

**MAINTENANCE MANAGEMENT PERFORMANCE
OF MALAYSIAN PALM OIL MILLS**

NAZIM BALUCH

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OF MALAYSIAN PALM OIL MILLS**

By

NAZIM BALUCH

**Thesis Submitted to
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CERTIFICATION OF THESIS

“I hereby verify that this thesis is my own work except for those reviews for which I have discussed the sources”

09 August 2012

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ABSTRACT

Performance of an organization should be appraised simultaneously, both in terms of its efficiency in resource utilization process and effectiveness in realizing the pre-determined goals. Measuring performance provides the required information to the management for effective decision making and is used by industries to assess progress against set goals and objectives in a quantifiable way. Deficient maintenance management can severely affect competitiveness of an organization by reducing throughput, increasing inventory, and leading to poor performance. Applying Overall Equipment Effectiveness, this research study, has evaluated maintenance management performance in Malaysian palm oil mills, highlighted how it helps to identify the factors causing poor performance and demonstrates how to improve and perpetuate company's productivity, profits, and sustainability by adopting world class maintenance strategies such as Total Productive Maintenance. This research study supplicated data by mail survey questionnaire sent to all Malaysia palm oil mills, validated data through triangulation, and analyzed using descriptive statistics. The research exalts practitioner's perspective and has determined that Scientific Management Theory axioms and Total Productive Maintenance principles are not being applied to optimize productivity in palm oil mills. The research also identified theory and practice gaps pertinent to maintenance management in palm oil mills and provided shop-level solutions to bridge those gaps. Research findings established how efficient and effective maintenance management offers, besides substantial cost savings, a wide scope of improvements for the palm oil industry. In order to ensure competitiveness and sustainability in the 21st century, it is obligatory for Malaysian palm oil mills to adopt best management practices in processing, manufacturing and maintenance.

Key Words: Maintenance management, Total Productive Maintenance, Measuring performance, Overall Equipment Effectiveness, Scientific Management Theory

ABSTRAK

Prestasi sesebuah organisasi perlu dinilai secara serentak, kedua-duanya dari segi kecekapan dalam proses penggunaan sumber dan keberkesanan dalam merealisasikan matlamat yang telah ditentukan. Pengukuran prestasi memberi maklumat yang diperlukan kepada pihak pengurusan untuk pembuatan keputusan yang berkesan dan ia digunakan oleh pihak industri untuk menilai pencapaian berbandingkan matlamat dan objektif yang ditetapkan dengan cara yang boleh diukur. Pengurusan penyelenggaraan yang lemah boleh menjejaskan daya saing sebuah organisasi dengan mengurangkan pengeluaran, meningkatkan inventori, dan menyebabkan prestasi yang merosot. Dengan menggunakan Keberkesanan Peralatan Keseluruhan, kajian penyelidikan ini telah menilai prestasi pengurusan penyelenggaraan dan menengahkan cara ia boleh membantu mengenal pasti faktor yang menyebabkan prestasi yang lemah dan memberi peluang untuk mengekalkan dan meningkatkan produktiviti, untung, dan kelestarian sebuah syarikat dengan mengguna pakai strategi penyelenggaraan bertaraf dunia seperti Penyelenggaraan Produktif Keseluruhan. Kajian telah memperolehi data melalui borang soalselidik yang dihantar kepada semua kilang minyak sawit di Malaysia, mengesahkan data melalui penyegitigaan, dan menganalisis data menggunakan statistik deskriptif. Penyelidikan ini meninggikan perspektif pengamal dan telah menentukan bahawa teorem Teori Pengurusan Sainifik dan prinsip Penyelenggaraan Produktif Keseluruhan tidak dilaksanakan untuk mengoptimumkan produktiviti di kilang minyak kelapa sawit. Kajian ini telah mengenal pasti jurang antara teori dan amalan yang penting untuk pengurusan penyelenggaraan di kilang minyak kelapa sawit dan menyediakan penyelesaian tahap-kedai untuk merapatkan jurang tersebut. Penemuan penyelidikan telah menunjukkan bagaimana pengurusan penyelenggaraan yang cekap dan berkesan boleh memberi, selain penjimatan kos yang besar, penambahbaikan dalam skop yang agak luas bagi industri minyak sawit. Bagi memastikan daya saing dan kelestarian industri minyak kelapa sawit di abad ke-21, ianya satu kewajipan untuk kilang minyak sawit di Malaysia menerima pakai amalan pengurusan terbaik dalam pemprosesan, pembuatan, dan penyelenggaraan.

Kata Kunci: Pengurusan Penyelenggaraan, TPM, OEE, SMT



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LIST OF ABBREVIATIONS

ABI	American Business Institute
ABAC	Asia Business Advisory Council
ADB	Asian Development Bank
AGVs	Automated Guided Vehicles
AIA	American Institute of Accountants
AICPA	American Institute of Certified Public Accountants
APEC	Asia Pacific Economic Cooperation
APOC	American Palm Oil Council
BDM	Break Down Maintenance
BOD	Biochemical Oxygen Demand
CBM	Condition Based Maintenance
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CI	Continuous Improvement
CIMA	Chartered Institute of Management Accountants
CM	Corrective Maintenance
CMMS	Computerized Maintenance Management System
CO ₂	Carbon Dioxide
CPKO	Crude Palm Kernel Oil
CPO	Crude Palm Oil
CSR	Corporate Social Responsibility
DCS	Distributed Control Systems
DV	Dependent Variable
EFB	Empty Fruit Bunch
EPD	Environment Protection Department
ERV	Equipment Replacement Value
ETP	Economic Transformation Program
EU	European Union
EU-RED	European Union Renewable Energy Directive
FAO	Food and Agriculture Organization
FBM	Failure Based Maintenance
FDI	Foreign Direct Investment
FELCRA	Federal Land Consolidation & Rehabilitation Authority
FELDA	Federal Land Development Authority
FFB	Fresh Fruit Bunch
FMEA	Failure Mode Effect Analysis
FMS	Flexible Manufacturing Systems
FRBD	Federal Reserve Bank Dallas
GAP	Good Agricultural Practices
GE	General Electric
GHG	Green House Gas
GMO	Genetically Modified Organism
GRI	Global Reporting Initiative
HACCP	Hazard Analysis Critical Control Points

