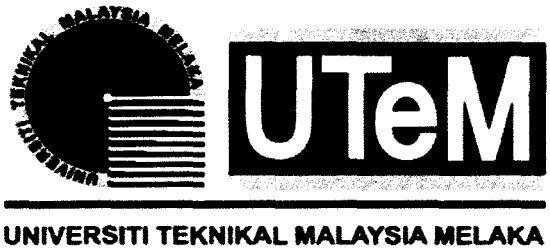


UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## Faculty of Manufacturing Engineering

# A STUDY ON BOTTELENECK OPERATIONS TO OPTIMIZE MANPOWER PLANNING FOR PRODUCTIVITY IMPROVEMENT AT 2HC DOOR LINING ASSEMBLY LINE VIA MODAPTS

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**Master of Manufacturing Engineering**

**2013**

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NUR AMIRA BINTI ZULKARNAIN

**A thesis submitted**

**in fulfilment of the requirement for the degree of Master of Science**

**in Manufacturing Engineering**

**Faculty of Manufacturing Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2013**

# DECLARATION

I hereby, declared this report entitled "A Study on Bottleneck Operations to Optimize Manpower Planning for Productivity Improvement at 2HC Door Lining Assembly Line via MODAPS " is the results of my own research except as cited in references

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# APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Master of Manufacturing Engineering The member of the supervisory is as follow:

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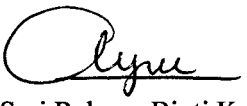
| Signature | : |  |
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| Date | : | 28th June 2013 |

# DEDICATION

This study is dedicated to Johnson Control Incorporation, JCI Alor Gajah plant. Hopefully the study will help JCI to grow further as the best Automotive Manufacturing line worldwide by having the least Equivalent Unit, EQU value among all JCI companies This study is also dedicated to bosses and top management level who always support any improvement and kaizen activities done in order to gain more profit and to further contribute to nation and people in need. They have given us the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been made possible.

# ABSTRACT

This study was performed in order to find optimize manpower planning for productivity improvement at 2HC 1.8 door lining assembly line. MODAPTS or Modular Arrangement of Predetermined Time Standards, which was developed by Mr. G. Chris Heyde, has been used widely in manufacturing field and benchmarking from the success of other well performance company, Johnson Control Incorporation, JCI is taking the initiative to use MODAPTS. MODAPTS system relates standard time value to human body movement in performing a work. In the study, MODAPTS code will be generated based on video taken and line balancing graph will be plotted. Using VSM layout, waste will be identified and this will be followed by improvement activity in order to reduce or eliminate the waste. Once again MODAPTS code will be generated to monitor the impact of the improvements activities carried out. Based on the line balancing graph and efficiency level of the assembly line, suggestion either to combine two different workstation will be made. This will be followed by initiation of MODAPTS code for the suggested activity. In order to make confirmation either the MODAPTS code is reliable enough, time study at the actual assembly line will be carried out.

# ABSTRAK

*Kajian telah dijalankan untuk menentukan bilangan pekerja yang optimum untuk penambahbaikan proses pemasangan 2HC 1.8 door lining. MODAPTS atau Modular Arrangement of Predetermined Time Standards, yang telah dicipta oleh Mr. G. Chris Heyde, telah digunakan secara meluas dan mendapat pengiktirafan antarabangsa. Dengan menjadikan kejayaan syarikat-syarikat terkemuka yang telah menggunakan MODAPTS sebagai penanda aras,Jonhson Control Incorporation, JCI mengambil initiatif untuk turut sama menggunakan MODAPTS. Sistem MODAPTS menghubungkan nilai ukuran masa dengan pergerakan badan manusia dalam menjalankan pekerjaan seharian. Di dalam kajian ini, kod MODAPTS akan dimuat naik berdasarkan aktiviti-aktiviti yang telah dirakamkan di dalam video dan rajah penyeimbangan melibatkan semua proses yang terlibat akan dibuat. Bukan itu sahaja, dengan menggunakan susunatur VSM, pembaziran yang terdapat di dalam process pemasangan door lining ini akan dikenalpasti dan ini akan diikuti oleh aktiviti-aktiviti yang boleh mengurangkan atau menyingkirkan pembaziran tersebut. Kod MODAPTS dan rajah penyeimbangan masa untuk setiap proses akan sekali lagi dimuat naik untuk memantau kesan daripada aktiviti-aktiviti mengurangan pembaziran Cadangan sama ada untuk menggabungakan dua stesyen kerja akan dibuat berdasarkan rajah penyeimbangan yang dibuatkan menerusi kod MODAPTS. Kajian secara manual menggunakan jam randik akan dijalankan sebagai pengesahan sama ada kod MODAPTS ini boleh diguna pakai sebelum cadangan ini dicadangkan secara langsung kepada pihak pengurusan JCI.*

# ACKNOWLEDGEMENT

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them.

