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*MSc Dissertation in
Engineering Business Management*

**LEAN MANUFACTURING IMPLEMENTATION:
A STUDY ON THE DEVELOPMENT OF
KEY PERFORMANCE INDICATORS (KPIs) AT
AN AEROSPACE MANUFACTURING
COMPANY**

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DECLARATION

This dissertation is submitted as part of fulfilment for the award of and MSc degree in

Engineering Business Management

The work is result of my own investigations. All sections of the text and result which have been obtained from others workers are fully referenced. I understand that cheating and plagiarism constitute a breach of University regulations and will be dealt with accordingly.

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Date: 20th August 2007

ABSTRACT

The title of this study is *“Lean Manufacturing Implementation: A Study on the Development of Key Performance Indicators (KPIs) at an Aerospace Manufacturing Company”*. The purpose of this study is to focus on the issue of the KPIs development which is linked to the goal, objective, mission and vision of CTRM Aero Composite Sdn Bhd. The KPIs are targeted to provide this company with a good performance measurement tools in supporting the success of their Lean Manufacturing journey and to be cost-competitive.

The aim of all these efforts is to achieve the company’s expectation of a positive gross profit around 30% of turnover and also a rise in their profit before tax around 5% of turnover.

In this study, a set of KPIs measured both objectively and subjectively are developed through a comprehensive extensive literature (case study reports), internal benchmark activities and best practices benchmark in KPIs implementation process flow by visiting a non – competitor company followed by a two days workshop where company KPIs had been identified and created through brainstorming and group discussions.

The other objective of this study is to learn and investigate the current communication gap at all level by using semi-structure interview and focus group discussion. A standard reporting report was also created to overcome this communications issue by having each person in each level to review and reports their standard operation to their subordinates regularly based on the decided frequency. The outcomes of KPIs implementation was tested in Strategic Development Department (SDD) and Manufacturing Operation B2 Department that have been chosen as the pilot area of the study.

As a company that has been implementing Lean Manufacturing, this study also assess the level of achievement of lean implementation efforts before and after the development of KPIs by using RAG (Red Amber Green) status to see the linkage between them. Subsequently, a new Lean House has also been constructed focusing on the new KPIs so that the lean manufacturing programme will be aligned with it.

Lastly, the significance and the contributions of the study followed by limitations and the recommendations for future works were discussed in the end of this research.

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ABBREVIATIONS

CAR	Correction Action Reports
CQ	Customer Quality
CTRM	Composites Technology Research Malaysia
CTRM AC	Composites Technology Research Malaysia Aero Composites
COGS	Cost of Good Sold
COPQ	Control of Poor Quality
DSAR	Daily Schedule Adherence Reports
EBIT	Earning Before Interest Tax
EBITDA	Earning Before Interest, Taxes, Depreciation and Amortization.
EBM	Engineering Business Management
FLELP	Fixed Leading Edge Lower Panels
FIFO	First In First Out
FTE	Fixed Trailing Edge
F/G	Finished Good
GM	General Manager
HOD	Head of Departments
HOS	Head of Sections
HOU	Head of Unit
HSE	Health Safety Environment
IPC	Individual Performance Contract
IPT	Internal Programme Tracking
IOFLE	Inboard Outer Fixed Leading Edge

JIT	Just In Time
KPIs	Key Performance Indicators
LPO	Lean Promotion Office
LOB	Line of Balance
LTE	Leading and Trailing Edge
MESA	Manufacturing Enterprise Solutions Association
MEP	Manufacturing Extension Partnership
MPS	Master Production Schedule
MC	Management Contract
MQ	Manufacturing Quality
MRP	Material Requirement Planning
MS	Management System
NCR	Non Conformance Reports
NIST	National Institute of Science and Technology
OT	Overtime
PBT	Profit before Tax
PDS	People Development System
PPM	Petronas (Penapisan) Melaka Sdn Bhd
PSR 1	Petronas Secondary Refinery 1
PSR2	Petronas Secondary Refinery 2
R&D	Research and Development
SDD	Strategic Development Department
SMED	Single Minute Exchange of Die
SMT	Self Management Team

SQ	Supplier Quality
TNA	Training Need Analysis
TPM	Total Productivity Maintenance
TPS	Total Production System
UK	United Kingdom
US	United Stated
UTeM	Universiti Teknikal Malaysia Melaka
VSM	Value Stream Mapping
WIP	Work In Progress

CHAPTER I

INTRODUCTION

1.1 Introduction

The aim of this study is to focus on the issue of development of Key Performance Indicators (KPIs) which needs to link to the goal and objective of the company. All elements in the selected Key Performance Indicators (KPIs) will be defined. The Key Performance Indicators (KPIs) are targeted to provide CTRM Aero Composite Sdn Bhd which is one of the leading aerospace and manufacturing company in South East Asia, a good performance measurement tools in supporting the success of their Lean Manufacturing journey and to be cost-competitive.