HSE	Health Safety & Environment
ICAS	Institute of Chartered Accountants of Scotland
ICM	Integrated Crop Management
ICT	Information & Communication Technology
IEC	International Electro-technical Commission
ILO	International labour Organization
IPM	Institute of Personnel Management
ISO	International Organization for Standardization
IT	Information Technology
IV	Independent Variable
JIPM	Japan Institute of Plant Management
JIT	Just in Time
KPI	key Performance Indicator
LCC	Life Cycle Costing
LED	Light Emitting Diodes
LM	Lean Manufacturing
LTP	Long Term Program
MACC	Malaysian Anti Corruption Commission
MCC	Milling Certificate of Competency
MDG	Millennium Development Goal
MESA	Maintenance Engineering Society of Australia
MFF	Mesocarp Fruit Fiber
MIAC	Malaysian International Aerospace Centre
MIDA	Malaysian Industrial Development Authority
MIER	Malaysian Institute of Economic Research
MMIS	Maintenance Management Information Systems
MMPM	Maintenance Management Performance Model
MPM	Maintenance Performance Measurement
MPOA	Malaysian Palm Oil Association
MPOB	Malaysian Palm Oil Board
MPOC	Malaysian Palm Oil Council
MQA	Malaysian Qualification Agency
MRO	Maintenance Repair & Overhaul
MTBF	Mean Time between Failures
MTTR	Mean Time to Repair
MV	Moderating Variable
NEM	New Economic Model
NGO	Non Governmental Organization
NKEA	National Key Economic Areas
O&M	Operations & Maintenance
OA	Operational Availability
OEE	Overall Equipment Effectiveness
OEM	Original Equipment Manufacturers
OER	Oil Extraction Rate
OLE	Overall Labour Efficiency
OPIEJ	Oil Palm Industries Economic Journal

O&R	Operations & Reliability
OR	Operations Research
PAM	Physical Asset Management
PKS	Palm Kernel Shells
PM	Preventive Maintenance
POME	Palm Oil Mill Effluent
POMTEC	Palm Oil Mill Technology Center
PORIM	Palm Oil Research Institute of Malaysia
PORLA	Palm Oil Registration and Licensing Authority
QOS	Quality Operating Systems
R&D	Research and Development
R&M	Reliability and Maintainability
RAV	Replacement Asset Value
RCM	Reliability Centered Maintenance
RF	Radio Frequency
RISDA	Rubber Industry Small Holders Development Authority
ROI	Return on Investment
RONA	Return on Net Assets
RPGDC	Remote Power Generating Diagnostics Centre
RSPO	Roundtable Sustainable Palm Oil
SALCRA	Sarawak Land Rehabilitation & Consolidation Authority
SCM	Supply Chain Management
SKU	Stock Keeping Unit
SLDB	Sabah Land Development Board
SME	Small & Medium Enterprises
SMI	Small & Medium Industries
SMT	Scientific Management Theory
SS	Six Sigma
TBL	Triple Bottom Line - People, Planet, Profit
TEEP	Total Equipment Effectiveness Performance
TOC	Theory of Constraints
TPM	Total Productive Maintenance
TQM	Total Quality Management
TSS	Total Suspended Solids
UBM	Use Based Maintenance
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment & Development
UNEP	United Nations Environment Program
USA	United States of America
USDA	United States Development Agency
USDOC	United States Department of Commerce
USITC	United States International Trade Commission
VBM	Vibration Based Maintenance
WCM	World Class Manufacturing
WO	Work Order

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Introduction to the Study

Management is obliged to measure performance of their organizations for effective decision making to ensure sustainable profits. This research study espousing practitioner's perspective will employ Overall Equipment Effectiveness (OEE), key performance indicator (KPI) of Total Productive Maintenance (TPM), to evaluate maintenance management performance in Malaysian palm oil mills and accent poor performance stimulating determinants. The study will discuss moderating effects of maintenance strategy, TPM, to improve palm oil mills' productivity, profits, and sustainability. Adopting world class maintenance strategy, TPM, would enable to establish palm oil sectors' competitiveness in the 21st century.

1.2 Background

1.2.1 Strategic Importance of Maintenance

Intense competitive pressure is triggering many companies to look for every possible source of competitive advantage. To achieve this, the ingenuity of each company lies in understanding the potential of each function – say, for example, manufacturing or maintenance. Once understood, it requires a proper strategy to exploit such potential. Strategy at any level, say at a business and functional level will provide the company with a sense of direction, integrity and purpose (Pintelon, Pinjala, & Vereecke, 2006). Tsang (2002) reported that maintenance plays a vital role in any organization using machinery and should be incorporated into an organizations' business model.

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