CRITICAL SUCCESS FACTOR AND BARRIERS IN IMPLEMENTATION OF TOTAL PRODUCTIVE MAINTENANCE

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ABSTRACT

Total Productive Maintenance (TPM) focuses in improving machine availability, machine performance efficiency and quality rate which can be key tool for manufacturing companies to survive intense global competition. Poor machine maintenance will lead increase in machine down time that affect the organization's performance in meeting customer requirement in term of product quality and quantity while increasing the operating and maintenance cost. The purpose of this research is to examine the role of critical success factor in TPM implementation adopting three tools of TPM. It is seen as a solution to increasing machine breakdown at Heimann Sensor Packinging Sdn. Bhd. that caused struggle in meeting customer demand. Besides that, barriers which act as challenges of the TPM implementation also evaluated. Data collected through questionnaire distributed face-to-face to the employees involve in TPM implementation. Regression used to study the relationship between critical success factor and TPM tools performance. Total 108 respondents participated in this survey with 100% response rate. Top management commitment, resources management, work culture and involvement are the critical success factors studied but the analysis proved that only top management commitment, resources management and training and education the critical success factor that enhance the TPM tools performance. TPM tools performance are indicated by autonomous maintenance, planned maintenance and focused maintenance. Resistance to change, improper tooling and poorly managed maintenance data are the barriers identified that need to be addressed during TPM implementation. Implementation of TPM improved the manufacturing performance in overall. As TPM implementation is long term mission measuring TPM tools performance instead of taking big leap to measure OEE during implementation stage will be an effective way to successfully implement TPM.

ABSTRAK

Total Productive Maintenance (TPM) meningkatkan kesediaan mesin untuk beroperasi, meningkatkan prestasi produksi dan kadar kualiti. Ia merupakan satu cara untuk industri pembuatan meningkatkan daya saing mereka di peringkat antarabangsa. Penyelenggaraan mesin yang lemah akan menyebabkan organisasi menghasapi masalah untuk memenuhi pelanggan dari segi produktivi and kualiti. Kajian ini bertujuan kajian untuk mengkaji peranan faktor kritikal kejayaan dengan mengamalkan tiga unsur TPM di Heimann Sensor Packaging Sdn. Bhd. Dimana ianya menhadapi masalah dalam memenuhi permintaan pelanggan disebabkan operasi mesin yang sentiasa tergendala, Selain itu, halangan yang bertindak sebagai cabaran pelaksanaan TPM juga dinilai. Maklum balas yang diperoleh daripada kakitangan yang therlibat dalam perlaksanaan TPM melalui soal selidik yang diagihkan Hubungan antara faktor kritikal kejayaan dengan prestasi unsur TPM dianalisis megunakan regression. Seramai 108 orang telah menyertai soal selidik ini dengan memberikan 100% kadar balas. Analisis membuktikan bahawa kommitmen daripada pihak pengurusan, pengurusan sumber serta latihan dan pendidikan merupakan faktor kritical kejayaan yang meningkatkan prestasi unsur TPM menyingkirkan faktor kritical budaya kerja dan penglibatan. Rintangan kepada perubahan, alatan perkakas yang tidak sesuai, pengurusan data penyelenggaran yang kurang baik merupakan halangan yang harus di pertimbangkan semasa perlaksanaan TPM. Ia adalah sangat efektif untuk mengukur prestasi unsur TPM di peringkat awal perlaksanaan sebelum mencapai OEE memandangkan perlaksanaan TPM memerlukan jangka masa yang panjang.

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LIST OF ABBREVIATIONS

AM	Autonomous Maintenance
BM	Breakdown Maintenance
CM	Corrective Maintenance
CMMS	Computerized Maintenance Management System
CSF	Critical Success Factor
MP	Maintenance Prevention
OEE	Overall Equipment Effectiveness
PdM	Predictive Maintenance
PM	Preventive Maintenance
PrM	Productive Maintenance
RCM	Reliability Centered Maintenance
SOP	Standard Operating Procedure
TPM	Total Productive Maintenance

CHAPTER 1

INTRODUCTION

1.1 Background of Study

According to Ahuja and Khamba (2008a), over the time manufacturing industry had changed significantly whereby, superior competition can be seen in term of low cost, better quality and diversified product with excellent performance. Globally manufacturing industry facing intense competition as customer demands had increased which was effect of competition on supply that heightened volatility in customer requirements. This stiff competition put manufacturing organization under great pressure to continuously improve by reducing cost and adding value to the customer. High quality, lower cost and innovativeness by research and development (R&D) are the key for organization to survive in business. The focus to achieve shorter lead time, innovation and reducing inventories lead to increase in demand on organization's preparedness, adaptability, versatility and flexibility (Ahuja and Khamba, 2008b). Mostly, down times caused by corrective maintenance are costly compare to downtime cost of preventive maintenance but, maintenance department receives fewer resources for preventive maintenance. This is because maintenance is seen as cost driving necessity than as a role player to increase competitiveness of the organization. Moreover, to any failure on machine can lead to increase in downtime then lost of production output and customer dissatisfaction. (Salonen and Bengtsson, 2011).

