

MAINTENANCE MANAGEMENT ASSESSMENT IN A LOCAL
MANUFACTURING COMPANY

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*Specially Dedicated To My Beloved Wife, Children, Mother, Siblings,
my fellow course mates and all my PMSB colleagues and friends for their
encouragements, supports and helps.*

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ABSTRACT

Modern maintenance management is not only to repair broken equipment. Modern maintenance management is to keep the equipment running at high capacity and produce quality products at lowest possible cost. There are numerous maintenance management strategies or framework that can be implemented in order to have the best maintenance practice. Assessment needs to be carried out to identify the weaknesses of the current maintenance management system. This is to ensure that the organization is implementing the correct strategy for the maintenance management system. This study is carried out at Prent Malaysia Sdn. Bhd. In order to achieve the objective identified, literature was review, methodology identified, afterward the data was collected and analyzed using quantitative analysis. The assessment was carried out by the top management and the staff that are involved in maintenance. Assessment was carried out based on 16 factors of maintenance management. Questionnaire and AHP method was used to identify the weakness area. Base on the data collected and analysis made, the three weakest area are predictive engineering, maintenance automation and maintenance planning and scheduling. Maintenance strategy was implemented to improve the weaknesses in order to increase performance, to provide an effective maintenance management system, provide control for maintenance activities, improve quality and to optimize the maintenance processes. OEE, MTBF and MTTR were been used as indicators to monitor the maintenance management systems performance.

ABSTRAK

Sistem pengurusan penyelenggaraan moden bukan hanya untuk membaik pulih peralatan yang rosak. Sistem pengurusan penyelenggaraan moden membolehkan peralatan beroperasi pada tahap kapasiti yang tertinggi dan juga mengeluarkan barangan yang berkualiti pada kos yang terendah. Terdapat pelbagai strategi dan juga rangka kerja untuk sistem pengurusan penyelenggaraan yang boleh diamalkan untuk mencapai amalan penyelenggaraan yang terbaik. Penilaian perlu dilakukan untuk mengenalpasti kelemahan kelemahan sistem pengurusan penyelenggaraan semasa. Ini adalah untuk memastikan organisasi melaksanakan strategi yang betul untuk sistem pengurusan penyelenggaraannya. Kajian ini dilakukan di Prent Malaysia Sdn Bhd. Untuk mencapai objectif yang telah ditentukan, kajian literatur yang terdahulu dinilai, dan kemudiannya data data dikumpul dan dianalisa menggunakan analisis kuantitatif. Penilaian ini dilakukan oleh pengurusan tertinggi dan juga mereka yang terlibat dengan penyelenggaraan. Penilaian telah dilakukan terhadap 16 faktor. Kaedah soal selidik dan juga kaedah AHP telah digunakan untuk mengenalpasti faktor faktor yang terlemah. Berdasarkan pada data data yang dikumpul dan dianalisis, tiga bahagian yang terlemah ialah kejuruteraan peramalan, penyelenggaraan automasi dan juga penjadualan dan perancangan penyelenggaraan. Strategi penyelenggaraan telah dilaksanakan untuk meningkatkan factor faktor yang terlemah ini, yang mana ia akan meningkatkan pretasi, untuk menyediakan sistem pengurusan penyelenggaraan yang berkesan, menyediakan kawalan bagi aktiviti penyelenggaraan, meningkatkan kualiti dan untuk mengoptimumkan proses penyelenggaraan. OEE, MTBF dan MTTR telah digunakan sebagai penunjuk untuk memantau prestasi sistem pengurusan penyelenggaraan.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	x
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xiv
	LIST OF APPENDICES	xvi
1	INTRODUCTION	
1.1	Overview	1
1.2	Background of Problems	1
1.3	Statement of Problems	2
1.4	Objective of Study	3
1.5	Scopes	3
1.6	Company Background	4
1.7	Process Flow	5

1.8	Production Layout	5
1.6	Thesis Structure	6
2	LITERATURE REVIEW	
2.1	Overview	8
2.2	Maintenance	8
2.3	Maintenance Management	12
2.4	Maintenance Management Assessment	21
2.5	Maintenance Strategy	22
2.6	Related Journal Review	24
2.7	Summary	28
3	METHODOLOGY OF RESEARCH	
3.1	Overview	29
3.2	Project Methodology	29
3.3	Methodology for Maintenance Management Assessment	31
3.4	Methodology for Collecting Data	34
3.4	Summary	35
4	PROBLEM IDENTIFICATION	
4.1	Overview	37
4.2	Maintenance Management Assessment	37
4.3	Data Collection and Analysis	46
4.4	Observation and Findings	56
4.6	Summary	56
5	PROPOSE STRATEGIES	
5.1	Overview	58
5.2	Predictive Engineering	58
5.3	Maintenance Automation	64

