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JUDUL: MANUFACTURING MODELING AND SIMULATION IN MANUFACTURING INDUSTRY CASE STUDY: STORAGE AREA

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**NATIONAL TECHNICAL UNIVERSITY COLLEGE OF MALAYSIA**

# Manufacturing Modeling and Simulation In Manufacturing Industry Case Study: Storage Area

Thesis submitted in accordance with the requirements of the National Technical University College of Malaysia for the Degree of Bachelor of Engineering (Honours) Manufacturing (Process)

By

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Faculty of Manufacturing Engineering

May 2006

# DECLARATION

I hereby, declare this thesis entitled "Manufacturing Modeling and Simulation in Manufacturing Industry Case Study: Storage Area" is the result of my own research except as cited in the reference.

Signature : AS.

Author's Name : Mohd Asnawi b. Omar

Date : 02/06/2006

# ABSTRACT

The paper will describe how the WITNESS Visual Interactive simulation tool and QUEST simulation supports different methods of simulation solution deployment. Three alternate methods of simulation deployment are described, both of which have proved successful in promoting the benefits of simulation within PETRONAS Penapisan Melaka. WITNESS and Quest provides significant functionality to support each method of deployment. This functionality is described in detail and related to real-world examples when possible.

# ABSTRAK

Di dalam pembentangan kertas kerja ini, ia akan menerangkan bagaimana perkakasan simulasi "WITNESS Visual Interactive simulation tool" dan simulasi "Quest" menyokong pelbagai perbezaan aplikasi dan dikembangkan mengikut kesesuaian kaedah yang digunakan. Terdapat tiga kaedah alternatif tentang pengembangan simulasi dinyatakan, di mana ia telah terbukti berjaya dalam memajukan akan manfaat aplikasi di dalam kawasan penyimpanan PETRONAS Penapisan Melaka. Simulasi "WITNESS" dan "Quest" memberikan fungsi yang bermakna untuk menyokong setiap pengembangan kaedah yang digunakan. Fungsi ini akan dinyatakan dengan lebih terperinci dan bertalian kepada contoh dunia sebenar dengan sebanyak mungkin.

# DEDICATION

*For my parents, Omar B. Salleh and Mariam Bt. Md Salleh*

*And to my beloved girl, Rohaizah Bt. Amin*

*And to my supervisor, Dr. Sharis B. Abdul Karim*

*And their supportive spirit*

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# LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

| | | |
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| PPM | - | Petronas Penapisan Melaka |
| AGV | - | Automated Guided Vehicle |

# CHAPTER 1
# INTRODUCTION

## 1.1 BACKGROUND

A fundamental challenge in simulation modeling of manufacturing systems is to produce models that can be understood by the problem owner. In this paper, the terms use of "*Manufacturing Modeling and Simulation in Manufacturing Industry*" covers three area's; (1) Manufacturing Modeling, (2) Manufacturing System regarding industries process and (3) Simulation in Manufacturing Industry. The case study for this project is to determine the flow process of Storage Area and include the analysis of inventories, arrangement product, standard time, problem statement and the role of simulation in design of material handling system. First, we defined the 3 area's where it is the critical path to understand more about the project title. Manufacturing (or production) systems can now be defined in the following three aspects:

1. *The structural aspect of manufacturing systems*: based on structural (or static) definition of the system, the manufacturing system is a unified assemblage of hardware, which includes workers, production facilities (Including tools, jigs, and fixtures), materials handling equipment, and other supplementary devices. Thus the structural aspect of the manufacturing system forms a static spatial structure of a plant, i.e., the plant layout. This aspect can be viewed as a production system. This phrase appeared in 1907. Since 1943 it has been also used to mean the inference mechanism operated by knowledge based systems in

the field of artificial intelligence (a different terminology should be introduced for this meaning).