Manufacturing has been one of the important sectors that contribute to Malaysian economy. Based on Economic report 2016 / 2017 by Ministry of Finance on gross domestic product by kind of economic activity at constant 2010 prices, manufacturing had been second major sector contributor for Gross Domestic Product in Malaysia over 5 years next to service sector. Thus, it is every essential to focus on further improving the manufacturing sector which contributing our country economy. Figure 1.1 shows the Gross Domestic Product by kind of economic activity at constant 2010 prices from year 2013 to year 2017.

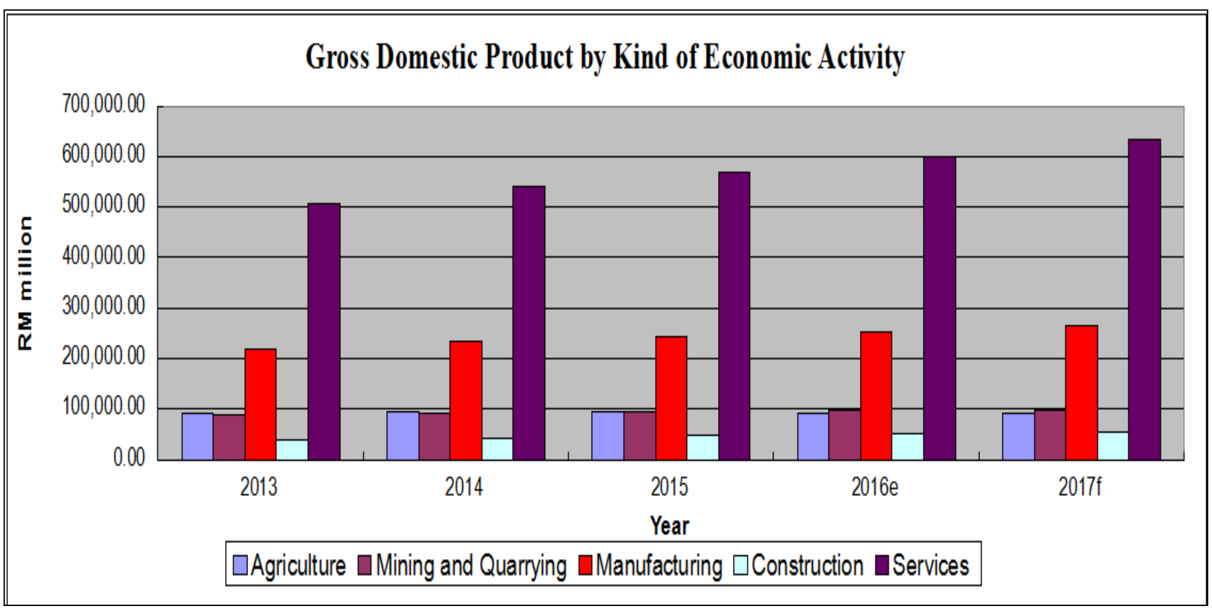

Figure 1.1 Gross Domestic Product by kind of economic activity (Website Department of Statistics and Ministry of Finance, Malaysia)

In recent years, changes in production management concept and pressing competitive pressures had increased awareness on importance of reliable production machines. Besides that, executives in manufacturing organization aims to achieve world class status which emphasis on increasing equipment availability and utilization, utilization of resources, productivity of machines, improvising quality and maintenance service's responsiveness. (Ahuja and Khamba, 2008c).

In modern manufacturing industries role of maintenance are becoming significant that companies want the maintenance to be a business element that generates profits. It is common that, maintenance cost is bigger part of any operational budget while 30 percent of total manpower of a manufacturing will belong to maintenance and operation department (Jain *et al.,* 2015). Total Productive Maintenance (TPM) is a manufacturing program that maximizes the effectiveness of machine over lifespan of the machine by involvement of overall workforce. By improving employees' skills and enhancing technology of equipment TPM will improve the technological base of the company. Besides that, TPM also plays role in improving capability of the organization by enabling cross functional learning and improving individuals' problem-solving skills (Ferrari *et al.*, 2002).

