UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF INVENTORY MANAGEMENT SYSTEM IN A TOTAL PRODUCTIVE MAINTENANCE ENVIRONMENT

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MASTER OF SCIENCE

UNIVERSITI PUTRA MALAYSIA

August 2004

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By

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Thesis Submitted to the School of Graduate Studies,
Universiti Putra Malaysia, in Fulfilment of the Requirements for the
Degree of Master of Science

August 2004

Dedicated to all my family members', thanks for their support and understanding throughout the years and their appreciation of knowledge.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science

DEVELOPMENT OF INVENTORY MANAGEMENT SYSTEM IN A TOTAL PRODUCTIVE MAINTENANCE ENVIRONMENT

By

BENEDICT LIM CHIN KHIAN

November 2003

Chairman: Associate Professor Megat Mohamad Hamdan Megat Ahmad, Ph.D.

Faculty : Engineering

Implementation of Total Productive Maintenance (TPM) is increasingly being seen as a suitable initiative or technique for effectively involving the workforce in manufacturing based organizations to increase productivity with the support of both effective and efficient maintenance works as well as inventory management system. The aim of this research is concerned with the development of a computerize inventory management system using Microsoft Visual Basic 6.0. This improvement is to replace present manual paperwork procedure towards the implementation of TPM and ISO14000. The proposed system attempts to achieve this by providing a database for parts information storage with search function, ability to record each inventory transactions in real time, calculating material requirement planning (MRP), create bill of materials (BOM) and making purchase order (PO). This research also includes the evaluation of the system on real data from the company. The data shows that this system produced correct result and reduce the time spend on data searching by 80.4% or increase the manpower efficiency by 510%. These

results show that this system can lead to increase the controllability and monitoring of inventory, and increase manpower efficiency.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

PERKEMBANGAN SISTEM PENGURUSAN INVENTORI DALAM PERSEKITARAN TOTAL PRODUCTIVE MAINTENANCE (TPM)

Oleh

BENEDICT LIM CHIN KHIAN

November 2003

Pengerusi: Profesor Madya Megat Mohamad Hamdan Megat Ahmad, Ph.D.

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Pelaksanaan TPM yang semakin meningkat, merupakan langkah pertama atau teknik yang sesuai mendorong keberkesanannya dalam penglibatan kesemua ahli kerja dalam organisasi berasas pembuatan menyokong kedua-dua keberkesanan dan kecekapan penyelenggaraan tugas kerja dan inventori untuk maningkatkan produktivitinya. Penyelidikan ini bertujuan menghasilkan suatu sistem pengurusan inventori berasas komputer menggunakan Microsoft Visual Basic 6.0. Penukaran ini adalah untuk mampertingkatkan taraf kerja-kerja kertasnya yang dilaksanakan sekarang menuju terhadap perlaksanaan TPM. Manujui pencapaian tujuan tersebut, sistem ini dilangkapi dengan fungsi pencarian untuk database penyimpanan informasi, penyimpanan rekod urusan inventori dalam masa yang sama, pengiraan MRP, pembentukkan BOM dan urusan pembelian (PO). Penyelidikan ini juga termasuk penilaian sistem ini dengan penggunaan data sebenar dari syarikat itu. Data-data yang dikemukakan mambuktikan bahawa system ini dapat mampamarkan keputusan yang sebenar dan mangurangkan masa untuk mancari data-data sebanyak 80.4% atau meningkatkan keberkesanan pekerja sebanyak 510%. Keputusannya

membuktikan bahawa sistem ini dapat maningkatkan pengawalan dan pengesanan inventori, dan meningkatkan keberkesanan pekerja.

ACKNOWLEDGEMENTS

A number of individuals have contributed to the success of this program software and it is a pleasure to acknowledge their contribution.

I wish to express my deepest gratitude and appreciation to my project supervisors, Associate Professor Dr. Megat Mohamad Hamdan Megat Ahmad, Associate Professor Ir. Dr. Md Yusof Ismail, Associate Professor Dr. Shamsuddin Sulaiman, and Associate Professor Dr. Napsiah Ismail.

I would also like to acknowledge the help of my team-mates Wang Chia Wu and Lee Pang Seng for the co-operation and teamwork spirit.

Moreover, I would like to thank my family, friends, colleagues and also my housemates for their encouragement and understanding given either directly or indirectly, which has helped me in completing this study. I also wish to thank sincerely all those concerned, in particular my girlfriend Miss Hii Chee Feen. Without her support, this project would not have been completed.

