

# Project Management Scheduling through Integrated PERT and Gantt Chart

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**Abstract**— In project management, scheduling is one of the important activities, where the project can be successfully finished within a desired time period. This study reviews the existing techniques in solving the scheduling problems. An integration technique between Program Evaluation and Review Technique (PERT), and Gantt chart is proposed for a better scheduling such that the efficiency of the proposed approach and the existing techniques can be compared. Data collection was carried out and the previous monthly data of the production was taken. After collecting data, the data will be transformed into PERT diagram and then the duration time and cost of the production were calculated. Consequently, the Gantt chart of the production was developed. As a result, an optimal scheduling can be suggested in future.

**Keywords**— *PERT, Gantt chart, Integration, project management, scheduling.*

## I. Introduction

Project management involves scheduling, planning, monitoring and controlling of limited resources to satisfy a variety of constraints so as a specific objective is achieved.

A proper scheduling is important in the completion of a project. This is because the project can be completed as desired by determining the earliest start and finish times of each activity, and the likelihood of a project is completed within a certain time period.

From the scheduling table, the production notifies the period when each activity should be done, what has already completed, and the sequence in which tasks needed to be finished according to the priority. Furthermore, the critical path of a project is determined such that the project will not be delayed.

Although there are many project management techniques, but it is less investigation in studying the integration techniques. In this paper, the aim of this study is to focus on an integrated technique, which combines Program Evaluation and Review Technique (PERT) and Gantt Chart (GC), for solving the scheduling problems.

Consequently, the completion time of a project is on track without having any delay.

## II. Literature Review

To overcome the problems arise in scheduling, such as time overrunning, wasting of raw materials and over budgeting, many techniques have been well developed to produce an optimal scheduling. Here, two common techniques, which are PERT and GC, are briefly reviewed.

### A. Project Management Technique

In general, a list of activities with the proposed start and finish dates are mentioned in a project. These activities are also stated in the development of a work breakdown structure (WBS), where the project is divided into a set of atomic activities. In this case, all of these activities are extracted, defined, elaborated and agreed upon using some consensus driven mechanism such as wideband Delphi [1].

Managers prefer to application of PERT rather than Activity on Node (AoN) in scheduling. From [2], PERT is embodied in time for various activities of projects.

For certain analytical techniques, the network structure of PERT is properly used in a project management [3]. According to [4], PERT was used to deal with problems that the logic relationships of activities were convinced but their durations were indeterminate.

Gantt chart is the fourth most used tools out of 70 tools and techniques that are related to project management conferring survey from 750 project managers [5]. Gantt chart is actually used universally which consists of many contexts and across the spectrum from continuous production (low variety, high volume) to projects (high variety, low volume) [6].

**B. Integration Technique**

Since the work breakdown structure cannot be used in a large-scale project, the integrated technique, which combines process model and Gantt chart, is then studied [7].

At the beginning, the integration framework of a process is done. In the process, activities are arranged to operate one task.

The sequence of activities is the key in the process such that the manufacturing system can be run. Here, organizations, resources and information represent a dynamic system in order to produce products and profits. Based on the mapping technique, some analyses are made:

- (a) Describing the relationship between two activities that have logical sequence and overlap in time axis cannot be done directly from process modeling method. However, it is easy for Gantt chart to present the overlapped relationship. The reasonable schedule can be developed with the recorded time, cost and resource when transferring the process model into Gantt chart.
- (b) Knowing how resource is being distributed in the time axis make easy, if there is any existence logic or time antinomy among activities by using project management.
- (c) Analyzing the relationship of activities based on Gantt chart can be done using the critical path method (CPM), where the critical path of activities is found in the reasonable process.

From [8], Data Flow Diagram (DFD) is integrated with Gantt chart and PERT. These techniques are integrated to automatically map system analysis object into project management objects that are more desired and feasible. In integrating the techniques, two techniques are considered, which are mapping model and mapping prototype.

In mapping model, a model of DFD object is considered into Gantt objects, while in mapping prototype, the mapping approach is prototyped and it only shows the result from the mapping DFD that has been transferred into Gantt diagrams by Microsoft's MS Project [8].

### III. Methodology

**A. Program Evaluation and Review Technique (PERT)**

PERT technique is being used to change the data from production into Activity on Node (AoN). This is to ensure the transformation from AoN into Gantt chart is easy.

Real data from a company, which contains ten products and three machines, are converted into a table form that divides to jobs and machines.

