



Faculty of Engineering

**IMPLEMENTATION OF STANDARDIZED WORK IN LOCAL
AUTOMOTIVE INDUSTRY**

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Mechanical and Manufacturing Engineering
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Final Year Project Report

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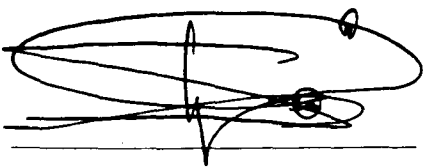
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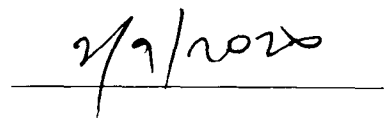
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**IMPLEMENTATION OF STANDARDIZED WORK IN LOCAL
AUTOMOTIVE INDUSTRY**

MUHAMMAD YAZID BIN MOHAMAD FUAD

This project is submitted in partial fulfilment of
the requirements for the degree of
Bachelor of Engineering with Honours
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Faculty of Engineering
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To my dearest parents, beloved family, lecturers and friends.

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ABSTRACT

This project is a study on the implementation of standardized work in local automotive industry. In today's highly competitive global automotive industry, maintaining and enhancing performance requires companies to implement leaner and more efficient systems. Thus, Lean manufacturing strategy was established which focuses on minimizing waste while simultaneously maximizing productivity within manufacturing systems. Standardized work is one of the lean manufacturing techniques which is the basis of the Lean Thinking and Kaizen philosophies. Standardized work comprises three main elements; Takt time, standard work sequence and standard work-in-progress inventory. The purpose of this study is to study the concept lean manufacturing in automotive industry and identify the implementation of lean that have been practice by the organization as well as proposing the standardized work for the organization. This research was performed by an exploratory single case study approach as well as open-ended questionnaire and semi-structured interview techniques with executive industrial engineer who are familiar with the lean manufacturing implementation projects. The chosen case study company for this research is Sime Darby Auto Engineering Sdn Bhd, which is a modular internal combustion engine assembly facility located in Kulim, Kedah. The findings show that this case study company have implemented Value-Added Production System (VPS) which is a BMW production system that is align with lean manufacturing principles and philosophies. They managed to eliminate wastes such as motion and waiting time in the assembly line, that is proven as they have ramp-up 20% increased target volume based in their installed capacity. The findings also show that the case study company have implemented standardized work techniques such as Work Instruction, Root cause analysis, Floor marking standardization, and Digital Dashboards. This study also proposed the case study company an important step to give more visibility to the lean concept by addressing the problem of lack of standard procedure. Consequently, will help the shop-floor and managements to focus their efforts in achieving high performance through effective implementation of standardized work. In order to maintain the reliability of the enhanced case study area, it is strongly recommended that the organization continue to update all current best practice documentation and existing production materials, such as the Standard Work Chart (SWC), Process Flow Chart (PFC), Work Instructions (WI), Standard Work Instructions (SWC).

