Faculty of Manufacturing Engineering

INDUSTRIAL ROBOTICS IN THE LEAN ENTERPRISE – A CASE STUDY IN SEMI-CONDUCTOR COMPANY

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DECLARATION

I declared that this dissertation entitled “The industrial robotics in the lean enterprise a case study in semi-conductor company” is the results of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have read this dissertation and in my opinion this dissertation is sufficient in terms of scope and quality as a partial fulfilment of Master of Manufacturing Engineering (Quality System Engineering).

Signature : ……

Supervisor Name : **Assoc. Prof. Ir. Dr. Puvanasvaran A/L A. Perumal**

Date : ……

DEDICATION

This dissertation is dedicated to my beloved parents, family and friends.

ABSTRACT

Industrial robotics replaced human workers in almost all field due to their abilities in multitasking, flexibility and configurability in any position they are involved in. However, implementing industrial robotics is challenging due to their high cost, expert handling and complexity. The case study determined the industrial robotics as a desirable tool in lean enterprise and through studying these areas availability, ease of use, standardization and visualization it shows the current mapping of the industrial robotics. Performance measurement of the industrial robotics is determined using the QCDAC method or (quality, cost, delivery, accountability and continual improvement). In terms of performance identification and ranking interpretive structural modelling (ISM) methodology is used to identify the most affected variable of the model. Cross tabulation showed the intersection result between the usage of industrial robotics and their performance to clarify the industrial robotics performance in these areas in which the industrial robotics was fit with and compatible with lean enterprise. The results showed that introducing the industrial robotics into lean enterprise will support it in terms of quality improvement, cost reduction and efficiency which lead the company to become a world class manufacturer.

ABSTRAK

Robotik perindustrian telah menggantikan pekerja manusia dalam kebanyakan bidang dengan kebolehannya yang boleh menjalankan tugasan-tugasan pada masa yang sama, fleksibiliti dan keberkesanan dalam mana-mana tugasan yang terlibat. Walaubagaimanapun, pelaksanaan robotik perindustrian adalah mencabar dengan kos yang tinggi, keperluan pengendalian pakar dan kerumitan. Kajian ini telah menentukan robotic perindustrian sebagai satu alat yang diingini dalam perusahaan bersandar dan menunjukkan pemetaan semasa untuk robotic perindustrian melalui pengkajian atas kemudahan penggunaan, piawaian dan visualisasi. Prestasi untuk robotic perindustrian diukur dengan menggunaakn kaedah QCDAC atau (kualiti, kos, penghantaran, akauntabiliti dan penambahbaikan berterusan).

Dari segi pengenalpastian prestasi dan kaedah pemodelan struktur penafsiran peringkat (ISM) dipergunakan untuk mengenal pasti pembolehubah model yang paling terjejas. Tabulasi silang menunjukkan hasil persilangan di antara penggunaan robotik perindustrian dan prestasi mereka untuk memperjelaskan prestasi industri robotik di kawasan-kawasan di mana robotik perindustrian bersesuai dan serasi dengan perusahaan yang bersandar. Hasil menunjukkan dengan memperkenalkan perindustrian robotik dalam perusahaan bersandar akan menyokong dari segi peningkatan kualiti, pengurangan kos dan kecekapan dan ini akan memimpin syarikat itu untuk menjadi pengeluar bertaraf dunia.

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CHAPTER 1

INTRODUCTION

This chapter will describe the goal of this study followed by the background then the problem statement, objective and lastly, scope of the study that is going to be performed.

1.1 Background of Study

Fast technological evolution and the current development that been done in robotics showed an achievement that been considered very hard to reach which is an effective communication between human and robotics. As (Tasevski et al., 2013a) highlighted lately robotics plays a very important role in human life and that's because the artificial intelligence technology which made the communication with robotics easier and in an intelligent way and not used in industrial application only, which considered a big step in the robotics evolution in contacting with humans.