2. *The transformation Aspect of Manufacturing Systems*: Based on a transformational (or functional) definition of a system, the manufacturing system is defined as the conversion process of the factors of production, particularly the raw materials, into the finished products, aiming at a maximum productivity.
3. *The procedural Aspect of manufacturing systems*: The manufacturing system is the operating procedures of production. This constitutes the so-called management cycle, i.e., planning, implementation and control. (Katsundo Hitomi, 1998)

For simulation process, *QUEST* is used as the simulation software. *QUEST* is designed for the construction of discrete event simulations that model the overall flow of resources through and between work cells and is thus well suited to reviewing the performance of production lines. *QUEST* presents a detailed and dimensionally accurate 3-dimensional animation of the system as part of its output, as opposed to the 2-dimensional animation (Peter J. Lawrence, 2003). The simulation technology is used for;

1. To analyze systems and operational processes.
2. To execute experiments.
3. To analyze material and information flows.
4. To identify interdependencies between processes.
5. To identify interrelations and weak points.
6. To show possible trends.
7. To optimize processes.

Simulation technology is employed in the following three stages;

1.) During the planning phase

If a new system is going to be acquired an available one has to be optimized. In a previous phase the system should be invested regarding dimensions, throughput, capacity, disrupting factors etc. In this way various alternatives can be analyzed and

compared. Investigations in reality absorb time and cause in addition high cost. Modification in a simulation model can often be realised very easy and without high effort and cost. The use of simulation technology already during the planning phase quickens the planning process and supports the planner in decision making.

2.) During the realisation phase

When a new system has to be implemented during the going concern. With the simulation model the personnel can be instructed for important situations before beginning the operations.

3) During the operation

If the personnel planning is arranged. Here a scenario which defines the daily schedule can provide information about required resources as well as about the utilization of the system. The optimization of task order can be subsequent objective of simulation.

Storage area is related to the conceptual of warehouse in every industry. Consider a warehouse that functions as a distribution center. Its requirements fall into two major categories. First, it receives incoming products. It must arrange to store these products. Important considerations include storage capacity and efficient space utilization. Secondly, it receives orders from its customers. It must arrange to ship these orders. Important considerations include timeliness and order-filling efficiency. Of course, these two types of requirements interact. For example, in the order-filling process, one would like for products to be stored in a manner that facilitates order-picking efficiency. Also, in a steady-state system, the amount of goods received should equal the amount of products ordered, over a long time horizon.

## 1.2 PROBLEM STATEMENT

In this chapter, it is decide to look into the problems occur within the storage area in daily operation. It means that it takes a lot of cost and time waste if we want to change layout design to get desire output. In this Petronas Penapisan Malaysia warehouse, the layout is fixed according to their origin layout, and it's hard to implement new optimization as the layout has been used over 15 years old. This is because it's need some major changes in the like of forklift path and machine to be organize so that it doesn't affect the current process. But first it must have appropriate system in which it must measure to determine the correct sequence. That's why the need of simulation tool is essential in the first place. The simulation can give us exact output (95%) from the actual time by using verification and validation system and will give us opportunity to planning which design is the best comparing to actual layout. In PPM, the actual running time from loading product to unload takes more than 10 to 15 minutes, so the task is to minimize/reduce time by using several alternatives by running it in simulation. So, it must develop a model simulation for warehouse in PPM and studying the performance of efficiency in the model itself. The current software to make simulation is by using QUEST from Delmia Corporation. It is used to analyze system and operational process and also to execute experimental.

## 1.3 OBJECTIVE

The objective of this paper is to give information about the arrangement of product in storage area, and how to manipulate each parameters and data to achieve high efficiency regarding the warehouse layout. The main objective fall into 2 parts:

1. To develop a primary model of a manufacturing system (storage area) using QUEST.
2. To study the effects of varying the design parameters on the performance by optimizing delivery time and improvement of productivity.

## 1.4 SCOPE OF THE PROJECT

The design of manufacturing system is normally confronted with the 'what if' questions. Physically, to answer such questions will incur high costs. Hence, simulation is used as an alternative. A manufacturing system (storage area) will be selected as a case study. Various design options will be tested. For a selected design layout, various design parameters will be changed and the effects will be studied. It is focusing more on storage area in Petronas Penapisan Malaysia where the boundary is not covering the production process. The process involve in delivering time is from loading part in forklift to unloading part in selected station. The parameter covers on the speed of forklift and distance from starting point until ending point, which means the forklift will reverse to the starting point again and pickup the part over and over again. The motion of the forklift is not unidirectional, but using bidirectional direction because of limitation of path. It also uses the data taken from PPM to interpret onto simulation model to validate whether the simulation model is the same as actual system. It must have appropriate alternatives to solve problem in the warehouse storage time so that it can optimize the output process.