ABSTRAK

Projek ini adalah kajian mengenai pelaksanaan kerja standard dalam industri automotif tempatan. Mengurus dan meningkatkan kecekapan dalam industri automotif global yang sangat kompetitif hari ini memerlukan syarikat untuk menggunakan sistem yang lebih Lean dan lebih fleksibel. Oleh itu, strategi pembuatan Lean dibentuk yang berfokus pada pengurangan sisa dan pada masa yang sama memaksimumkan produktiviti dalam sistem pembuatan. Kerja standard adalah salah satu teknik pembuatan ramping yang menjadi asas kepada falsafah Lean Thinking dan Kaizen. Kerja standard merangkumi tiga elemen utama; takt masa, urutan kerja standard dan inventori kerja dalam proses standard. Tujuan kajian ini adalah untuk mengkaji konsep pembuatan Lean dalam industri automotif dan mengenal pasti pelaksanaan kurus yang telah dipraktikkan oleh organisasi serta mencadangkan kerja standard untuk organisasi. Penyelidikan ini dilakukan dengan pendekatan kajian kes tunggal yang eksplorasi serta soal selidik terbuka dan teknik wawancara separa berstruktur dengan jurutera industri eksekutif yang biasa dengan projek pelaksanaan pembuatan Lean. Syarikat kajian kes yang dipilih untuk penyelidikan ini adalah Sime Darby Auto Engineering Sdn Bhd, yang merupakan kemudahan pemasangan enjin pembakaran dalaman modular yang terletak di Kulim, Kedah. Hasil kajian menunjukkan bahawa syarikat kajian kes ini telah menerapkan Value-added Production System (VPS) yang merupakan sistem pengeluaran BMW yang selaras dengan prinsip dan falsafah pembuatan Lean. Mereka berjaya membuang sisa seperti pergerakan dan masa menunggu di barisan pemasangan, yang terbukti kerana mereka telah meningkatkan 20% jumlah sasaran berdasarkan kapasiti terpasang mereka. Hasil kajian juga menunjukkan bahawa syarikat kajian kes telah menerapkan teknik kerja standard seperti Work Instruction, Root cause analysis, Standardisasi penandaan lantai, dan Papan Pemuka Digital. Kajian ini juga mengusulkan syarikat kajian kes sebagai langkah penting untuk memberikan lebih banyak penglihatan terhadap konsep kurus dengan mengatasi masalah kekurangan prosedur standard. Oleh yang demikian, akan membantu pihak operator dan pihak pengurusan untuk memfokuskan usaha mereka dalam mencapai prestasi tinggi melalui pelaksanaan kerja piawai yang berkesan. Untuk mengekalkan kebolehpercayaan kawasan kajian kes yang dipertingkatkan, sangat disarankan agar organisasi terus mengemas kini semua dokumentasi amalan terbaik semasa dan bahan pengeluaran yang ada, seperti Standard Work Chart (SWC), Process Flow Chart (PFC), Work Instruction (WI), Standard Work Chart (SWC).

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LIST OF ABBREVIATIONS

Abbreviation	Definition
ASSB	Assembly Services Sendirian Berhad
BMW	Bayerische Motoren Werke AG
CDC	Cell Debugging Checklist
CKTS	Cell Kaizen Target Sheet
CT	Cycle Time
DoBoTech	Dosing and Bonding Technology
EST	Tightening equipment brand
INOKOM	Producer of light commercial vehicles
JIT	Just-in-time
Kaizen	Continuous Improvement
Kanban	Pull system
LACS	Loss Analysis Check Sheet
LM	Lean Manufacturing
MODENAS	Manufacturer of Motorcycles
MRP	Material Requirement Planning
MTB	Malaysian Busses and Trucks
OBC	Operator Balance Chart
OEE	Overall Equipment Effectiveness
PCCS	Production Capacity Check Sheet

Perodua	Perusahaan Otomobil Kedua Nasional
Proton	Perusahaan Otomobil Nasional
PTCS	Periodical Task Check Sheet
SDAE	Sime Darby Auto Engineering Sdn Bhd
SKU	Supplier Kaizen Unit
SMED	Single Minute Exchange of Die
SOP	Standard Operating Procedure
SW	Standardized Work
SWC	Standardized Work Chart
SWCT	Standardized Work Combination Table
TMS	Time Measurement Sheet
TPM	Total Productive Maintenance
TPS	Toyota Production System
VPS	Value Added Production System
VSM	Value Stream Mapping
WI	Work Instructions

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Due to the soaring competition of the markets, companies are now striving to improve their system performance constantly to remain competitive and meet customer requirements. Lean techniques are becoming one of the most effective methods for optimizing manufacturing processes and reduction of waste (Pereira et al., 2016). In this context, the automotive companies have searched for alternative strategies to achieve an advantage in the market and to gain a higher customer interest in order to maintain their place in the market (Elkins, Huang, & Alden, 2004). According to Carpanzano and Jovane (2007), the companies should take a greater asset development as a priority within this context if they are about to improve their competitiveness as an important business sector. Important factors such as improved capacity, technological creativity, delivery times, quality and trained workforce must be considered among the other factors.

As a result, local industry for automotive in Malaysia has shown a rapid development. For instance, Perusahaan Otomobil Nasional (Proton), Perusahaan Otomobil Kedua Nasional (Perodua), Malaysian Busses and Trucks (MTB), a manufacturer of motorcycles (MODENAS) and a producer of light commercial vehicles (INOKOM). The consequence is that the standard of vehicles such as automobiles, bikes, trucks and buses has grown rapidly and reach to world-class quality. The manufacturing companies are always striving to follow the newest advanced technology. Therefore, these organizations aim to search for the finest industrial strategies for their

manufacture areas, including technologies and production systems that can be implemented to their companies (Jaffar, Halim, & Yusoff, 2012).