5.4	Maintenance Planning and Scheduling	69
5.3	Summary	75
6	RESULT AND DISCUSSION	
6.1	Overview	76
6.2	Predictive Engineering Strategy Result	76
6.3	Maintenance Automation Strategy Result	78
6.4	Maintenance Planning and Scheduling Strategy Result	79
6.5	Overall Equipment Effectiveness	80
6.6	Mean Time between Failure	81
6.7	Mean Time to Repair	82
6.8	Summary	83
7	CONCLUSION	84
	REFERENCES	86
	APPENDIX	89

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Maintenance management factors	14
2.2	Journal review	26
2.3	Summary on literature review on maintenance management strategy	27
3.1	Standard preference scale for AHP	32
4.1	Maintenance management assessment process	38
4.2	Assessment result	39
4.3	Pairwise comparison result	43
4.4	Factor weight from AHP	44
4.5	PWDi result	44
4.6	Cumulative PWDi	45
4.7	Unscheduled breakdown for January 2015	46
4.8	Unscheduled breakdown for February 2015	48
4.9	Unscheduled breakdown for March 2015	49
4.10	Unscheduled breakdown for April 2015	51
4.11	Unscheduled breakdown for May 2015	53
4.12	Unscheduled breakdown for June 2015	53
4.13	Unscheduled breakdown from January until June 2015	54
4.14	The former form station electrical failure component occurrence from month of January to June 2015	55
5.1	Number of motor in production floor	59

LIST OF TABLES

TABLE	TITLE	PAGE
5.2	Sample means and variance	61
6.1	OEE data from January 2015 until June 2015	80
6.2	Operation availability time, breakdown frequency and breakdown time from Jan to Jun 2015	81

LIST OF FIGURES

FIGURE	TITLE	PAGE
1.1	PMSB at Senai	4
1.2	Thermoforming process	5
1.3	Process flow	5
1.4	Production floor	6
2.1	Maintenance types	9
3.1	Research methodology flow chart	30
4.1	Spider chart for the assessment score	40
4.2	Individual maintenance assessment score	41
4.3	Pareto chart for PWDi	45
4.4	Unscheduled breakdown for January 2015 until June 2015	54
4.5	Pareto Chart for Breakdown from January 2015 until June 2015	55
5.1	Fish bone analysis	59
5.2	Motor torque monitoring on HMI	60
5.3	Alarm display for motor torque	61
5.4	PLC code for motor torque monitoring	62
5.5	Control chart for motor torque	62
5.6	OPAC flowchart	64
5.7	Autonomous checklist form	64
5.8	Work order request	65
5.9	Maintenance planning	66

LIST OF FIGURES

FIGURE	TITLE	PAGE
5.10	Breakdown record	66
5.11	Work Order / Setup	67
5.12	Maintenance checklist	68
5.13	Inventory manager	69
5.14	Inventory reorder report	69
5.15	Old flowchart	70
5.16	Comprehensive maintenance flow chart	71
5.17	Work breakdown structure (WBS)	72
5.18	Scheduled machine major maintenance project predecessor and time	73
5.19	CPM chart	74
5.20	Gantt chart for major maintenance	74
6.1	Motor failure	77
6.2	Average downtime from Jan to June 2015	78
6.3	Inventory reorder report	79
6.4	OEE data chart	80
6.5	MTBF from January 2015 to June 2015	82
6.6	MTTR from January 2015 to June 2015	83

LIST OF ABBREVIATIONS

ABBREVIATIONS	FULL NAME
AHP	Analytical Hierarchy Process
AM	Autonomous Maintenance
CBM	Condition-based Monitoring
CM	Corrective Maintenance
CMMS	Computerized Maintenance Management System
CPM	Critical Path Method
d	Downtime
df	Downtime delay
f	Number of failure
HMI	Human Man Interface
li	Maximum score of factor i
LCL	Lower Control Limit
MTBF	Mean Time before Failure
MTTR	Mean Time to Repair
N	Number of factor
OEE	Overall Equipment Effectiveness
OPAC	Out of Control Action
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PMSB	Prent Malaysia Sdn Bhd
PWD	Percentage Weighted Deviation

LIST OF ABBREVIATIONS

ABBREVIATIONS	FULL NAME
RCFA	Root Cause Failure Analysis
RCM	Reliability Centered Maintenance
S	Scheduled production time
Si	Score of factor i
SPC	Statistical Process Control
TPM	Total Productive Maintenance
TQM	Total Quality Management
UCL	Upper Control Limit
WBS	Work Breakdown Structure
Wi	Normalized weight for factor i

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Maintenance management system assessment questionnaire	100

CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter will provide an introduction of the project, background of problems, statement of problems, objectives and scopes of this project. This project is mainly about an assessment of a company maintenance management system and to develop maintenance management strategies in order to improve the overall company performance.

