

[Type here]

Optimizing Fuel Management in Coal Mining: A Digitization at PT. XYZ

By

M. DIDIK SURYADI
22352002

MASTER'S DEGREE
in

ENGINEERING MANAGEMENT
MASTER OF MECHANICAL ENGINEERING



SWISS GERMAN UNIVERSITY
The Prominence Tower
Jalan Jalur Sutera Barat No. 15, Alam Sutera
Tangerang, Banten 15143 - Indonesia

July 2024

STATEMENT BY THE AUTHOR

The author states that this thesis, "Optimizing Fuel Management in Coal Mining: A Digitization at PT. XYZ," is my own work and has not been submitted for other degrees or qualifications. I hereby declare that this submission is an entirely original work of mine, with the exception of any passages where appropriate credit is given in the thesis. It also contains no material that has been previously published or written by someone else, nor does it contain any material that has been substantially accepted for the award of any other thesis at any educational institution.

M. Didik Suryadi

Student

Date

Approved by:

Assoc. Prof. Dr. Ir. Henry Nasution, M.T., IPP

Thesis Advisor

Date

Dr. Ir. Gembong Baskoro, M.Sc., IPU

Thesis Co-Advisor

Date

Dr. Ir. Maulahikmah Galinium, S.Kom., M.Sc

Dean

Date

ABSTRACT**Optimizing Fuel Management in Coal Mining: A Digitization at PT. XYZ****By****M. Didik Suryadi, S.Pd.T****Assoc. Prof. Dr. Ir. Henry Nasution, M.T., IPP, Advisor****Dr. Ir. Gembong Baskoro, M.Sc., IPU., Co-Advisor****SWISS GERMAN UNIVERSITY**

The production of coal in Indonesia exceeded the target of 694 million tons in 2023, with 766.95 million tons produced, according to the Ministry of Energy and Mineral Resources. However, as a contractor, PT. XYZ has been compelled to be efficient in its operating activities due to market uncertainties and changes in coal prices, particularly with regard to diesel fuel expenses, which make up 19.7% of total costs. Since PT. XYZ's fuel management system does not currently use a digital system, inaccuracies in recording and inefficiencies may occur. The objective of this study is to digitize the fuel management process in order to decrease fuel working losses from -0.65% to -0.40% and enhance the accuracy of the fuel usage records. This research is significant because it provides the mining contractor industry with an improved fuel management system, raises the standard of the fuel management system, increases the accuracy of the company's financial statements, and reduces losses from unnecessary spending. Three research topics are being addressed: how to build a system that enhances PT. XYZ's management of diesel fuel; how to adopt digitization to increase recording accuracy; and how to reduce fuel working losses associated with digital transformation.

Keywords: Fuel, Diesel, Fuel Management, Digitization, Accuracy, Working Losses, Coal Mining, Digital Transformation.

© Copyright 2024
by M. Didik Suryadi
All rights reserved

DEDICATION

To Allah SWT

My Lovely wife, Dewi Nurjanah, and
My Wonderful Daughter, Kayla Almira Hafizah, Nayla Aulia Azzahra

My Parent :
Mardjuni and Sumiyati, Gito Suparno and Suwarti

Younger Sister :
Ratna Andika Safitri and Rianes Thoharini

ACKNOWLEDGEMENTS

In the name of Allah, the Most Gracious, the Most Merciful, I am grateful to Him that, with His blessings, I was able to complete this thesis on time. I would also like to thank my family, my wife and children, my parents, and my sister, who have provided moral support to keep me motivated and fighting to complete this thesis. I would also like to express my deep gratitude to my advisor, Assoc. Prof. Dr. Ir. Henry Nasution, M.T., IPP, and my co-advisor, Dr. Ir. Gembong Baskoro, M.Sc., IPU, who have taken the time to guide and assist me in completing this thesis. Without their guidance and help, I am sure I would have encountered many problems in finishing this thesis. Finally, I would also like to thank my friends who have helped me throughout the process of completing this thesis. I pray that Allah SWT will repay all the kindness you have shown. Thank you.

TABLE OF CONTENTS

STATEMENT BY THE AUTHOR.....	2
ABSTRACT	3
DEDICATION	5
ACKNOWLEDGEMENTS	6
LIST OF FIGURES	9
LIST OF TABLES.....	10
CHAPTER 1 - INTRODUCTION	11
1.1. Background.....	11
1.2. Research Problems	14
1.3. Research Objectives	15
1.4. Significance of Study	15
1.5. Research Questions	15
1.6. Hypothesis	15
CHAPTER 2 - LITERATURE REVIEW	16
2.1. Fuel Management.....	16
2.1.1 Transportir.....	18
2.1.2 Stock Taking	19
2.1.3 Refueling.....	21
2.1.4 Financial Report	21
2.2. Fuel Cost.....	23
2.2.1 Cost.....	23
2.2.2 Fuel Cost.....	23
2.3. Fuel Losses	24
2.3.1 Losses	24
2.3.2 Supply loss/transport loss	24
2.3.3 Working loss	24
2.4. Lead time posting/ time to record diesel fuel usage in the system	25
2.5. Waste and Type of Activity	25
2.5.1 Value Stream Mapping	29
2.5.2 Root Cause Analysis.....	30
2.6. Six Sigma.....	32
2.7. Digitization	34
2.8. Previous Research.....	35

