SUSTAINABLE ENVIRONMENTAL MANUFACTURING PRACTICES AND FIRM PERFORMANCES: MODERATING ROLE OF ENVIRONMENTAL REGULATION AND PERCEIVED BENEFITS

ADEBAMBO HAMEED OLUSEGUN

DOCTOR OF PHILOSOPHY

UNIVERSITI UTARA MALAYSIA

January 2015
SUSTAINABLE ENVIRONMENTAL MANUFACTURING PRACTICES AND
FIRM PERFORMANCES: MODERATING ROLE OF ENVIRONMENTAL
REGULATION AND PERCEIVED BENEFITS

BY
ADEBAMBO HAMEED OLUSEGUN

Thesis Submitted to
School of Technology Management and Logistics,
Universiti Utara Malaysia
In Fulfillment of the Requirement for the Degree of Doctor of Philosophy
PERMISSION TO USE

In presenting this thesis in fulfilment of the requirement for a Post Graduate degree from the Universiti Utara Malaysia (UUM), I agree that the Library of this university may make it freely available for inspection. I further agree that permission for copying this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor or in her absence, by the Dean of Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia. It is understood that any copying or publication or use of this thesis or parts of it for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the Universiti Utara Malaysia (UUM) in any scholarly use which may be made of any material in my thesis.

Request for permission to copy or to make other use of materials in this thesis in whole or in part should be addressed to:

Dean of School of Technology Management & Logistics
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman
ABSTRACT

More attention has been shifted to the environmental impacts of manufacturing companies on firm performance as sustainable environmental manufacturing practice has become an issue of concern to most researchers and practitioners. Theoretical evidence from previous studies showed that a considerable amount of attention has been given to environmental issues in academic studies in the past years and the link between environmental practices and performance of firms has been widely discussed, which results into different views. Thus, the relationship between sustainable environmental practices and firm performance remains inconclusive. This study investigates the impact of sustainable environmental manufacturing practices (SEMP) on firm performance through the moderating effects of perceived benefits (PB) and environmental regulation (ER). In addition, the relationships between the antecedent factors and SEMP were investigated. Data was collected from manufacturing companies in Malaysia using a cross sectional study design and stratified random sampling method. 103 usable questionnaires were collected by using a mail survey method and analysed with SmartPLS-SEM. The result indicated that five out of the 12 hypothesized relationships (both the direct and moderating hypotheses) were supported. Specifically, the study found that top management commitment and stakeholder pressure positively influence sustainable environmental manufacturing practices and that sustainable environmental manufacturing practice has a direct positive influence on environmental performance. The study also established that perceived benefits moderates the relationship between sustainable environmental manufacturing practice and operational performance, while the relationship between sustainable environmental manufacturing practice and environmental performance is moderated by environmental regulation. In addition, it was found that sustainable environmental manufacturing practice is still regarded as ethical behaviour and yet to be considered as a strategic factor of firms in Malaysia. Hence, important implication of this study to the environmental regulatory policy makers, academics and manufacturing practitioners in Malaysia is to create more awareness on the perception of SEMP as a strategic factor towards achieving better firm performance. It also reveals the need for environmental policy makers and the concerned authorities to revisit the environmental regulations on manufacturing practices to provide supportive environmental policies that will enhance a better firm performance in the Malaysian manufacturing industry.

Keywords: antecedent factors of SEMP, environmental regulation, firm performance, sustainable environmental manufacturing practices and perceived benefits.
ABSTRAK


Kajian ini mengkaji kesan amalan pembuatan alam sekitar mampam (SEMP) ke atas prestasi firma melalui kesan menyederhana manfaat yang dirasakan (PB) dan peraturan alam sekitar (ER). Di samping itu, hubungan antara faktor-faktor anteseden dan SEMP dikaji. Data dikumpulkan daripada syarikat-syarikat pembuatan di Malaysia dengan menggunakan reka bentuk kajian rentang dan kaedah persampelan berstrata rawak. 103 borang soal selidik telah dikumpulkan dengan menggunakan teknik kaji selidik melalui pos dan dianalisis dengan menggunakan SmartPLS-SEM. Hasil menunjukkan bahawa lima daripada 12 hubungan hipotesis (kedua-dua hipotesis langsung dan menyederhana) telah disokong. Secara khusus, kajian ini mendapatkan komitmen pengurusan atasan dan tekanan dari pihak berkepentingan secara positif mempengaruhi amalan pembuatan mampam alam sekitar (SEMP) dan juga, amalan pembuatan mampam alam sekitar mempunyai pengaruh yang positif secara langsung terhadap prestasi alam sekitar. Kajian ini juga membuktikan manfaat teranggar menyederhanakan hubungan antara SEMP dan prestasi operasi, manakala hubungan antara SEMP dan prestasi alam sekitar disederhanakan oleh peraturan alam sekitar. Di samping itu, kajian ini mendapati bahawa amalan pembuatan mampam alam sekitar masih dianggap sebagai tingkah laku beretika dan belum dianggap sebagai faktor strategik firma di Malaysia. Oleh itu, implikasi penting kajian ini kepada penggubal dasar peraturan alam sekitar, ahli akademik dan pengamal pembuatan di Malaysia adalah, mereka perlu membentuk lebih banyak kesedaran mengenai tanggapan SEMP sebagai faktor strategik ke arah mencapai prestasi firma yang lebih baik. Ia juga mendedahkan keperluan untuk penggubal dasar alam sekitar dan pihak yang terlibat untuk mengkaji semula peraturan alam sekitar berkaitan pengamalan pembuatan untuk menyediakan dasar menyokong alam sekitar yang akan meningkatkan prestasi firma dalam industri pembuatan Malaysia.

