
To help you prepare a budget for any repairs or restoration					
To advice you in the amount ongoing maintenance requirement					
Ability to manage risks, forecasting, and budgets					
To help manage project costs					
<b>Effectiveness of using planning and scheduling software (Time)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
To outline the repair options and give you a repair timeline					
Time saving improvement from software planning					
Provide a “roadmap” that is easily followed and lead to project completion date					
Project can be done on time					
Allows project managers to break large projects into smaller, achievable projects, tasks, and activities					
Due dates on subsequent task are automatically updates					
Help in viewing details such as the task start date, projected end date, percent complete and who is responsible for completing it					
Allowing you to easily share information and stay up-to-date with project changes					

**---- End of Survey ----**