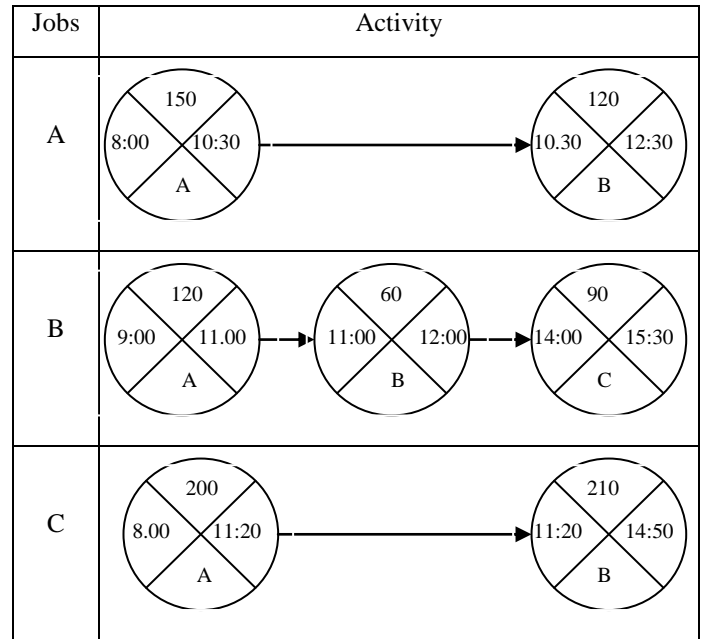


Figure 1: Diagram of PERT

Figure 1 shows the activity on node (AoN). The node in the diagram means activity of the project and the arrow shows the relationship between the activities. For Job A, the activities should be finished before starting the activities of Job B. On each node, the duration of the activity (in minutes) as well as the start and finish times of the activity are stated.

**B. Gantt Chart**

Gantt chart is the final output of the scheduling. When getting all of the data, a new scheduling is then resulted and presented in Gantt chart.

**C. Integrated PERT and Gantt chart**

In this study, the integrated PERT and Gantt chart produce a new scheduling. After changing the data into PERT diagram, each of the data will be changed into Gantt chart diagram by using software such as Microsoft Office Project or Primavera.

The output of the integration technique is significantly displayed when the company applies PERT as well as uses Gantt chart.

### iv. Discussion

The data that collected from a company is used for this study. Two products, which are A and B, are considered and the data is shown in Tables 1 and 2, respectively.

Table 1: Data production of product A

Machine	Weight (kg)	Start time	Finish time
1	275	9:00	12:15
1	250	12.15	15.10
2	250	9.00	10.30
2	275	10.30	12.40
2	250	12.40	14.30
3	275	9.45	10.00
3	250	10.00	12.45
3	275	12.45	15.00
<b>Total</b>	<b>2100</b>	<b>84.75</b>	<b>101.70</b>

Table 2: Data production of product B

Machine	Weight (kg)	Start time	Finish time
1	250	8:30	11:00
1	250	11.00	13.30
1	250	13.30	16.00
2	250	8.00	10.00
2	250	10.00	12.00
2	250	12.00	14.30
2	250	14.30	16.30
<b>Total</b>	<b>1750</b>	<b>76.90</b>	<b>92.90</b>

All of the data in Tables 1 and 2 are changed into PERT diagram as shown in Figures 2 and 3 to present the connection between the machines and the products.