1.2 Background of Problems

The approach to maintenance has changed dramatically over the last century. Up to about 1940, maintenance was considered an unavoidable cost and the only maintenance was corrective maintenance (CM). Whenever an equipment failure occurred, a specialized maintenance workforce was called on to return the system to operation. Maintenance was neither incorporated into the design of the system, nor was the impact of maintenance on system and business performance duly recognized (Murthy *et al.*, 2004).

In the highly competitive environment, to be successful and to achieve world-class-manufacturing, organizations must possess both efficient maintenance and effective manufacturing strategies. The effective integration of maintenance function with engineering and other manufacturing functions in the organization can help to

save huge amounts of time, money and other useful resources in dealing with reliability, availability, maintainability and performance issues (Moubray, 2003)

In reality, the breakdown of a machine which is due to unplanned maintenance (suddenly failure) will increase the repair cost and machine downtime (production lost) (Nakajima, 1988). Therefore, this has resulted the function of a maintenance division to be an important activity in the manufacturing industries in order for their operation to become stable. The introduction of several philosophies such as Corrective Maintenance (CM), Preventive Maintenance (PM) or Total Productive Maintenance (TPM) have provided additional solutions to a maintenance planning problem faced by company in comparison to the conventional fire-fighting syndrome.

There are many maintenance strategies that can be implemented by a company. All strategies have one main objectives, to reduce the failure rate of the machine or equipment, so that the machine downtime and maintenance (repair or replacement) costs can be reduced.

1.3 Statement of Problems

The increasing of manufacturing cost (material, labor, and transportation), challenges in producing quality part and optimum safety standard has push maintenance management into the front line. Poor maintenance will cause loss of time, money, production efficiency, reduce quality and safety.

Competitiveness has forced companies to improve the overall performance of the business. In the area of maintenance, much has been written about strategies, such as total productive maintenance or reliability centered maintenance, which can increase the reliability and therefore capacity of the industrial plants in their quest for world-class maintenance(Oscar Fernandez *et al.*, 2006) It's critical for company to have sound maintenance management system which can control its maintenance

cost at the lowest level and maintain its overall equipment effectiveness at highest level (Tu *et al.*, 2001).

Machine breakdown and unplanned maintenance still occur even though Prent (Malaysia) Sdn. Bhd. even though a simple fixed time interval preventive maintenance and a major maintenance activity base on the machine total cycle policy has been adopted. Thus, a proper maintenance management strategy need to be implement in order to overcome this issue.

1.4 Objectives of Study

The main objective of this study is to assess the existing maintenance management system at Prent (Malaysia) Sdn. Bhd (PMSB). This project is also to analyses the problems of the existing maintenance management system and to propose and implement improvement strategies for the maintenance management system in order to attain higher Overall Equipment Effectiveness (OEE), low Mean Time to Repair (MTTR) and higher Mean Time before Failure (MTBF)

1.5 Scopes

The scope of this project is:

- a) Study will be limited to the production equipment at PMSB.
- b) Analysis will be carried out on at least 3 problematic areas.
- c) At least 3 strategies to overcome the problems identified will be proposed using the industrial engineering tools.
- d) At least 2 of the strategies will be implemented.

1.6 Company Background

Prent's World Headquarters, located in Janesville, WI, USA, is the flagship Center of Best Practices. It was developed for the comprehensive design and production of custom thermoform packaging. Inside our world-class ISO 9001 certified facility are Class 8 clean room environments with matched, computer-controlled thermoformers and secondary operations equipment. Also on the campus of our Headquarters are global Package Design Teams, our Worldwide Machine Build Facility and our International Custom Tool Build Facility.

Opened in 1998, PMSB is a large, full-service ISO 13485, ISO 9001 and ISO 14001 environmental thermoforming center. The modern, clean, climate-controlled facility is a Class 8 clean room environment with complete thermoforming and secondary operations. In addition, we have an international plastic design team, a large facility for thermoform tool build and quality control operations to ensure full-service thermoformed packaging capabilities for Prent's Asian customers. This plant consists 14 thermoforming machine and 180 workers. Figure 1.1 shows the outside view of PMSB.



Figure 1.1: PMSB at Senai, Johor [www.prent.com.my, March 2015]

1.7 Process Flow

PMSB manufactures plastic thermoforming trays. The trays are used for packaging and shipping tray of electronics component, medical equipment, etc. Figures 1.2 and 1.3 show us how is the thermoforming process and its process flow. The process is started by loading the material into the machine, which then goes to the heating process inside the oven. After the plastic reach the softening point of temperature, it will be transferred into next station for the forming and cutting process. Finally, it will be inspected and will be packed.

