



**Faculty of Manufacturing Engineering**

**LEAN ADOPTION FOR EFFECTIVE MACHINE'S  
MAINTENANCE PERFORMANCE**

**TAN WEE KIEN**

**Master of Manufacturing Engineering  
(Manufacturing System Engineering)**

**2016**

**LEAN ADOPTION FOR EFFECTIVE MACHINE'S MAINTENANCE  
PERFORMANCE**

**TAN WEE KIEN**

**A thesis submitted  
in fulfillment of the requirements for the Master of Manufacturing Engineering  
(Manufacturing System Engineering)**

**Faculty of Manufacturing Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2016**

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("Agreement")**

by and between

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- hereinafter referred to as "**Recipient**"

and

**Infineon Technologies (Malaysia) Sdn. Bhd. (56645-D)**

with office at Free Zone, Batu Berendam, 75350 Melaka, Malaysia

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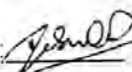
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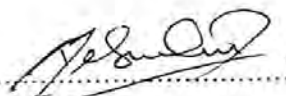
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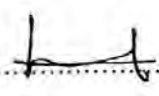
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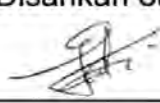
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Date : 20/3/2016 .....

## APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Manufacturing Engineering (Manufacturing System Engineering).

Signature	
Supervisor Name	DM. DR. RIZAL
Date	18.3.2016



## ABSTRACT

In the manufacturing, every industry will involve in ramp up. This will indirectly encourage the company to purchase more machines to meet the increasing demand proportionately. However, as more machines and utilities are purchased, the working area needs to be expanded accordingly as well. During such steep ramp up, most of the plans and strategies may not be fulfilled thoroughly. Therefore, with increase of machines and utilities, the maintenance system requires makeover in order to cope with the ramp up too. The 5S will deteriorate together with the planned activities which are applicable previously, but may not be applicable now. Lean manufacturing system in maintenance bay is one of the project plans to improve the current situation to cope with the steep ramp up. The tools, re-layout, 5S, Total Productive Maintenance (TPM), Single Minute Exchange Die (SMED) are all taken into consideration in this project to help ensure that the manufacturing is one step ahead towards the next level of maintenance, the predictive maintenance. The intention for this system has always been to cope with the ramp up as well as minimize the equipment downs frequency by making use of proper tools, 5S, TPM concept and SMED concept. The end in mind of this project is to meet the vision of lean manufacturing in maintenance by eliminating common wastes faced by such industry.

## ABSTRAK

Dalam sektor perkilangan, setiap industri akan terlibat dalam ramp up yang ketara. Ini secara tidak langsung akan menggalakkan syarikat untuk membeli lebih banyak mesin untuk memenuhi permintaan yang semakin meningkat secara berkadar. Walau bagaimanapun, semasa banyak mesin dan utiliti yang telah dibeli, kawasan kerja perlu diperluaskan dengan sewajarnya juga. Sepanjang ramp up yang ketara ini, kebanyakan rancangan dan strategi tidak boleh dipenuhi dengan sempurna. Oleh itu, dengan peningkatan mesin dan utiliti, sistem penyelenggaraan memerlukan makeover untuk menghadapi situasi ramp up tersebut. 5S akan merosot bersama-sama dengan aktiviti-aktiviti yang dirancang yang terpakai sebelum ini, tetapi mungkin tidak sesuai untuk dipakai kini. Sistem pembuatan Lean dalam Maintenance Bay adalah salah satu pelan projek untuk memperbaiki keadaan semasa untuk menghadapi ramp up tersebut. Alat, semula susun atur, 5S, Total Productive Maintenance (TPM), Single Minute Exchange Die (SMED), semuanya diambil kira dalam projek ini untuk membantu memastikan bahawa pembuatan adalah satu langkah ke hadapan ke arah peringkat seterusnya penyelenggaraan. Niat untuk sistem ini adalah sentiasa untuk menghadapi ramp up serta untuk mengurangkan kekerapan surut peralatan dengan menggunakan alat-alat yang betul, 5S, konsep TPM dan konsep SMED. Pencapaian utama projek ini adalah untuk memenuhi wawasan pembuatan lean dalam penyelenggaraan dengan menghapuskan pembaziran yang biasa dihadapi oleh industri tersebut.



