Manufacturing Modelling & Simulation
In A Manufacturing Industry.

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By

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JUDUL: MANUFACTURING MODELING AND SIMULATION IN A MANUFACTURING INDUSTRY


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DEDICATION

For My Father and Mother.
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This case study discuss the initial efforts to implement simulation modelling as a visual management and analysis tool at an assembly shop floor that produced door sash. Discrete-event simulation (DES) techniques are used for improving efficiency in manufacturing systems. It allows different test to be carried out by step-by-step alteration. The production shop floor was modelled using WITNESS software to identify bottleneck, and evaluate machine performance, cycle time that are essential for efficient production control. For Projek Sarjana Muda (PSM) report, it consists of the beginning construction of a case study title Manufacturing Modelling and Simulation in a Manufacturing Industry. Here, the problem statements and the objectives of this study have been identified. Besides that, scope of this study and the importance of the study and the outline of the study have been reviewed and discuss. For literature review, starting with searching information in reference books and internet especially in the journals for manufacturing information and its history, definition of modelling and simulation, its advantages and disadvantages, importance of simulation and review of previous case study are reviews in general. In methodology, a brief review of purpose of conducting the study are reviewed starting from the beginning of the study until the end of PSM and the basic steps of simulation are discussed. In data collection, general reviews of how the data have been collected are review starting from constructing the data table until the ending of data collection. In simulation modelling, a review of the results from the simulation that had been done is discussed. There are three alternatives that had been purposed in this case study. From here, the cost effectiveness analysis has been discussed in order to select the best alternatives that effective to be implement and at the same time increasing the output of the production line and save the company budget. For simulation analysis, the validation of the data and the findings is discussed briefly. From the analysis, the best alternative that possible to be implementing is alternative 1, terminate one point at CO₂ Robot Welding Process. This is because the production cost of CO₂ Robot Welding Machine and CO₂ Welding By Hand is the lowest among others alternatives.
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<td>By Hand</td>
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<tr>
<td>Bhd.</td>
<td>Berhad</td>
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<td>B.C</td>
<td>Before Century</td>
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<tr>
<td>CIM</td>
<td>Computer-Integrated-Manufacturing</td>
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<td>Co.</td>
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<td>DES</td>
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CHAPTER 1
INTRODUCTION

1.0 Introduction.

The survival of any industry in today's competitive market place depends on response time, production costs and flexibility in manufacturing (Chase et al. 2001). Because of the complexity and dynamic behaviour of such systems, simulation modelling is becoming one of the most popular methods of evaluating their floor layout design and operating strategies (Hlupic and Paul, 1993), (Pidd, 1992), (O'Keefe and Haddock, 1991).

Nowadays, for a manufacturing company, an increased productivity and better overall efficiency of the production line are the most important goals for almost all manufacturing company.

Manufacturing modelling and simulation is a concept of creating real world problems in simulation software. The purpose of creating real problems in software is to reduce production cost and at the same time increasing output productivity.

This chapter will provide an overview of the case study titled Manufacturing Modelling and Simulation in a Manufacturing Industry. Generally, problem statement briefly discuss about the problems that manufacturing industry faced during the production of a products.
In this chapter, an overview of the objectives of this case study and scope of this case study will be reviewed. Basically, the objective of this study is to find an alternative way to increase productivity. This study will be done in one of the automotive factories in Malaysia. Here, the importance of the study to the manufacturing industry will be also reviewed. Lastly, in this chapter, the review of the study outline will be discussed in general.

1.1 Problem Statement.

In a manufacturing industry, production floor layout involves the selection and the arrangement of equipment such as machine that will be used to produce a product, the buffer that will be used in the production floor, the tools that need to perform required process and resources such as raw material to manufacture a product. There are many methods exist by which a layout could be design to be analyzed.

Simulation software such as ARENA, Quest, ProModel and WITNESS was developed to allow the user to build several alternatives of the production floor layout in order to increase the productivity and identify the problems that the operator faced during the production of a product. By using the simulation software, the analysis of problems can be performing in a short time or in other hand within one hour because we can create the real world problems in the simulation software.

This study tries to illustrate the flow of an existing plant layout in order to identify the problems occur in actual layout. The creation of several alternatives of plant layout will be purposed based on the company requirement to increase the production output and at the same time try to reduce the operating cost. The
The proposed plant layout is implemented in the simulation software to solve existing production floor layout performance problem.

1.2 Objectives.

The main objective of this study was to simulate the manufacturing process for manufacturing door sash and evaluate effectiveness of the process in terms of machine utilization and systems performance. Besides that, the other objectives of the study are:

1. To identify problems in existing production floor layout.

2. To design and improve manufacturing production floor layout by using simulation software and by observation during the collection data of cycle time.

3. To measure manufacturing performance such as production quantity, lead time, bottle neck and by using cost effectiveness analysis.