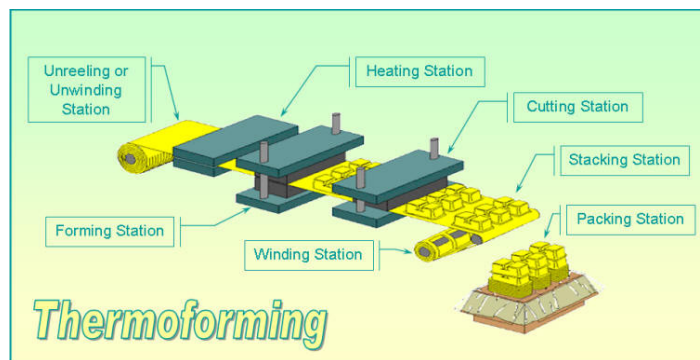


Figure 1.2: Thermoforming Process [www.prent.com.my, March 2015]

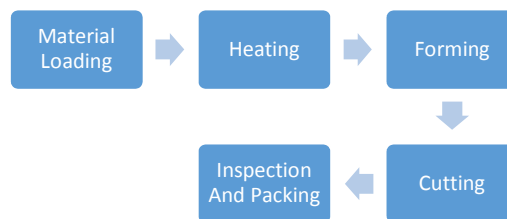


Figure 1.3: Process Flow

1.8 Production Layout

The production floor consist of 14 thermoforming machine and 5 press machine. The machine is fully automated machine control by the Programmable Logic Controller (PLC) and monitored by the machine operator or the line leader. The machine is operated 24hours per day, with 2 shift basis. The layout of the production floor is shown un Figure 1.4.

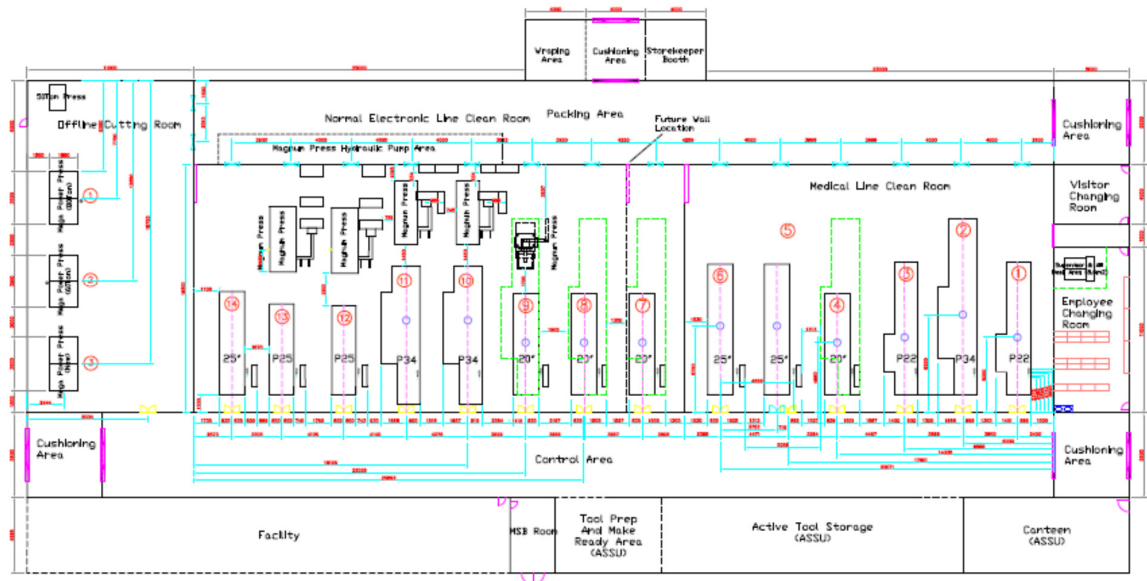


Figure 1.4: Production Floor

1.9 Thesis Structure

This thesis is divided into seven chapters. Chapter one describe about introduction of this project which consist of the background and statements of problems, objectives and scopes of study. Chapter two represents the findings of the literature review carried out that is related to this case study. Methodology of collecting data for this study is discussed in the following chapter, chapter three. In chapter 4, the problems will be identified based on the maintenance management assessment and also base on the collected historical data, observation and also interviews. In chapter 5, strategies for the maintenance management system will be proposed to overcome the problem that has been identified. Result and discussion of

the strategies that has been proposed will be discussed on chapter 6. The conclusion is summarized in the last chapter, chapter seven.

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