(Zafarzadeh, 2013) mentioned about the competitive environment between companies always encourage them to use the latest technology in order to improve faster than other companies in terms of production, quality and labour cost, and the use of robotics in this fields will give these companies advantages. In addition to using the latest technology that robotics offers there are approaches that will help in improving the company's production and other fields such as lean approach which proves itself consequently as a powerful tool to increase quality in production. After implementing lean enterprise which focuses on reducing waste some challenges will

occur in terms of the suitable use of the automation within lean, so in order to use their advantages fully determining a suitable automation type and the level is required and with lean accomplishing this won't be impossible.

Most of robot's application in the industrial environment are replacing human labour from doing repetitive, accurate and dangerous tasks due to their high technology they are considered as a help to the workforce because they will no longer have to perform such tasks. Industrial robotics programmed to perform a specific task that requires a certain degree of speed, accuracy, precise and repetitive in the way or degree that the programmed specified so basically they better than human labour in these tasks (Seegrid Corporation, 2012).

(Singh et al., 2013) pointed to the evolution of industrial robotics has made an impact and widen their application range to reach to health care application due to their high-tech performance and features that could be used in health care in which they will perform better than human labour, robotics are flexible and reprogrammable so they can adapt changes fast in which they can reduce waste and operating cost.

1.2 Problem Statement

As (Thrun, 2004) pointed out that industrial robotics have a various range of application in different fields to perform tasks such as assembly, transportation and repetitive tasks in the production line prepared with minimal sensing and computing. (Akan, 2012) related the wide usage of industrial robotics with the competitive climate along with different benefits from reducing waste to increasing efficiency even though the investments in industrial robotics is challenging because it's costly and complex in terms of programming, controlling and architectures.

(Zhang et al., 2004) noted that a friendly user interface is required for the workers to get families with industrial robotics. Generally, industrial robotics can't be operated and programmed by any person they need professionals and experts because of their complexity. (Povše et al., 2010) mentioned that industrial robots working in close aid with humans which will lead to human physical safety concerns. (Corrales et al., 2012) highlighted about cooperation between industrial robotics and human will enhance the flexibility and performance of the industrial environments.

Industrial robotics performance can improve productivity, flexibility, quality, cut waste. Even though industrial robotics is very costly and it needs expert help in training the workforce or in maintenance but the benefits that they provide more in the long run in terms of quality, production, and savings. However, the industrial robotics performance can help in accomplishing the organization goals or it will only add complexity to the production line and great a hesitation of usage by workers, that's what the project result will determine according to the case study semiconductor company.

1.3 Objectives

The purposes of this case study are:

(a) To identify the industrial robotics as a desirable tool in lean enterprise.

(b) To develop a mapping of the current usage of the industrial robotics for the case study company.

(c) To determine the current industrial robotics performance which fit and compatible to the lean enterprise.

1.4 Scope

This study performed in a semiconductor manufacturer in Melaka. The scopes of the study focus on the industrial robotics used in the production line in the manufacturer which practicing lean enterprise. The aim of this study only concentrates on the front end operation which includes die bond and wire bond process in order to map the current usage of industrial robotics and the performance of the industrial robotics in lean.

1.5 Significant of Study

The importance or the significance of completing the study will answer the important question in the study which is regarding the industrial robotics fit and compatible to lean enterprise in terms of improving the products quality and reducing defects or it will add complexity to the production line.

1.6 Report Organization

This report contains five chapter as mention below:

Chapter 1, which the introduction chapter in which the background of the study will be explained then the objective of the study then the problem statement of the research questions and lastly the scope and importance of the study. Chapter 2, which is the literature review of the study in term history of the study, turnover event related to the study, definition and related work, research paper, and journals.

Chapter 3, which is the methodology which explains the methodology that been carried out to achieve the objective and the study using research tools and statistical tool and so on. Chapter 4, which is the result gained from doing the methodology in which it will show the answers to the research question and objectives. Chapter 5, which is the conclusion in terms the last summary of the project in terms of planning, doing, adjusting and finalizing the result then documentation.