Kata kunci: factor-faktor anteseden SEMP, peraturan alam sekitar, prestasi firma, amalan pembuatan alam sekitar mampam dan manfaat teranggar.
ACKNOWLEDGEMENTS

Glory be to the almighty Allah (S.W.T), the most high and the most merciful, may his blessing be upon our sacred prophet Muhammad (S.A.W), the leader of all spiritual teachers in existence. My dream would not have come to reality without the grace of the almighty Allah (Alhamdulillah).

My journey towards PhD would not have been easy if not for the constructive criticisms and the quality guidance of my supervisors, Dr. Hasbullah Ashari and Dr. Norani Nordin. They are not just supervisors; they are also my parents. I will forever remain indebted to you. Also, my profound gratitude goes to Dr Santhirasegaran and Assoc. Prof. Dr. Siti Norezam for acting as my reviewers in proposal defence. Your comments really helped in improving this research. To all the staff members of STML, Universiti Utara Malaysia, you are wonderful for your individual and collective support.

I will not cease to mention the love, care and the prayers of my mother, Adebambo Seidat kehinde in ensuring my success. May almighty Allah (S.W.T) continue to strengthen her and make her reap the fruit of her labour. To my late father, Hon. Surveyor Adebambo Olumayowa, who invested all he had in me to ensure that I received the best education in life, he had high hope in me but could not wait to see this date. I pray to almighty Allah to forgive all his sins and make Al-Jannat Fridaus his final abode. To my elder ones: Ibraheem & Halimat and their families, and younger ones: Rasheed & Mukadeen, you took upon my responsibilities and took care of me during my
academics. I am glad we started this together and today, we are saying Alhamdulillah. I say thank you and appreciate you all. May the bond that ties us together never break.

Now I believe in the saying that “behind a successful man, there is a good woman”. Adeyinka Ashabi Adebambo, you are indeed “a God sent to me”. To my in-laws, Alhaja Adeyanju and the family, I appreciate your words of encouragement, understanding and prayers. Words of mouth are not enough to thank you. I will not stop saying thank you to my extended families; the Abijos, Adelajas, Alademerins, Lawals and the Odukoyas for their support both financially and in kind towards ensuring my success.

My sincere gratitude goes to those who in one way or the other contributed towards this history making journey such as Dr Rasheed Jimoh who facilitated my MSc admission, Professor T. Ramayah and Dr Mohd. Azim for their tireless effort in ensuring that I am well grounded in the practical aspect of data analysis; Dr & Dr Mrs Abdul Jaleel Shittu and Dr Mrs Baqi for their guidance and support. My colleagues at UUM especially STML postgraduate reading room from whom I received a source of motivation and challenge, I thank you all for your support. This book is incomplete if I fail to mention the ever growing friendship of my roomies and friends; Rodu, Prince-Hector, Semiu, Waraj, Victor, AY and Afeez, they are friends indeed. To those names am unable to mention, you are equally important. May you all walk and never stumble.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMISSION TO USE</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>v</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xix</td>
</tr>
</tbody>
</table>