CHAPTER 3 - RESEARCH METHODS	41
3.1. Study Limitation	41
3.2. Research Design.....	41
3.3. Research Program	42
3.4. Research Framework.....	43
3.5. Solution Approach for Fuel Management System by DMAIC Method	44
3.6. Time Frame Of Research.....	46
CHAPTER 4 – RESULTS AND DISCUSSIONS	47
4.1. Find the Problem and Objective	47
4.2. Data Analysis	48
4.3. Root Cause Analysis	51
4.4. Problem Solutions	61
4.5. Develop System	64
4.5.1 System Design.....	64
4.5.2 Technology Selection	65
4.6. Implementation & Verification.....	67
4.6.1 Implementation Plan.....	67
4.6.2 Implementation	68
4.6.3 Evaluation and Standardization.....	84
CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS.....	91
5.1. Conclusions.....	91
5.2. Recommendations	92
GLOSSARY	93
REFERENCES	94
CURRICULUM VITAE	97

LIST OF FIGURES

Figure 1.1. Realization of production and sale of coal (https://modi.esdm.go.id/)	11
Figure 1.2 Percentage Cost of Revenue (Financial Report PT.XYZ 2023)	12
Figure 2.1 Diesel Fuel Management Concept	16
Figure 2.2 Fuel Truck Transportir	19
Figure 2.3 Cause and Effect Diagram or Fishbone Diagrams	31
Figure 2.4 Step DMAIC	33
Figure 2.5 Analog to digital conversion change	35
Figure 3.1 Research Framework	43
Figure 3.2 System Architecture (Fuel Management System)	45
Figure 4.1 Time to record diesel fuel usage Jan-Des 2023	48
Figure 4.2 Costing diesel fuel according to the period Jan-Des 2023	48
Figure 4.3 Diesel fuel working losses period Jan-Des 2023	49
Figure 4.4 Project Structure Organization	53
Figure 4.5 Focus Group Discussion	53
Figure 4.6 Fishbone Diagram	54
Figure 4.7 Documentation pieces of the investigation into diesel fuel theft	58
Figure 4.8 Analog Refueling Module	59
Figure 4.9 Internal Audit Report (Fuel and Oil Section)	60
Figure 4.10 Example of a damaged manual logsheet	61
Figure 4.11 Digital Transformation at PT. XYZ	64
Figure 4.12 System Design Digitization Fuel Management	65
Figure 4.13 Socialization of procedures and the importance of accuracy recording data to the logsheet	69
Figure 4.14 Hardware and software purchase documents (Ellipse)	71
Figure 4.15 Hardware arrival monitor from vendor	72
Figure 4.16 Checking and testing hardware & software before instalation	73
Figure 4.17 Hardware Installation Process	74
Figure 4.18 Illustration of network mapping	74
Figure 4.19 Stages of change management	78
Figure 4.20 Socialization activities	79
Figure 4.21 Workshop & Training	79
Figure 4.22 Demonstration activities	80
Figure 4.23 Appointment of change agent	81
Figure 4.24 Weekly Review Program	83
Figure 4.25 Launching Program	84
Figure 4.26 KPI Achievement Time to Record Diesel Fuel to The System April-May 2024	85
Figure 4.27 KPI Achievement Costing Diesel Fuel According to The Period April-May 2024	87
Figure 4.28 KPI Achievement Working Fuel Losses April-May 2024	89
Figure 4.29 Comparison Before and After Digitization	89
Figure 4.30 New SOP Refueling Process	90

LIST OF TABLES

Table 1. Diesel Fuel Usage 2023 at PT. XYZ.....	13
Table 2 Key Performance Indicator 2023	14
Table 3 Root Causes of Waste	27
Table 4 Time Frame Of Research.....	46
Table 5 Diesel fuel usage period Jan-Des 2023	51
Table 6 Calculation of Diesel Fuel Losses 2023	51
Table 7 Team Collaboration.....	52
Table 8 Number of Fuelman	55
Table 9 Questionnaire for mapping understanding of fuel man.....	57
Table 10 Brainstorming Result.....	62
Table 11 Cluster Ideas (Grouping Ideas)	63
Table 12 Tender Evaluation of Hardware & Software	66
Table 13 Hardware & Part Recommendations.....	67
Table 14 Implementation Time Frame (By: Monday Work Management).....	68
Table 15 Questionnaire for mapping understanding of fuel man (After re-socialization)	70
Table 16 Problem found during the trial.....	75
Table 17 Point concern & preventive action change management	77
Table 18 Table of discussion and survey results	82
Table 19 COE Training for increase competence	84
Table 20 Issuing fuel data	86
Table 21 Costing fuel data	88