KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA

SIMULATION MODELING AND OPTIMIZATION IN MANUFACTURING: CASE STUDY SHOP FLOOR

Thesis submitted in accordance with the requirements of the Kolej Universiti Teknikal Kebangsaan Malaysia for the Degree of Bachelor of Manufacturing Engineering (Honours) (Manufacturing Process)

By

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I hereby, declare this thesis entitled "Simulation Modeling and Optimization in Manufacturing: Case Study Shop Floor" is the results of my own research except as cited in the reference.

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APPROVAL

This thesis submitted to the senate of KUTKM and has been accepted as fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Honours) (Manufacturing Process). The members of the supervisory committee are as follows:

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DEDICATION

For my family; Allahyarham Mohamad Halim bin Sepaie,

Mrs. Faridah binti Awang,

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Mr. Awang bin Hussin,

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ABSTRACT

This PSM Project report is about the simulation model that applied in the manufacturing system. This simulation model will showed the process that included in the factory. From here also, we can see the process of producing a product from beginning until finishing. Firstly, before starting this project, an objectives and scope of project should be defined before. This is a guideline for me to complete this project. Then, the literature review or studying this title is done by referring to the journal, books, and articles. This process is important because to generate some ideas until know completely about the simulation model. Beside that, this is purpose to study about the definition of shop floor in factory and to know about the application of shop floor. Some of the generate ideas and practices have been described in this report. The limitation and problem occurred also have been stated in this reports. The topics will be discussed in this report included manufacturing issues that will be addressed using simulation, simulation software that will be using in manufacturing applications, technique to developed a simulation model and result from the simulation model. Comparison for each alternative and propose layout also will be discussed. For this PSM project, the project is more focused on Witness simulation software. This software acted as tool to create a simulation modeling in manufacturing system. This simulation software have been selected because it is easy and capable to simulate the activities, and also capable to simulate the arrival entities for each station of process. The process also can be set up for one shift duty that is 8 hours for working hours. Time that used in this process is in seconds. Process planning and the methodology in completing this process also have been described in this report completely.

Keywords: productivity, cycle time, Work In Progress (W.I.P), tolerance, modeling.

ABSTRAK

Projek PSM ini adalah berkenaan dengan model yang telah disimulasikan dan diaplikasikan didalam sistem proses pembuatan. Model yang telah disimulasikan ini menunjukkan proses yang berlaku dalam kilang. Dari sini juga, kita dapat lihat proses untuk penghasilan produk dari permulaan hingga ke akhir proses. Pada mulanya, sebelum memulakan projek ini, objektif dan skop projek perlulah dikenalpasti dahulu. Ini merupakan satu panduan kepada saya untuk menyiapkan projek tersebut. Kemudian, kajian ilmiah atau proses mempelajari secara mendalam tentang tajuk ini telah dilakukan dengan membuat rujukan melalui jurnal-jurnal, buku-buku rujukan dan rencana-rencana. Rujukan-rujukan ini adalah penting kerana ia bertujuan untuk mendapatkan idea-idea sehingga mengetahui secara mendalam proses untuk membuat suatu model yang ingin disimulasikan. Selain itu juga, ia bertujuan untuk mempelajari tentang definisi "Shop Floor" di kilang dan untuk mengetahui tentang applikasinya. Sesetengah idea yang diperolehi akan dihuraikan secara mendalam dalam tesis ini. Kekurangan dan masalah timbul sewaktu menjalankan projek ini juga akan diterangkan didalam tesis ini. Antara topik-topik yang akan dibincangkan termasuklah isu sistem pembuatan yang akan ditunjukkan didalam bentuk model yang telah disimulasikan, perisisan simulasi yang akan digunakan dalam applikasi sistem pembuatan, teknik-teknik untuk membangunkan simulasi model dan keputusan yang diperolehi dari simulasi model. Perbandingan bagi setiap alternatif dan cadangan bentuk susunan mesin juga akan dibincangkan. Untuk projek PSM ini, ia lebih tertumpu pada perisian simulasi Witness. Perisian ini telah dipilih kerana ianya mudah dan mampu untuk membangunkan aktiviti dan juga boleh menunjukkan bentuk proses yang berlaku didalam kilang bermula dari proses awal hingga akhir untuk setiap seksyen. Proses yang dijalankan juga boleh ditetapkan untuk

masa satu shif iaitu 8 jam waktu bekerja. Masa yang telah ditetapkan dalam model ini adalah dalam bentuk saat. Perancangan dan juga kaedah-kaedah untuk projek ini juga akan diterangkan dalam tesis ini dengan selengkapnya.

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LIST OF ABBREVIATIONS, SPECIALIZED NOMENCLATURE

PSM	-	Projek Sarjana Muda.
KUTKM	-	Kolej Universiti Teknikal Kebangsaan Malaysia.
OR	-	Operation Research.
IE	-	Industrial Engineering.
M	-	Malaysia.
FMS	-	Flexible Manufacturing Systems.
CIM	-	Computer Integrated Manufacturing.
R & D	-	Research and Control.
Q	-	Quantity.
P	-	Production.
GT	-	Group Technology.
SLP	-	System Layout Planning.
R	-	Routing.
S	-	Supporting Service.
T	-	Time.
CAD	-	Computer Added Design.
DBR	-	Drum Buffer Rope
TCO	-	Total Lost Of Ownership.
PCB	-	Printed Circuit Board
DBR	-	Drum Buffer Rope.
QC	-	Quality Control.
QA	-	Quality Assurance
OL	-	Outer Layer.
W.I.P	-	Work In Progress.
Avg W.I.P	-	Average Work in Progress.