1.3 Scope of the Study.

This study will analyze an industry specific problem of production floor layout in order to increase the productivity and try to solve it through several alternative production floor layouts. At the moment, this study will be conduct at Ingress Precision Sdn. Bhd. Located in Kawasan Perindustrian Nilai. This company is one of the subsidiaries of Ingress Corporation Berhad which produce an automotive part for Proton and Perodua as it major customer. The core products of this company are Door Sash, one of the components to make a car door. In order to produce a complete set of car doors, there are 4 types of Door Sash that have been produced in this company. They are:
1. Front Door Sash Left Hand.

2. Front Door Sash Right Hand.

3. Rear Door Sash Left Hand.

4. Rear Door Sash Right Hand.

For a moment, this study will be focused at Front Door Sash Left Hand for M-Car (Wira) model and GX (Waja) model. Both of the products were chosen because the cycle time of both products is the longest in this company factory and at the same time, the output per hour cannot achieve the target that had been set by the company. At the end of this study, a new proposed of production floor layout will be chosen.

Figure 1.1: Front Door Sash Left Hand products.
1.4 Importance of the Study.

The importance of this study is to come out with a good solutions that could improved the cycle time of a products by introducing a framework model that can be used with other models that have almost the same process with other models. At the same time, by performing this study, it will hope to help other people to identify what are the problems occurred and come out with several of solutions for these problems.

1.5 Outline of the Study.

This study will be divided into seven chapters. In the first chapter, the introduction of the study will be discussed. This chapter will be provided with the problem statement of the study. Then the objectives of this study will be reviewed. An overview of scope of the study also will be discussed in this chapter. Lastly, the importance of the study will be review to identify the importance of manufacturing modelling and simulation.

For chapter two, the literature review of the study will be discussed. This chapter will provide with introduction to manufacturing. Here, an overview of manufacturing will be discussed. Then, a brief history of manufacturing will be discussed in this chapter. Manufacturing industry (automotive) environment in Malaysia will be reviewed as it is the main sector that will be studied. Then, the review of manufacturing modelling and simulation, definition of manufacturing modelling and simulation will be discussed and lastly, the important of modelling and simulation will be review including the review of the previous study that have been conducted by researchers.
In chapter three, the review of methodology will be review. The design of the study and the framework of the study will be review at first. Then, the introduction of simulation software, simulation software that will be used and the advantages and the disadvantages of this software will be discussed.

In chapter four, the data collection of this study will be discussed briefly. In this chapter, the setting up of the data collection will be discussed. Followed by the data collection table and the examples of the data that have been collected will be discussed.

In chapter five, the review of simulation modelling is discuss in a brief. In chapter six, a view of discussion of the finding that has been analyzed will be review. Lastly, in chapter seven, the discussion on the recommendation and the conclusion of the study will be reviewed. The next page shows the summary of the outline of this study.
Introduction to the study

Literature review of the study

Methodology of the study

Data collection

Discussion

Recommendation and Conclusion

Figure 1.2: Summary of the outline study.
CHAPTER 2
LITERATURE REVIEW

2.0 Introduction.

This chapter will provide a review of the concepts of Manufacturing Modelling and Simulation in a Manufacturing Industry which leading to the research in manufacturing modelling and simulation. Manufacturing, in its broadest sense, is the process of converting raw material into finish good products that can be used by consumer or customers. In the other hand, manufacturing industry can be defined as an industry which produces products in a large quantity to sell to the customers for the used of the customers.

Modelling and simulation is one of the techniques that have been used to analyze the situation in order to make a correct decision or tools that help human in order to make a correct decision making. For this research, we will be focus on discrete-event simulation models or continuous models. A brief discussion on the issues related to discrete-event simulation models or continuous models is also given.

Since this research involving modelling of a production line, the production line modelling is also reviewed. Discussions include identifying the layout of the machine, modelling a framework and condition of the equipment will be used in this research. Finally, a review of performance measures used by previous researchers is conducted before concluding the chapter.
2.1 Introduction to Manufacturing.

Generally, manufacturing in its broadest sense, can be defined as the process of converting raw materials into a required products. Kalpakjian, S & Schmid, S.R 2001 notes that manufacturing encompasses:

1. The design of the product.
2. The selection of raw materials.
3. The sequence of process through which the product will be manufactured.

Manufacturing can be said as a backbone of industrialized nations. Its important is emphasized by the fact that as one of the economic activity, it comprises approximately about 20 percent to 30 percent of the value of all goods and services that have been produced. Nowadays, a country’s level of manufacturing activities can be said directly related to its economic health. The higher level of manufacturing activity in a country, the higher standard of living of its people.

Manufacturing is also involves activities in which the manufactured products used to make other products such as a large presses to shape sheet metal for car bodies, roll forming process to make doors for cars and machinery to make bolt and nuts. Another important aspect of manufacturing activities is the servicing and maintenance of this machinery during the machine useful life cycle.

Kalpakjian, S & Schmid, S.R 2001, in Manufacturing Engineering and Technology, Fourth Edition state that the word manufacturing is derived from the Latin word, *manu factus* which means made by hand. The word manufacture first appeared in the year 1567 and appeared again in 1683. In this modern world, manufacturing involves making products from raw materials by the means of various processes, machinery, and operations through a well organized plan for each activity.