

**IMPLEMENTING TPM APPROACH IN  
SEMICONDUCTOR COMPANY**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2014**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**IMPLEMENTING TPM APPROACH IN SEMICONDUCTOR  
COMPANY**

**This report submitted in accordance with requirement of the Universiti  
Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing  
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**by**

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## ABSTRAK

Industri pembuatan semikonduktor mempunyai ciri-ciri penempatan mesin canggih dan automatik dalam proses pembuatan untuk menambahkan pengeluaran. Ini membawa kepada cabaran penyelenggaraan untuk memastikan ketersediaan maksimum peralatan pengeluaran. Dalam persekitaran pembuatan termaju hari ini, penyelenggaraan tidak boleh lagi dilihat sebagai satu fungsi yang beroperasi di latar belakang. Kemunculan Total Productive Maintenance (TPM) konsep menaikkan kepentingan penyelenggaraan sama dengan pengeluaran. TPM bertujuan untuk meningkatkan keberkesanan persekitaran pengeluaran, terutamanya melalui kaedah untuk memaksimumkan keberkesanan peralatan. Pada masa ini, kejayaan pelaksanaan TPM yang telah dilaporkan secara meluas dalam banyak industri di seluruh dunia. Projek ini dijalankan di sebuah syarikat multinasional syarikat pembuatan semikonduktor, dengan objektifnya untuk memahami kembali - akhir aliran proses keseluruhan dan untuk menentukan adanya peralatan rendah Talian Ujian Elektrik. Kedua, pendekatan TPM itu dapat meningkatkan ketersediaan peralatan. Pendekatan TPM akan tingkah laku oleh 8 tiang sebagai alat untuk meningkatkan ketersediaan. Berdasarkan analisis data sebelum ini, melaksanakan rukun sesuai untuk penambahbaikan. Data yang dikumpul dari talian pengeluaran, sebelum dan selepas pelaksanaan TPM yang dianalisis dan keberkesanan keseluruhan peralatan ( OEE ) sebagai penilaian prestasi utama, akan dibandingkan. Objektif terakhir adalah bertujuan untuk menunjukkan peningkatan dalam ketersediaan peralatan. Hasilnya, ketiga-tiga objektif tercapai dengan pendekatan TPM dilaksanakan, hanya terdapat Latihan dan Pendidikan, Fokus Peningkatan, Penyelenggaraan Autonomi, menyeluruh, dan ramalan Penyelenggaraan telah melaksanakan. Ketersediaan talian ujian elektrikal meningkat dengan sebanyak 6% dalam tempoh empat bulan daripada 86% ketersediaan.

## **ABSTRACT**

The semiconductor manufacturing industry is characterized by the deployment of highly sophisticated and automated machines in the production processes to maximize throughput. This leads to the challenge of maintenance to ensure maximum availability of production equipment. In today's advanced manufacturing environment, maintenance can no longer be viewed as a function that operates in the background. The emergence of Total Productive Maintenance (TPM) concept elevates the importance of maintenance equal to that of production. TPM aims to increase the effectiveness of production environments, especially through methods to maximize the effectiveness of the equipment. Currently, the successful implementation of the TPM has been widely reported in many industries around the world. This project is conducted in a multinational semiconductor manufacturing company, with the objectives of, firstly, to understand the overall back-end process flow and to determine the low equipment availability in Electrical Test Processes. Secondly, the TPM approach is employed to improve equipment availability. TPM approach will be conducted by 8 pillars as the tools to improve the availability. Based on the analysis of previous data, implement the suitable pillars for improvement. Data collected from the shop floor, before and after the TPM implementation are analysed and the overall equipment effectiveness (OEE) as the key performance measure, will be compared. The last objective aims to highlight the improvements in equipment availability. As a result, the three objectives are achieved by implemented TPM approach, there are only Training and Education, Focus Improvement, Autonomous Maintenance, Preventive Maintenance, and Predictive Maintenance had implemented. The Availability of electrical testing line is significantly increased about 6% in four months from 86% of Availability.



## DEDICATION

*Dedicated to my beloved father, Mr. Tan Cheow Keat and my lovely mother, Mrs. Ooi Soo Kuan who are very concern, patient and supportive.*

*Last but not least, to all my sisters and friends. The work and success will never be achieved without all of you.*

*May God bless them for their positive supports which give me motivation to excellence in my future undertaking.*

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# **LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE**

TPM	–	Total Productive Maintenance
OEE	–	Overall Equipment Efficiency
RCM	–	Reliability-Centred Maintenance
FM	–	Focused Maintenance
PM	–	Preventive Maintenance
PdM	–	Predictive Maintenance
QM	–	Quality Maintenance
AM	–	Autonomous Maintenance
TQM	–	Total Quality Management
PPM	–	Planned Preventive Maintenance
WCM	–	World Class Manufacturing
OSHA	–	Malaysia's Occupational Safety and Health Act
PSM	–	Projek Sarjana Muda
DPM	–	Defect per million
UD	–	Unscheduled Downtime
SD	–	Scheduled Downtime
AV	–	Availability
SPC	–	Statistical Process Control

# **CHAPTER 1**

## **INTRODUCTION**

This chapter provides an overview of the project background which focused on improve machine availability in a SS Semiconductor Company. The background of the study includes problem statement, objectives, scope are presented. The organisation of this report is described at the end of this chapter.

### **1.1 Background of Study**

This study is mainly concerned on the semiconductor industry. The South East Asia region is showing good signs of growth in semiconductor and electronics industry. Overall, the semiconductor industries have widely experienced continuous growth. However, semiconductor industries have to remain competitive and increase the productivity by implementing highly automated production. Automation in semiconductor manufacturing originated from replacing human operators in tasks that are routine but tedious, or that should be done in dangerous or hazard environments. By eliminating these human factors and environmental hazards, and thus, the productivity of the company is believed to be increased and improved.