This chapter begins with an overview of the study and then proceed with discussions of the problem statement, objectives, scopes, problem faced, the significances and research methodology for this study. Finally, the organisations of the remainder of this thesis are presented.

1.2 Overview of the study

The growing of global competition have made businesses around the world more difficult and complicated than before. Every company have tried to search for a solution to make them survive and for making their business remain successful and being competitive.

For manufacturing companies, it has become more complex and complicated. To make them survive in this competition, companies have been struggling to improve their streamline business process, inventories, cycle times and factors related to cost. Factors

related to cost involves reducing the manufacturing costs, strengthen relationships with the suppliers, offering variety of product and most importantly to reduce the response time to their customer needs and expectations. It has been estimated that almost 50% of manufacturing costs are attributed to purchase items, the raw material account for 80% of a finished product's lead time and 30% of its quality problems (Willis & Huston, 1990 and Doolen et.al, 2006). All of these are actually driven by the economic needs. Moreover, if that manufacturing company manage to be successful and competitive to overcome all of these problems, it will bring them more customer demands.

However, many manufacturing companies nowadays are in different situation. They have problem such as too much inventories, not as a competitive as before, losing the market share and unable to cater to the customers' needs on time.

Therefore, many manufacturing companies try to search for a system that can make their process more effective to overcome these problems. Over two decades there have been numerous manufacturing "revolutions", accompanied by clarion calls for universal adoption of some new paradigm such as Manufacturing Resources Planning (MRPII), Just in Time (JIT), Optimized Production Technology/Theory of Constraints (OPT/TOC), Flexible Manufacturing Systems (FMS), Total Quality Management (TQM), Lean Manufacturing, Agility, Time –Based Competition (TBC), Quick Response Manufacturing (QR/QRM) and Business Process Re-Engineering (BPR) (MacCarthy & Wilson, 2001). One of the alternatives that have been implemented by Composites Technology Research Malaysia Sdn Bhd (CTRM) Aero Composites is the implementation of Lean Manufacturing, which means waste elimination.

1.2.1 Lean Manufacturing

Lean manufacturing has been introduced by Womack (Womack et.al, 1990). In this book, it describes the TPS (Toyota Production System) which was developed by Eiji Toyoda and Taiichi Ohno at Toyota Motor Company in Japan. Taiichi Ohno, one of co-developers of the Toyota Production System; according to Kilpatrick,(2003) have suggested that “waste accounts for nearly 95% of all costs” and that is why Lean Manufacturing is practised to reduce the non-value added activities produced by an organization or factory (Comm & Mathaisel, 2005). In other words, it can be said that the philosophy of Lean Manufacturing can be illustrated by using Toyota Production System as an example (Burcher et.al, 1996).

The reason for the term ‘lean’ is majority of all activities are doing less compared to mass production techniques such as deducting half of the labour hours, factory space and tooling investment (Burcher et.al, 1996). New products can also be developed by using less engineering hours. This principle is not only successfully applied in automotive industry but also in other sectors, including aerospace industry (across Europe and North America) (Haque & Moore, 2004). All of these reasons make Composites Technology Research Malaysia Sdn Bhd (CTRM) choose lean as a drive to be competitive.

Composites Technology Research Malaysia Sdn Bhd (CTRM); is one of the leading aerospace and manufacturing company in South East Asia. Located at Batu Berendam Malacca, Malaysia, CTRM productions are running based on Make to Order. Most of the processes are still using manual operation. CTRM AC Sdn Bhd as a subsidiary company of CTRM have established a Lean Promotion Office (LPO) to promote Lean Manufacturing culture as company wide activities and to monitor all lean activities in production floor and report the progress to top management. The main tasks of LPO are

to promote lean tools for wide company acceptance to drive cost reduction. In addition, LPO which is under Strategic Development Department (SDD) is responsible to organize internal lean manufacturing training and workshop in terms of principles, basic approach, tools and techniques, 7 wastes based on quality, cost, delivery, accountability and continuous improvement targets.

Actually, even though CTRM AC Sdn Bhd already had two years experience in implementing lean manufacturing in their operation system, they still had major obstacle in Lean Manufacturing implementation. For example, they had difficulty in implementing Lean Manufacturing effectively as well as to improve overall efficiency and to be cost competitive. Therefore, after a discussion between the top management of CTRM AC Sdn Bhd with author's employer, UTeM (Universiti Teknikal Malaysia Melaka), both parties agreed to have a project carried out under MoA (Collaborative Research and Development) between UTeM and Aerospace Component Manufacturer (CTRM AC Sdn Bhd). This collaboration project is focussed on four main areas i.e. a study on Lean Training and Education, a study on Lean Tools Applications and Effectiveness, a study on Value Stream Mapping (VSM) and also on development of Key Performance Indicators (KPIs).

However, as one of the project members that had been attached in CTRM, author will only emphasize on the details of developing KPIs. It will be carried out as the author's research as a fulfilment for the award of MSc degree in Engineering Business Management (EBM).