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## LIST OF ABBREVIATIONS

A2	-	Plating Process
AHP	-	Analytical Hierarchy Process
AV	-	Availability
CBM	-	Conditional Based Maintenance
CI	-	Consistency Index
CM	-	Corrective Maintenance
CR	-	Consistency Ratio
DC	-	Design Concepts
DMAIC	-	Define, Measure, Analyse, Improve, Control
DOE	-	Design of Experiments
DP	-	Distance from Parts
ESH	-	Ergonomics, Safety, Health
FMEA	-	Failure Mode Effect Analysis
IS	-	Inventory Size
JIPM	-	Japan Institute of Plant Maintenance
JIT	-	Just-In-Time
M	-	Motion
M2	-	Module 2
MCDM	-	Multiple Criteria Decision-Making Techniques
MEC	-	Microelectronics Center
MMO	-	Man-Machine Optimization
MP	-	Machine Performance



MTBA	-	Mean Time Between Assists
NV	-	New Vector
NVA	-	Non Value Added
OCAP	-	Out of Control Action Plans
OEE	-	Overall Equipment Efficiency
OJTI	-	On Job Training Instructions
OVA	-	Operation Value Added
PC	-	Personal Computer
PM	-	Preventive Maintenance
POM	-	Power Melaka
PQCDMS	-	Productivity, Quality, Cost, Delivery, Morale, Safety
PR	-	Productivity
PSI	-	Preference Selection Index
PV	-	Priority Vector
QCDMS	-	Quality, Cost, Delivery, Morale, Safety
QM	-	Quality Maintenance
QRA	-	Quick Response Actions
RI	-	Random Index
RTR	-	Reel to Reel
S	-	Safety
SAP	-	System Applications Products
SD	-	Scheduled Downtime
SMART	-	Specific, Measurable, Achievable, Realistic, Timely
SMED	-	Single Minute Exchange Die
STS	-	Strips to Strips
TFM	-	Total Fab Manufacturing

- TIMWOOD - Transport, Inventory, Motion, Waiting, Over-process, Over-production, Defects
- TOPSIS - Technique for Order Preference by Similarity to Ideal Solution
- TPM - Total Productive Maintenance
- TPS - Toyota Production System
- TQM - Total Quality Management
- TWI - Training Within Industries
- T&E - Training and Education
- UD - Unscheduled Downtime
- VA - Value Added
- VSM - Value Stream Mapping
- WIP - Work In Progress
- 4M - Man, Method, Machine, Material
- 5S - Seiri, Seiton, Seiso, Seiketsu, Shitsuke
- Amax - Maximum Eigenvalue

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

In this topic, the company that will be the subject is Infineon Technologies and the area of focus is on molding process in Module 2 (M2) DPAK Strip to Strip (STS). Infineon Technologies is a manufacturing company in semiconductor industry which manufactures chips encapsulated in units form usually to be installed for electrical and electronic appliances. This manufacturing involves processes such as chips in wafer form (wafer sawing), die bond, wire bond, A2 plating, molding, plating, trim and form, vision check, and testing. Each process plays an important role in terms of machine performance as well as its productivity. This is important especially when millions of such units are produced in a short period of time.

This study focuses on the Lean Adoption for Efficient Machine's Maintenance Performance for molding process. There are many types of wastes that can be observed from the maintenance side if they are not managed and identified properly. Several numbers of wastes when they are combined together may cost the company millions or billions of dollars of losses.



While productivity increases, number of wastes such as defects may be inevitable. Therefore, it becomes essential to look at the contribution from the maintenance side to not only on the machines performance, but also on its effectiveness, efficiency, and wastes reductions.

Many companies faced millions of dollars losses yearly due to improper planning and the unnecessary expenses on wastes such as transportation, inventory, motion, waiting, over-processing, overproductions, and defects. Infineon Technologies is no stranger to such wastes. As semiconductor industry becomes more competitive; process and manufacturing improvements, as well as wastes reductions are essential where adopting the Lean concept is one of the important keys to increase the profit margin of the company by reducing unnecessary costs.

With the current ramp up, more machines are purchased and tools management need to be further improved and must take into account the number of machines involved. This requires proper planning on production line and also on the maintenance room. The maintenance room is the heart of the production lines as the activities carried out will support the machines performance and the production. Therefore, it is important to understand the situation that the current production lines and maintenance are facing.

With the current ramp up also, comes proper planning. This planning will take into consideration the transportation and motion where the time taken to transport tools for maintenance to machines cannot be taken lightly. This will also help to reduce the waiting time which is a non-value added activity. Therefore, the proper tools kit to perform Preventive Maintenance (PM), weekly or daily maintenance, calibrations, and other maintenance must be effective and meaningful. Besides transportation, inventory to store