Nowadays, maintenance has become a critical issue in a highly automated manufacturing industry. Maintenance is considered one of the important strategic decisions in operation management. Manufacturing sectors ensure no disruption in equipment breakdown, stoppages and failures in order to maintain operation effectiveness and efficiency. According to Mobley (2008), maintenance can solve the day to day inherent problems and keep the physical facility (plant, machine, building,

and service) in good condition, and help increase the availability of the physical facility.

Increase of production throughput will improve cost effective and profit. One of the plans is Total Productive Maintenance (TPM), it is able to increase the production throughput by improving the availability and efficiency of equipment.

## **1.2 Background of company:**

This project is conducted in a semiconductor manufacturing company located in the Batu Berendam Free Trade Zone, Melaka and has become the largest backend manufacturing site with accumulative investments of more than RM 6 billion. Besides that, the company has been continuously enlarging its operations and expanding its production facilities by investing in state-of-art technologies and creating a new design and new product lines to meet customer's demand for its product.

The case company is committed to the highest product quality and providing solutions to application requirements, improve productivity and efficiency with uncompromising adherence to delivery schedules and protecting the environment. Some examples of products are transistors and pinless microchip, and it's mostly used in telecommunication products. Furthermore, the major wireless applications in a mobile phone include the primarily cellular communication.

This project is focusing on the backend inspection's process in the semiconductor manufacturing. The vision and mission of this department are to produce excellent quality products at competitive cost through continuous improvement in technologies and logistics by striving to understand and achieve customer's expectation and perception.

### **1.3 Problem Statement**

The company is facing low throughput issue in Electrical testing process which identified by the company's engineer. Breakdown is one of the issues affected availability of equipment that cause low throughput.

The problem will be clear as “how to reduce the breakdown on electrical testing process to increase availability as a result of throughput increase?”

### **1.4 Objectives of Study**

Based on the problem formulated in the preceding section, the main aim of this project is to improve the production's throughput which interrelates to increase production's Availability. Specifically this study embarks the following objectives:

- i. To understand the process flow of the electrical testing process in the company
- ii. To determine availability of equipment in the electrical testing process.
- iii. To implement TPM approach to improve equipment availability.

### **1.5 Scope and Limitation of Study**

This study will focus on the backend inspection's process which is only electrical testing process. Real production data for product XYZ will be collected at the shop floor through the computerized recording system. In addition, result of the analysis will have the variation due to limited time frame. Regarding the calculation of OEE, Performance and Quality are not considered because TPM members is suggested improvement plan without influence both of its. Performance and quality data will reconfirm the result variation after implement improvement plans.

## **1.6 Benefit to company**

This study has potential to reduce the manufacturing lead time and cost of machine replacement within the semiconductor company. Moreover, performance of the machine improves in term of availability and interrelated to increase throughput. The maintenance run as scheduled will reduce unnecessary cost.

Furthermore, this study can be used as future reference and research for the academicians and also for the semiconductor manufacturing company. The results from this study can be delivered to the company to be implemented in their manufacturing process.

## **1.7 Organization of the project:**

Chapter 1 introduces the research topic area and explains the aims of the work. A general introduction of background to the research addressed in this study is followed by an explanation of the aims of the research. Researches on how availability affected throughput in semiconductor manufacturing. Additional, compare the present OEE and new OEE after implement TPM. This chapter also describes the TPM approach used in this study and the link between theory and practice in Semiconductor Manufacturing Company.

Chapter 2 presents a review of previous literature on these projects that have been outlined in the previous chapter. Furthermore, literature review conducted to ease the understanding of all types of published work that relevant to this study and helps to determine how much work has been done previously. In this chapter, we can summary previous research work and to learn TPM critical success factors, 8 pillars analysis tools, and 6 losses by Nakajima.

Chapter 3 provides an overview of research methodologies and describes the appropriate methodologies chosen to carry out this study. It includes fundamental approach to be taken to achieve the objectives.

Chapter 4 concludes the data collection and analyses of the study. Data collections conducted are all exhibited in this chapter. The data were analysis by SPC tools to get the root causes for low availability.

Chapter 5 discusses the implementation of TPM and the result of finding. Every progress of implementation is explained. The result before and after implement TPM is compared and shows the differences.

Chapter 6 discusses the conclusion of the finding and further implementation plans. The result has been proven that able to increase the Availability and indirectly increase throughput.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This chapter provides an overview of the manufacturing trends in Malaysia. The importance of automation and maintenance is presented in the following sections. However, 5 types of maintenance strategies will be explained in details. Furthermore, the overview of TPM and its implementation in the manufacturing industry in general and semiconductor manufacturing specifically are discussed.

#### **2.1 Trend in Manufacturing Sector in Malaysia**

Many manufacturing companies today are under pressure from supplier, competitors, employees, availability of equipment, refined market segment, and rigorous customers demand and choices. According to Bascand (2013), labour cost increase about 8% per year start from 2011 to 2013 in New Zealand. As a result, manufacturers find new suppliers, new partners, cheap material sources, and new ways of running operations, new products and new deliver product and services at acceptable prices (G.S. Dangayach & S.G. Deshmukh, 2006).

According to the Office Of Chief Statistician Malaysia (2013), from the statistical performance in sales value, number of employees, salaries & wages, and productivity show that sales value is decreasing from RM 362,962.5 Million to RM 354647.2 Million. It was slightly decreasing about 2.3% yearly. However, the number of employees was increasing up to 1,037,583 people as at end of July 2013. It was about 0.8% increased. Productivity and sales value keep decrease but number of employees and salary keep increase in year 2013. Automation used to replace human