CHAPTER 1
INTRODUCTION

1.1 Background

In this PSM project, I had chosen the title of Simulation Modeling and Optimization in Manufacturing: Case Study Shop Floor to fulfill my study in KUTKM. This case study focuses on the simulation for shop floor in industry. For this case study, to complete this project, I have chosen Company X Sdn. Bhd. that is locating at Batu Berendam area. This company produces a PCB product for Communication Company for Malaysia and Singapore. In this project, my case study will focus on the problem occurred at the production line for producing this product. Here, I also will determine the capacity output for this product and using Witness simulation I will show the process that is used in actual factory.

Firstly, I will go through for time study at this production line. For this part, I will go to Company X Sdn. Bhd. to take all the data in this factory. The data including all the time needed for the machine to produce a PCB product. These time studies are important for me because all this time will be using to put into the simulation using Witness simulation.

When the simulation is complete, we can see the operation after running the simulation. This simulation will show us the location all the machine and the plant layout that has in the factory an on how the product produces from raw material until

finish product. From this simulation, I can make analysis after the data print out from this simulation.

During this simulation model, I can observe what the problems are during the process. The problems that may be occur such as machine stop during the process of buffer. All this problems will affect the productivity. So that, it is my job to solve the problems in order to increase production line or reduce cost.

From here, I can say that this simulation is important for industry because we can make observation and detect the problem occur in the production line. After that, the improvement process will be done easily and faster.

1.2 Situation in industry

Now a day, we can see that manufacturing industries are facing a growing and rapid change. Major trend like globalization, customer orientation and increasing market dynamic lead to a shift in managerial principles: enterprises have to become more flexible, open, fast, effective, self organized, decentralized, to sum it up, agile. On enterprise level this lead to a *"shift from manufacturing to innovative, knowledge-based information and service application of products."*

Still manufacturing serves as a basic function for any agile enterprise. Manufacturing faces the same challenges as the enterprise as a whole. For the future, manufacturing can not only rely on technical excellence in machining, technologies and methods but has to achieve organizational excellence in knowledge, experience and motivation as well. The shop floor as provider of physical goods has to become an agile entity within the enterprise and within a network or enterprises forming a virtual organization.

The call for agility challenges the shop floor with several problems. With an increasing occurrence of changes and dominating customer demand, management of manufacturing processes and the coordination of the various resources, i.e. machines materials, information, information, knowledge and humans, becomes a core task for shop floor control. Besides not only an optimal management of the current situation is necessary but a continuous improvement of practices and performance.

This lead to the question of adequate design concepts for shop floor control. Assessing industry, global leaders, best practices and hidden champions can be found. But in industrial reality at large, "the shop floor is not under control". Even though various solutions ranging from organizational strategies like group technology, knowledge based scheduling and genetic algorithm do exist, the problem of inadequate performance of shop floor control tends to remain omnipresent in most industrial enterprises until today.

The situation can be summarized by the following observations:

a. Most current managerial concepts tend to address the overall enterprise and usually are very general and not focused on manufacturing industry or the shop floor respectively.
b. The shift towards the entrepreneurial function of management tends to leave manufacturing out of sight and often leads to the impression among practitioners that manufacturing is of no further importance.
c. While managerial literature deals with organizations, classic industrial engineering research still tends to neglect the organizational issues of shop floor control while simultaneously producing an immense number of highly theoretical and hypothetical solutions every year.

d. In industry shop floor control is overshadowed by the paradigm of "command and control" leaving management to rely on power as means of ensuring effective control rather than any kind of conceptual approach. Therefore any conceptual approach as a means of altering the command structure is opposed. As a result, operators and workers are left with an increasing pressure replacing an empty prophecy of self control.

1.3 Problem statement

Research on shop floor has long concentrate on the scheduling problem and its solution. Solving an organizational problem underwent reduction to a mathematical model. Traditional approaches, such as those in Operations Research (OR). Industrial Engineering (IE) and some commercial software development try to achieve ideal scheduling systems by focusing on the scheduling process itself. The modeling techniques applied thus result in a simplification of the original problem. In contrast, most practical engineering approaches try to avoid any sophisticated scheduling as such and focus upon stable design of the manufacturing system and the requirements of systems control and controllability. The neglect of scheduling and control is omnipresent in most commercial software packages which usually do feature no sophisticated scheduling solution. All these approaches still maintain the fiction of a deterministic world where one cause determines one result.

Shop floor control is an object for various disciplines from engineering, management to the social sciences. No comprehensive framework or even overview on shop floor control research currently exists. As a result, many problems of the real world remain unsolved, because deterministic approaches from research and practice have significant drawbacks. Due to the fixation on mathematical solutions in traditional research, many potentials present of real world production are not considered, e.g. operator experience, motivation and qualifications, are not taken into account. The