1.2 Statement of Problem

Total Productive Maintenance is a machine maintenance tool or practice that improves and increases overall equipment effectiveness with to involvement of everyone in the organization. In other word, increasing overall equipment effectiveness is improving machine availability for production, performance efficiency and also the quality rate.

In Heimann Sensor Packaging Sdn. Bhd., various machine related issues had increased overall machine downtime which led to drop in production performance. Higher machine breakdown and longer model conversion time are the main reason for increase in overall machine downtime. Increasing machine breakdown had affected daily production planning where else, longer model conversion time had reduced production's daily output.

Moreover, all the maintenance department personnel are always busy repairing the machine or doing model conversion with no time to analyze the machine problem and take improvement actions. This had caused arising quality issues and poor utilization of machine capacity like operating the machine in slower speed than the ideal speed.

To compensate poor machine conditions effecting production performance, company had to arrange overtime for the workers on weekend to meet the on-time delivery. Company had to run 24/7 due to the overtime and it incur increase in operating cost and also had caused fatigue among worker.

Data collected from management review meeting of Heimann Sensor shown in Figure 1.2. It shows that major breakdown (the machine down more than 24hrs) are increasing above the allowable major machine breakdown from September 2015. One case of major breakdown is allowable as the impact of it can be managed by transferring the production plan to back up machine. The graph shows that average down time also increasing above the target down time from August 2015. At the same time the overtime overlimit also increasing drastically from August 2015. The data shows that, increase in major machine breakdown and machine downtime had led to increase in overtime overlimit.

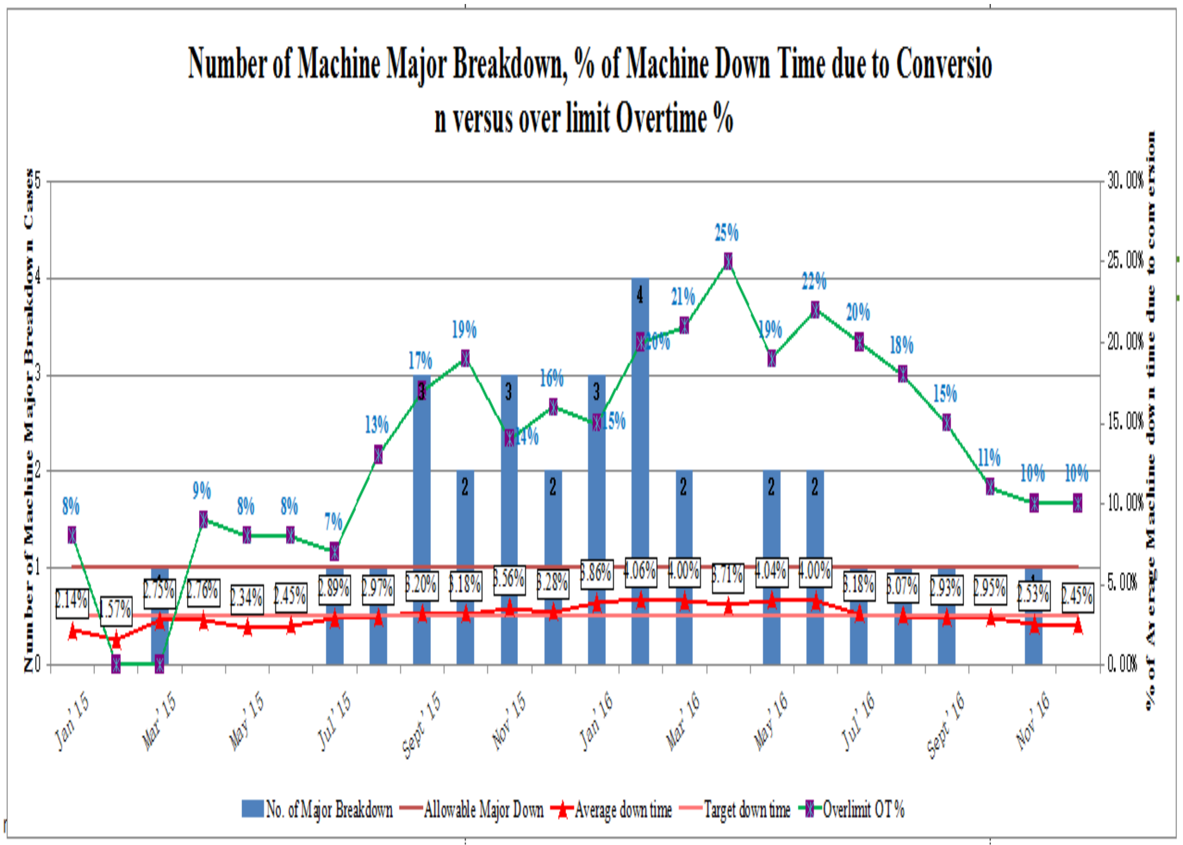

Figure 1.2 Number of machine major breakdown, % of machine down time due to conversion versus over limit overtime percentage.