Your support, understanding and effort have changed and lead my life to a more successful path.

Thank you.

I certify that an Examination Committee has met on 22 JUN 2004 to conduct the final examination of Benedict Lim Chin Khian on his Master of Science thesis entitled "Development of a production planning and control software in a Total Productive Maintenance environment" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommended that the candidate be awarded the relevant degree. The Committee Members for the candidate are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirements for the degree of Master of Science. The members of the Supervisory Committee are as follows :

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

BENEDICT LIM CHIN KHIAN

Date: 26 AUG 2004

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LIST OF ABBREVIATIONS/NOTATION/GLOSSARY OF TERMS

AM	Autonomous Maintenance
BI	Business Intelligence
BOM	Bill Of Materials
CD	Compact Disk
CD-ROM	Compact Disk-Read Only Memory
CRM	Customer Relationship Management
CRT	Cathode Ray Tube
EOQ	Economic Order Quantity
ERP	Enterprise Resource Planning
FIFO	First In First Out
JIPE	Japan Institute of Plant Engineers
JIT	Just In Time
L4L	Lot for Lot
MBNQA	Malcolm Baldrige National Quality Award
MIS	Management Information System
MOQ	Minimum Order Quantity
MRP	Material Requirement Planning
NPC	National Productivity Corporation
OEE	Overall Equipment Effectiveness
P	Period
PIC	Person-In-Charge
PM	Preventive Maintenance
PO	Purchase Order

POQ	Period Order Quantity
PPC	Production Planning and Control
MPS	Master Production Scheduling
QC	Quality Control
RAM	Random Access Memory
RF	Radio Frequency
ROL	Re-order Level
ROP	Reorder Point System
SCM	Supply Chain Management
SGA	Small Group Activities
SS	Safety Stock
TCT	Total Cycle Time
TGI	Thomas Group International
TPM	Total Productive Maintenance
TQ	Total Quality
TQC	Total Quality Control
TQM	Total Quality Management
TQSR	Total Quality System Review
USA	United States of America

CHAPTER I

INTRODUCTION

1.1 Total Productive Maintenance

Total Productive Maintenance (TPM) was first brought from the United States in the 1950's. It is a kind of marriage between Preventive Maintenance (PM) and Total Quality Management (TQM) [1]. Before TPM started, the types of maintenance begin practiced are Preventive Maintenance (PM), Predictive Maintenance and Condition-based maintenance.

According to the Japan Institute of Plant Engineers (JIPE) TPM is a system of maintenance covering the entire life of the equipment in every division, including planning, manufacturing, maintenance, and all other division, involving everyone from the top executives to the shop floor workers and promoting productive maintenance through morale-building management and small-group activities in an effort to maximize equipment efficiency [2].

Edward Willmott, a pioneer of TPM in United Kingdom defined TPM as seeks to engender a company-wide approach towards achieving a standard of performance in manufacturing, in term of the overall effectiveness of equipment, machines and processes, which is truly world class [3].

Edward Hartmann, president of the International TPM Institute Inc., who is recognised by Nakajima as the father of TPM in the USA, also provides a definition

that is suggested as being more readily adopted by Western companies: total productive maintenance permanently improves the overall effectiveness of equipment with the active involvement of operators [4].

Another US advocate of TPM, Wireman suggests that TPM is maintenance that involves all employees in the organization and accordingly includes everyone from top management to the line employee and indicates TPM encompasses all departments including, maintenance, operations, facilities, design engineering, project engineering, instruction engineering, inventory and stores, purchasing, accounting finances, plant /site management [5].

From the definition given, it can be summarized that Total Productive Maintenance (TPM) is a manufacturing program designed primarily to maximize the effectiveness of equipment throughout its entire life by the participation and motivation of the entire workforce of the company [6].

1.2 Inventory Management System in TPM

Other than having good maintenance awareness to take good care of all equipments by each department, there is a division/department, which plays a very important role in TPM, which is inventory management. It can determine the success or failure in a company.

Inventory management is an important concern for managers in all types of business. For a company with low profit margins, poor inventory management can seriously undermine the business [7]. The challenge is not to scale down inventories to the bone to reduce cost or to have plenty around to satisfy all demands, but to have the right amount to achieve the competitive priorities for the business most effectively. Because inventory is so important, many companies specialize in consultation of how to handle inventory.