I am highly indebted to Johnson Control Automotive Seating (M) Sdn Bhd, especially to Alor Gajah Plant's members for their guidance and constant supervision as well as for providing necessary information regarding the project & also for their support in completing the project.

I would also like to express my gratitude towards my parents for their kind co-operation and encouragement which help me in completion of this project. My thanks and appreciations also go to my colleague in developing the project and people who have willingly helped me out with their abilities.

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# LIST OF SYMBOLS

| | | |
|---|---|---|
| JCI | - | Johnson Control Incorporation |
| JCAS | - | Johnson Control Automotive Seating |
| JCAS-SA | - | Johnson Control Automotive Seating Shah Alam |
| JCAS-TM | - | Johnson Control Automotive Seating Tanjung Malim |
| JCAS-Pkn | - | Johnson Control Automotive Seating Pekan |
| MODAPTS | - | Modular Arrangement of Predetermine Time Standard |
| TPS | - | Toyota Production System |
| JIT | - | Just in Time |
| VSM | - | Value Stream Mapping |
| SALBP | - | Simple Assembly Balancing Problem |
| MTM | - | Method Time Management |
| MOST | - | Maynard Operational Sequence Technique |
| PMTS | - | Predetermined Motion Time System |
| CI | - | Continuous Engineer |
| HMSB | - | Honda Malaysia Sdn Bhd |
| Fr RH | - | Front Right Hand |
| Fr LH | - | Front Left Hand |
| Rr RH | - | Rear Right Hnad |

| | | |
|---|---|---|
| Rr LH | - | Rear Left Hand |
| Assy | - | Assembly |
| FG | - | Finish Good |
| WSHTP | - | Weather Strip |
| VA | - | Value Added |
| NVA | - | Non Value Added |
| NNVA | - | Necessary Non Value Added |

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Johnson Controls (JCI) is a global diversified technology and industrial leader serving customers in more than 150 countries. Globally we are a major player in Automotive, Electronic, Power Solution and Building Efficiency. JCI has been listed as one of the most successful company around the world and this can be observed based on Fortune 500 performance year to year basis. The Fortune 500 is an annual list compiled and published by Fortune magazine that ranks the top 500 U.S. closely held and public corporations as ranked by their gross revenue after adjustments made by Fortune to exclude the impact of excise taxes companies incur. The list includes publicly and privately held companies for which revenues are publicly available.

Table 1: Johnson Control (JCI) Ranking in Fortune 500 for 2010 until 2012

| Year | Ranking | Revenue | Profit |
|---|---|---|---|
| 2010 | 83 | 28,497.00 | -338 |
| 2011 | 76 | 34,305.00 | 1,491.00 |
| 2012 | 67 | 40,833.00 | 1,624.00 |

Johnson Control which operated in Malaysia is having three different entities:

- Johnson Control Automotive Seating (M) Sdn Bhd;

- Johnson Control Automotive Interiors (M) Sdn Bhd;
- Johnson Control Automotive Components (M) Sdn Bhd

In Malaysia itself, JCI is located at four different plants serving local and international automotive base. Our plants and our customers in Malaysia are:

Table 2: JCI plant in Malaysia and its customers

| Plant Location | Customer |
|---|---|
| Shah Alam Plant (JCAS-SA) in Selangor | Proton, Toyota, Volvo |
| Tanjung Malim Plant (JCAS-TM) in Perak | Proton, BMW and Volkswagen |
| Pekan Plant in Pahang (JCAS-Pkn) | Mercedes and Isuzu |
| Alor Gajah Plant in Melaka (JCAS-AG) | Exclusively build up for Honda Malaysia Sdn Bhd |

The year of 2012 and 2011, is a very challenging year for Johnson Control as a whole. This is due to reduction of total number of business which was cause by natural disaster especially in Asia Region, focusing in Malaysia, therefore, in order for JCI to remain as the most favorable seat supplier, JCI has to be competitive enough. A lot of automotive assemblers in Malaysia prefer to have JCI as their main seat supplier due to products' quality showed. The only reason that make they have a second taught of JCI mainly due to the price which they consider quit expensive comparing to others seat manufacturers in Malaysia.

## 1.2 The Main Challenges for JCI in 2012 and 2011

Thailand which located at the southern east part of Asia is situated in between 15° 00' North latitude and 100° 00' East longitude. Due to its location at particular latitude and longitude, Thailand is having three distinctive seasons which are:

- Summer Season (April to May)
- Rainy Season (June to October)
- Winter Season (November to February)