To find solution for this pressing problem management decided to implement Total Productive Maintenance (TPM). Adopting TPM practices will improve machine utilization, increase performance and also quality while reducing the wastage. The strategies of this implementation are utilizing three pillars which are autonomous maintenance, planned maintenance and focused maintenance by enhancing critical success factors. Overcoming the barriers of the new implementation will be the challenge faced by the company.

1.3 Purpose of the Study

The purpose of this study is to examine critical success factor influences the initiation of Total Productive Maintenance implementing Autonomous Maintenance, Planned Maintenance and Focused Maintenance and overcome the barrier of TPM implementation.

1.4 Research Question

Research question of this study is developed to guide through the research by focusing on the purpose of the research.

The research questions of this study are;

i. What are the critical success factors in implementation of TPM?

ii. What is the relationship between critical success factor of TPM implementation and TPM tools performance?

iii. What are the barriers that affect implementation of TPM?

1.5 Research Objective

In order to achieve the aim of research, several objectives are stated as below;

i. To identify the critical success factors in implementation TPM.

ii. To examine the relationship between critical success factor of TP implementation and TPM tools performance.

iii. To verify barriers that affect implementation of TPM.

1.6 Scope of the study

The research on implementation of TPM through Autonomous Maintenance, Planned Maintenance and Focused Maintenance by enhancing the critical success factor and overcoming barriers carried out at Heimann Sensor Packaging Sdn Bhd. Heimann Sensor Packaging Sdn Bhd (HSPM) is a German base infrared thermopile sensor manufacturing company located at Senai, Johor. The respondents, who are employee of the organization involved in TPM program. The research data collected and analyzed based on questionnaire distributed.

1.7 Significant of Research

Based on Bartz et al., (2014), the maintenance system should operate effectively so that production can run smoothly with lower cost and be profitable without wastages. As large investments are made to generate profit to the organizations managing equipment maintenance plays an important role to sustain the operations of equipment. According to Jain et al., (2015), today the high quality of the product is playing a vital role to satisfy customer's needs, which can be attained by adopting a good maintenance strategy to maintain machines on the shop floor. This is because when machines are reliable to produce goods of higher quality than the customer will automatically satisfy.

In manufacturing, the primary concern is machines not operating at their desired capacities when needed due to disruptions caused by machine failures. The consequences are low productivity, production planning complication, intemperate inventory buffering, and escalating production costs (Chong, et al., 2012). The best way to overcome this problem is by implementing Total Productive Maintenance (TPM). To reduce machine downtime, production losses and producing reject parts TPM will be an effective tool whereby it will enhance the productivity of the employees and also equipment (Jain et al., 2014).

For a successful implementation of TPM all the critical success factors are need to be identified. Enhancing role of the CSF contribute for success of the implementation. The circumspection of TPM has laid down a set of principles or tools called pillars. The definition of the pillars is varied and personalized according to company requirements. Whereby, The TPM model proposed by Nakajima only has five pillars but the one by Suzuki presented TPM models with eight pillars (Chong, et al., 2012). In this study, the

TPM implementation studied using basic tools. The strategy of incorporating 3 TPM pillar by enhancing the role of critical success factor with the consideration of challenges faced during the implementation are key of this study.

Maintenance function need to be considered as essential element that saves cost and create competitive advantage by manufacturing organizations. As maintaining the equipment's are crucial TPM implementation can give positive inclination towards company by improving equipment effectiveness, productivity and work efficiency of all employees. To compete in global markets SMEs should adopt TPM implementation practices (Jain et al., 2014). Thus, focusing on autonomous maintenance, planned maintenance and focused maintenance will be an effective way for a small company to adopt TPM.

1.8 Operational Definition

1. TPM – Total Productive Maintenance

   Machine maintenance concept or practice that improves and increase overall equipment effectiveness with involvement of everyone in the organization.

2. CSF – Critical Success Factor

   Important factors that identified assisting in realizing required purpose.

3. AM – Autonomous Maintenance

   Operators carry out simple maintenance task for the machines they operate.

4. OEE – Overall Equipment Effectiveness

   Total usability of a machine inclusive of availability of the machine to production, performance efficiency (speed of the machine or output of the machine) and quality rate (error free product).

5. SOP – Standard Operating Procedure

   A written guideline of method to carry out any specific work.

6. BM – Breakdown Maintenance

   Repair work that carried out after stoppage or failure of equipment.

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