Inventory is a process in which a requirement is generated, has to be authorized before starting the material procurement process. Based on this authorization, material is ordered. When the material comes in, there is another process involved where procurement is checked and depending again upon the original order placed, the quality of material received, and some other factors material is accepted and stored. Then again, material is issued internally for further processing or consumption [8].

Inventory is created as a buffer to hedge against differences in rates and timing between supply and demand which are caused by four factors; economies of scale, operations smoothing, customer service and uncertainty [9]. There are three basic decisions in managing inventory; quantity decisions, timing decisions and control decisions. The reasons why companies should keep a supply of inventory on hand are in order to maintain the ability of independence of operation, qualify to meet variation in product demand, to be flexible enough in production scheduling, to provide a safeguard for variation in raw material delivery time and economic purchase-order size preferred in a company [10]. There are many different types of

inventory. The types of inventory include raw materials, the finished product, component parts, and supplies

1.3 Problem Statement

As mentioned in module 1.2, TPM is primarily to maximize the effectiveness of equipment throughout its entire life by the participation and motivation of the entire workforce of a company. In that respect, the maintenance will not only require parts to be repaired but also need to be replaced whenever necessary. Parts need to be available whenever it is required. As such the inventory management system available needs to be able to fulfill the requirements.

At present, no studies have been found which relates between inventory management system and TPM. Studies that have been carried out only focused on either inventory management system or TPM. This study therefore is to look at the benefits that will be obtained in implementing a good inventory management system in a TPM environment.

1.4 Scope of Study

A local company, which in the process of practicing TPM has been selected for this study. Since its operation in 1995, there has been an increased in its product rejection due to poor quality. As a consequence, products need to be reproduced which resulted in severe raw material shortage. Short fall of parts and raw materials for a

week is as high as 100 types which estimates additional cost of RM6,000 while waiting period to replenish the stock that according to plan is as long as 2 weeks.

Another main concerned was that, some of the finished goods and raw materials were found to be missing. This missing amount may be due to human error while manually filling records or data being changed intentionally. These problems have slowed down the daily production operation as well as increasing the estimate cost of RM2,000 for materials per week. It has also affected the TPM implementation.

An inventory management system was thereby developed in this study to overcome the above problem. By using this software, it is hope that it will improve on the TPM implementation, and will bring a lot of convenience and effectiveness to the manager as well as the supervisor because monitoring and controlling inventory is centralized in one place. The data will automatically update in the system if any transaction is done and approved and even the purchaser from purchasing department can easily check on the parts or raw material quantity before making any purchase order to supplier.

With this system, the manager and supervisor can easily monitor the inventory level from time to time as well as all transaction that has been made to the internal or external supplier and customer through the software in real time.

1.5 Objective

Based on the problem statements stated above, the objectives of the study are:

i. To develop an inventory management software for controlling and monitoring inventory.

ii. To increase manpower efficiency as a result of using the software.

It is hoped that with better inventory management and manpower efficiency will improve further the implementation of TPM.

1.6 Thesis Layout

In this thesis, it contained six chapters, which includes introduction, literature review, methodology, system design, result and discussion, and conclusion. In chapter one, it discussed on the introduction of Total Productive Maintenance and Inventory Management System and the relationship of these two issues. The problem statement of this thesis also has been discussed as well as the main objective.

Literature review was discussed in chapter two. This was followed by Methodology in Chapter 3 where it discussed on the planning for the project and preparations of the software making. Chapter 4 discussed on the system design procedure of each steps involved in order to create the software successfully.

Chapter five discussed on the result of each section of the created software as well as the discussion on the advantages and disadvantages of the software. Lastly is the conclusion and recommendation chapter, which gives the overall results of the software and recommendations for further improvement.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the studies that have been carried out on the development of an inventory management system in Total Productive Maintenance (TPM) environment. The review will begin with studies that have been done on TPM. This will be followed by related studies on inventory management system specifically on software development. Then the review will focus on the relationship between inventory management system and TPM. Finally, some related software system currently available would be discussed and this chapter ends with a conclusion.

2.2 Studies on TPM

TPM is a change management approach that has been shown to have considerable impact on the internal efficiency of manufacturing organizations, both in the West and in Japan as well as successfully introduced in Malaysia.

In Malaysia, Hicom-Teck See Manufacturing Malaysia Sdn., Bhd., the biggest automotive plastic molding company, through a 2 years collaboration with National Productivity Corporation (NPC) has launched Total Productive Maintenance (TPM), a holistic approach to further prepare the company for upcoming challenges [11]. As