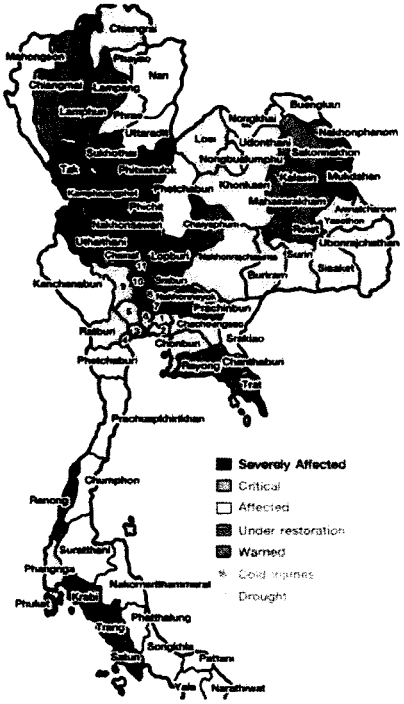


Figure 1: Flooded area in Thailand dated on 8th October 2011. (Taken from http://www.thaiflood.com/en/)

During the fourth quarter of 2011, Thailand faces a massive flood throughout the country which affected three quarter of the country and is the worst in more than 50 years. According to Jeff Master's blog, for 2011, Thailand faced the highest disaster cost worldwide due to its flood crisis which started on Jun 2011 and only end on November 2011 causing USD 45.0 billion damage. The main Thailand economic sectors affected by the hit are agriculture, tourism and manufacturing. The flood had forced seven main industrial estates in Thailand to halt their operation and this has never happened for the past 40 years.

Table 3: Affected Industry Estate during Thailand Flood Crisis on October 2011. (Taken from http://www.gccapitalideas.com/2011/11/03/floods-in-thailand-2/)

| Industrial Park | Region | Number of companies | Companies impacted (examples) | Reported flood height |
|---|---|---|---|---|
| Bang Pa-in | Bang Pa-In, Ayutthaya | 90 | Western Digital | >1.0m |
| Bangakdi | Mueang Pathum Thani, Pathum Thani | 50 | Nidec, Nissan, Sony, Toshiba Semiconductor | 3.0m |
| Factory Land | Wang Noi, Ayutthaya | 99 | Canon Engineering, HDK, Sony | 1.5m |
| Hi-Tech | Bang Pa-In, Ayutthaya | 143 | Canon Engineering, HDK, Sony | 3.4m |
| Nava Nakorn | Khlong Luang, Pathum Thani | 227 | Western Digital, Toshiba, Casio, Fujitsu, JVC, Seiko | 2.0-3.0m |
| Rojana | Uthai, Ayutthaya | 198 | Honda, Furukawa, TDK, Nidec, Canon, Nikon, Panasonic, Sanyo Semiconductor | 3.0m |
| Saha Rattana Nakorn | Nakhon Luang, Ayutthaya | 43 | Yamamoto | >1.0m |

## 1.3 Problem Statement

Johnson Control Automotive Seating (JCAS) Alor Gajah plant was builds purposely to serve Honda Malaysia Sdn. Bhd. (HMSB). In order to be competitive enough and become the main seat and interior parts assembler and supplier in Malaysia, any improvement activity is welcome especially those which can reduce the overall total cost of operation.

## 1.4 Objective

The overall objective is to study current line balancing at Johnson Control Automotive Seating (M) Sdn. Bhd for 2HC 1.8 door lining assembly processes. The specific objectives are as follow:

(i) to study current line balancing using MODAPTS approach

(ii) to analyze area of improvement

(iii) to propose Value Stream Mapping for the process to improve its productivity.

## 1.5 Scope of study and limitation

Study will be focussing on the latest business opportunity granted by Honda Malaysia Sdn Bhd.which is door lining interior business for 2HC (Civic) model and the focus variant will be on 2HC 1.8 variant. There are other variant for this particular model, however focus study will be base on the easiest and simplest variant and benchmarking will be done before proceeding to other variant due to additional processes and parts used.

## 1.6 Finding on Research (MODAPTS)

It is suggested that MODAPTS can be used to relate standard time value to human body movement in performing a work. No stopwatch required, it is ergonomically and method sensitive. It is easy to be learn, inexpensive and there is no royalty fees involved when it is used, not like other predetermined time system method.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

The background of car manufacturing system and the concept of Toyota Production System (TPS), Toyota Production System (TPS) versus Lean Production, Line Balancing, Value Stream Mapping, Predetermined Time Systems (PTS), Method Time Measurement (MTM), Maynard Operational Sequence Technique (MOST) and Modular Arrangement of Predetermined Time Standard (MODAPTS) will be discussed in this chapter which will be applied in the later part of the study.

## 2.2 Background of Car Manufacturing System

Johnson Control Inc. (2010) explained that the automotive manufacturing environment has evolved over time starting from craft production which stated on 1894 through Fordism in 1908 to Toyota Production System (TPS) in late 1940. Skilled craftsmanship focussed on producing car by skilled worker in individual production which took long assembly time, high personalization of cars, produced at small volume at high costs and extended delivery time while Fordism, which carry over Hendy Ford's name focussed on combining mass consumption with mass production in order to produce sustained economic growth and widespread material achievement. Making profit and at the same time focussing on satisfying customer with highest quality product at lowest cost and in shortest time while developing workers' skill and improving workers' safety and morale through continuous