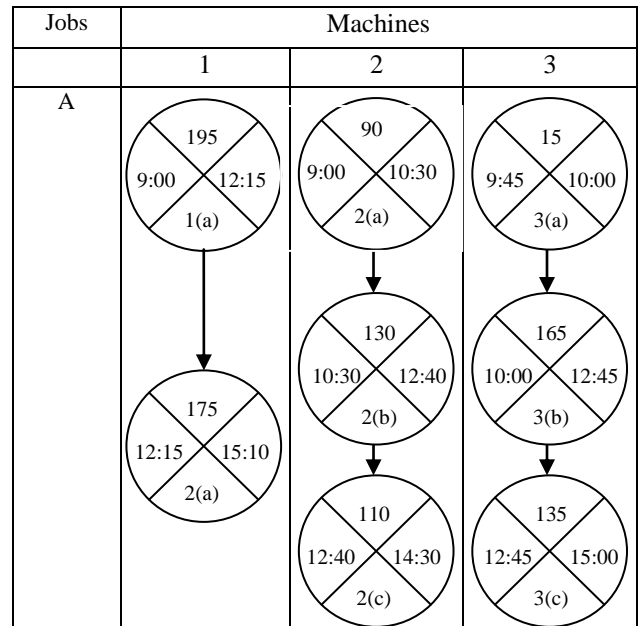


Figure 2: Diagram of PERT for product A

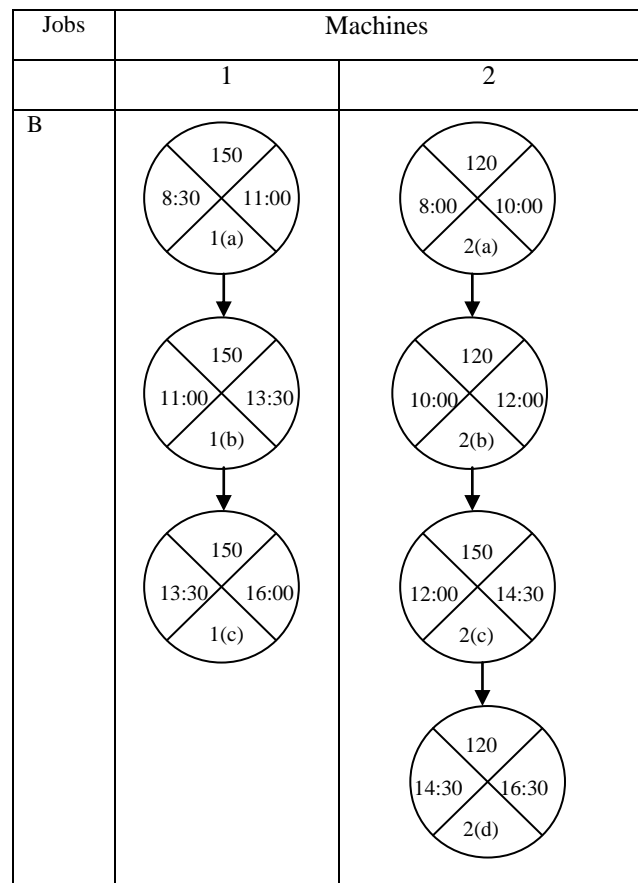


Figure 3: PERT diagram of product B

Parameters for each product are calculated using the start time and the finish time. Weights are provided to know the period (in minutes) and the respective cost for each product A is RM7.04 per kilogram and RM6.92 per kilogram for each product B. The following formulae are used to calculate the parameters:

$$\text{Period} = \text{finish time} - \text{start time} \quad (1)$$

$$\frac{\text{Total}}{\text{Cost}} = \frac{\text{amount of}}{\text{production}} \times \frac{\text{cost per}}{\text{kilogram}} \quad (2)$$

The durations and the costs for each product are calculated from (1) and (2), which are shown in Tables 3 and 4, respectively. Then, Gantt chart for each product is generated by using these calculated values. See Figures 4 and 5.

Table 3: Duration and cost for product A

Machine	Duration (Minute)	Cost (RM)
1	195	1936
1	175	1760
2	90	1760
2	130	1936
2	110	1760
3	15	1936
3	165	1760
3	135	1936
<b>Total</b>	<b>1015</b>	<b>14,784</b>

Table 4: Duration and Cost for product B

Machine	Duration (minute)	Cost (RM)
1	150	1730
1	150	1730
1	150	1730
2	120	1730
2	120	1730
2	150	1730
2	120	1730
	<b>960</b>	<b>12,110</b>

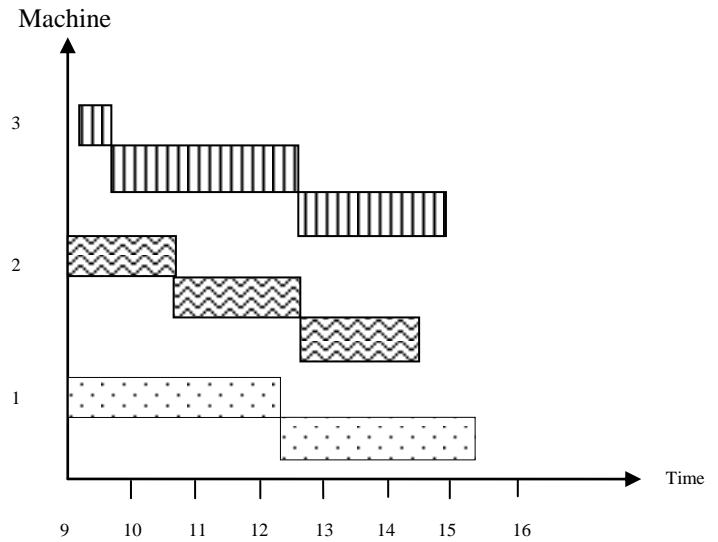


Figure 4: Gantt chart for product A

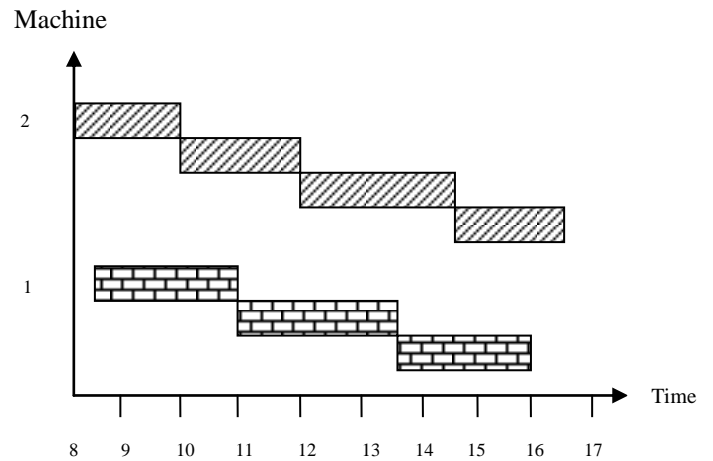


Figure 5: Gantt chart for product B

## V. CONCLUSION

Selecting suitable and appropriate project management technique is very helpful in controlling the duration of completion of a project. This paper discussed a new project management scheduling through integration of existing techniques, which are PERT and Gantt chart. The integrated technique was applied to study the production scheduling from a company. The PERT diagram and Gantt chart provide a good scheduling for the company in their production planning. In future, application of Genetic Algorithm to the integrated PERT and Gantt chart will be studied so as the production scheduling can be improved.

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