The most excellent manufacturing exercise should include the manufacturing system and management along with the implementation of the most recent machine and technology. The introduction of lean manufacturing (LM) is a potential improvement technique to address the demands of restoration. Lean provides a set of concepts and tools for operational efficiency, waste management and productivity improvement (Kurilova-Palisaitiene, Sundin, & Poksinska, 2018). As a result, most companies around the world have commonly used the LM techniques. The LM was introduced in Malaysia by Japanese investors in automotive industry such as Toyota, Kayaba and Honda. Nowadays, the local car manufacturers like Proton, Perodua and their vendors also using LM in their business (Jaffar et al., 2012).

The LM tools and techniques is an approach based on team to define and terminate waste by continuously improving material flow regarding non-value additional activities. For example, waiting, storage, transport and other activities. To produce a well ordered, high-standard organizational structure which capable to create final products in the standards that meet consumers requirement without any waste is the LM technique ultimate objective (Nordin, Deros, & Wahab, 2010). This is a generic manufacturing process concept derived by Toyota Production System (TPS) in the Japanese manufacturing sector which was known as 'Lean' in the 1990s (J P Womack, Roos, & Jones, 1990). Most manufacturing companies use LM in various ways and names to suit their market and requirements. Study must be carried out in order to identify LM implementation methods and procedures in manufacturing sector (Muslimen, Yusof, & Abidin, 2013). Therefore, it is essential to adopt methods that boost available capacity, improve productivity in daily production lines and increase the efficiency of machinery and operators.

Standardized work methodology is one of the methods widely used to address this issue, which is the basis of the Lean Thinking and Kaizen philosophies. It is significant to take into account that some of the lean techniques were developed by Ford Motor Company for example, standardization of work technique. In 1913, Henry Ford first used standardized work in his Highland Park in Michigan assembly plant for the automotive industry (J P Womack et al., 1990).

The assembly plant of Ford was the first plant in which each technician had a particular order of tasks within the conveyor or assembly line within a certain space which use dynamic process or flow process known as standardized in other word (El-khalil & Zeaiter, 2015). In the context of manufacturing, standardized work is characterized as the department's recorded and documented visual system given by administration as the primary reference point to the unit of production, mainly for line operators to manage their operations through number of duties (Jaffar et al., 2012). Standardized work provides management with the best guide to train new employees in the best way to perform and eliminate waste in a reliable, effective, efficient and safe way, while ensuring a quality, defect-free and scheduled delivery (Halim et al., 2015).

1.2 Problem Statement

Nowadays, demand from customers and high-quality products are the most important than low costs. In addition, the customer requires good quality, sufficient quantities and on-time delivery. Companies must manage increasing demand efficiently and effectively so that companies can overcome fierce surrounding. So, it is important to manufacture products which have good quality products and satisfy demands of the customers in today's competitive global markets. Quality here are refers to the products' standard to be mass produced and the work need to be done. This initiative may be carried out within existing resources, such as workers, equipment and other facilities.

In order to achieve this, waste management in the automotive industry is very important element in cost reduction and profit growth, and that is increasingly essential. However, the application of lean manufacturing tools and techniques is still low, and they do not know how lean functions in automotive industries although it has many advantages. Therefore, one of the lean tools and techniques which is Standardized Work has become a basic foundation in today's industrial facilities that can influence and improve the work efficiency. To achieve the most efficient standardization of work, it is necessary to properly schedule, and position manpower, methods, materials, machinery, equipment and other production supports and facilities.

Due to the historiographic increase in published LM articles, the fact that most research gaps were identified in recent papers, which are between 2014 and 2016. The research gaps classified in each of the concepts are very interrelated, which means that every concept is one-dimensional and substantially different from the other. Thus, the concepts of research gaps in relation to the Lean approach can be further divided into three groups which are pre-implementation phase, the implementation phase itself, and the post-implementation phase of Lean in the manufacturing sector (Bhamu & Sangwan, 2014). However, the concept of research gaps that describe factors other than the Lean approach, concerns with the company, the country in which the company operates, the diverse management systems available and the research methodology approach.

It is obvious from the above that the concepts of the research gaps mainly related to the Lean implementation phases, rather than the factors outside the Lean approach. This means that it is the Lean approach itself which must first be further studied including its phases, to build a solid Lean system which capable of adapting to all areas. Many writers and experts expressed themselves in the deficiency of literature review studies on LM and encourages the authors to review the literature that focuses on LM's research gaps in a comprehensive manner (Psomas & Antony, 2019).

1.3 Research Objectives

The purpose of this research is to analyze the application of one of the most powerful lean techniques which is standardization of work at Sime Darby Auto Engineering Sdn Bhd. Thus, the main objectives of this research are:

- i) To study the concepts of Lean manufacturing which has been used by the global and local automotive industries around the world.
- ii) To investigate the implementation of Lean manufacturing in local automotive industries.
- iii) To propose and make recommendation of Standardized Work for SDAE to assist the company for effective data collection and analysis.

1.4 Scope of the Study

This research will look into the status of Lean manufacturing application techniques in the local automotive industry especially at Sime Darby Auto Engineering Sdn Bhd throughout their overall modular engine assembly operation. A proposal will be developed to make a recommendation of implementation one of the Lean manufacturing technique which is Standardized Work to the corporation. The application of that lean manufacturing technique will result in standardization of work and it will also result in increased efficiency and process stability in term of productivity, reliability and operator performance.

1.5 Chapter Overview

An overview on background of study is discussed in the first chapter. After the background of the study, problem statement including research gap, project objectives and project scope are followed. This chapter ends with overview of each chapter.

In chapter two, literature review will be discussed. The importance of the lean philosophy and its context, theory and implementation globally and locally. Lean performance and barriers will also be part of this chapter, along with a brief explanation of productivity as an effective tools and techniques. This chapter also emphasized on the literature of standardized work.

Chapter three discusses methodology applied for the project. To accomplish the main objective mentioned in the first chapter it was agreed to perform a case study. The case study method helps the researcher to maintain the comprehensive and relevant aspects of the real life events (Yin, 2009). A case study was conducted in Kulim, Kedah, at one of the local automotive company. An interview was performed using a semi-structured interview and open-ended questions which used to gain information into the state of lean manufacturing and standardized work approach implementation at the case study company.

In chapter four, the data obtained will be analyzed and discussed. There is an observation made in the production area to identify the process related to production and the final product the organization produced. The data regarding to organization's lean manufacturing tools and

techniques implementation will be discussed in detail with previous researcher papers related to the scope of this case study. After that, it followed by discussion regarding to improvement after the organization applying the standardized work approach.

Chapter 5 is the proposal made for the organization to implement standardized work effectively. After the problem is identified, this proposal is established as the guidelines for the organization which discussed the steps towards improvement of implementing standardized work.

Finally, Chapter 6 is the last chapter which the conclusion is made based on the objectives of this study. There are also some recommendations for future improvement of this study and also for the organization.

CHAPTER 2

LITERATURE REVIEW

2.1 Global Competitiveness in Automotive Industries

In the worldwide automotive manufacturing, the economic crisis has regenerated. Based on Mohr et al. (2013) study, the industrial profits were much higher in 2012 (EUR 54 billion) than in 2007 (EUR 41 billion), last year of the pre-crisis era, and upcoming development prospects are much greater. By the year of 2020, worldwide earnings might rise to EUR 79 billion by a further EUR 25 billion. This is positive news, but the advantages are not evenly distributed in every region or in every car type. Certain areas and sections are a lot finer than others instead.

In the last three decades, both the organization and geography of production have undergone major change (Pavlínek, 2017). Geographically, this industry can be classified into Europe (except Russia); North America (Canada, USA, Mexico); Japan and South Korea; BRICs (Brazil, Russia, India, Chinese) and the rest of the world (RoW). Roughly 30% of worldwide earnings were accounted approximately by BRICs and RoW in 2007 and 60% by 2012 (Mohr et al., 2013).

Car manufacturers in Europe face heavy competitive edge that urged them to widen into previous socialist nations of Central and Eastern Europe at the end of the 20th century. Although Western European car manufacturers sustained innovation operation and high-value-added manufacture for themselves, the CEE area fascinated producers with their trained labor, low wages and strong geographical accessibility to Western European Market. Furthermore, Central and