## CHAPTER ONE  - INTRODUCTION   

1.1 Background of the study 1

1.2 Problem Statement 7

1.3 Research Questions 12

1.4 Research objectives 13

1.5 Significance of the Study 14

1.6 Scope of the Research 16

1.7 Organization of the Thesis 17
# CHAPTER TWO - LITERATURE REVIEW

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Introduction</td>
<td>19</td>
</tr>
<tr>
<td>2.2</td>
<td>Firm Performance</td>
<td>19</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Measuring performance in firm</td>
<td>21</td>
</tr>
<tr>
<td>2.3</td>
<td>The Concept of Sustainability</td>
<td>29</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Sustainable Manufacturing Practices</td>
<td>30</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Sustainable Environmental Manufacturing Practices</td>
<td>32</td>
</tr>
<tr>
<td>2.3.3</td>
<td>Sustainable Environmental Manufacturing Practices in Malaysia</td>
<td>36</td>
</tr>
<tr>
<td>2.4</td>
<td>Perceived Benefits of Sustainable Environmental Manufacturing Practices</td>
<td>38</td>
</tr>
<tr>
<td>2.5</td>
<td>Antecedents/Drivers of Sustainable Environmental Practices</td>
<td>43</td>
</tr>
<tr>
<td>2.5.1</td>
<td>Stakeholder Pressure</td>
<td>43</td>
</tr>
<tr>
<td>2.5.2</td>
<td>Top Management Commitment</td>
<td>46</td>
</tr>
<tr>
<td>2.5.3</td>
<td>Public Concern</td>
<td>48</td>
</tr>
<tr>
<td>2.6</td>
<td>Environmental Regulation</td>
<td>52</td>
</tr>
<tr>
<td>2.6.1</td>
<td>National Environmental Policy in Malaysia</td>
<td>54</td>
</tr>
<tr>
<td>2.7</td>
<td>Past Literatures on the Variables of the Studies</td>
<td>58</td>
</tr>
<tr>
<td>2.7.1</td>
<td>Previous Literatures on SEMP and Firm Performance</td>
<td>58</td>
</tr>
<tr>
<td>2.7.2</td>
<td>Previous studies on the Antecedents/Drivers of SEMP</td>
<td>63</td>
</tr>
<tr>
<td>2.7.3</td>
<td>Previous Literatures on Perceived Benefits of SEMP</td>
<td>67</td>
</tr>
<tr>
<td>2.7.4</td>
<td>Past Literatures on Environmental Regulation</td>
<td>68</td>
</tr>
</tbody>
</table>
2.8 Theoretical Perspectives

2.8.1 Natural Resources-Based View of Firm

2.8.2 Connection between Natural Resource Base View (NRBV) and This Study

2.9 Summary

CHAPTER THREE - RESEARCH FRAMEWORK

3.1 Introduction

3.2 Theoretical Framework

3.3 Hypotheses Development

3.3.1 Relationship between antecedent factors (TMC, SP and PC) and SEMP

3.3.2 Relationship between SEMP and Firm Performance

3.3.3 Moderating role of Perceived Benefits between SEMP and Firm Performance

3.3.4 Moderating Role of Environmental Regulation on SEMP and Firm Performance

3.4 Statement of Hypotheses Development

3.4.1 Hypotheses statement of the direct relationship

3.4.2 Hypotheses statement of moderating relationship
CHAPTER FOUR - RESEARCH METHODOLOGY

4.1 Introduction

4.2 Research Design

4.3 Instrumentation

4.3.1 Questionnaire Structure

4.3.2 Scale of the Questionnaire

4.3.3 Validation of the measurement Instrument

4.4 Measurement of Variables and Operational Definitions

4.4.1 Operational definition and measurement of Firm Performance

4.4.2 Operational definition and measurement of Sustainable Environmental Manufacturing Practices (SEMP)

4.4.3 Operational definitions and measurement of the Antecedent factors of SEMP

4.4.4 Operational definition and measurement of Stakeholder pressure

4.4.5 Operational definition and measurement of Top management commitment

4.4.6 Operational definition and measurement of Public concern

4.4.7 Operational Definition and Measurement of Perceived benefits
4.4.8 Operational Definition and Measurement of Environmental regulation 114

4.5 Research Ethical Considerations 115

4.6 Pilot Test 117

4.7 Data Collection Method 120

4.8 Population and Sample 121

4.8.1 Sample Size 122

4.8.2 Sampling Techniques 124

4.8.3 Unit of Analysis 127

4.9 Method of Data Analysis 127

4.9.1 Descriptive Analysis 128

4.9.2 Partial Least Squares (PLS) Technique 128

4.10 Summary 130

CHAPTER FIVE - DATA ANALYSIS AND FINDINGS 132

5.1 Introduction 132

5.1.1 Response Rate 132

5.1.2 Test for Non-response Bias 135

5.1.3 Data Coding 131

5.2 Preliminary Analysis 132
5.2.1 Missing Data 132
5.2.2 Detection and Treatment of Outliers 133
5.3 Fundamental Assumptions of Statistics 134
  5.3.1 Common Method Bias 134
  5.3.2 Test of Linearity 136
5.4 Characteristics of the Sample of Study 139
5.5 Descriptive Analysis of the Constructs 144
5.6 Confirmatory Factor Analysis (CFA) 145
5.7 Model Evaluation 147
  5.7.1 The Measurement Model using PLS-SEM 148
  5.7.2 Constructs’ Validity 150
  5.7.3 Convergent Validity 150
  5.7.4 Discriminant Validity 156
  5.7.5 Structural Model 159
5.8 Analysis of Direct Effects 160
  5.8.1 Testing the hypotheses between the antecedents and SEMP 160
  5.8.2 Testing the hypotheses between SEMP and Firm Performance 161
5.9 The Quality Indexes - Goodness of Fit Measure (GoF) 164
5.10 Determining the Effect size ($F^2$) 164
5.11 Determining the predictive Relevance ($Q^2$) of the Model 166
5.12 Testing the Moderating Effects

5.12.1 Test for the moderating effect of Perceived benefits (PB) on the relationship between SEMP and FP 167

5.12.2 Test for moderating effect of perceived benefit (PB) on the relationship between SEMP and OP. 170

5.12.3 Test for moderating effect of perceived benefit (PB) between SEMP and environmental performance (EP) 171

5.12.4 Test for moderating effect of environmental regulation (ER) between SEMP and financial performance (FP) 173

5.12.5 Test for moderating effect of environmental regulation (ER) on the relationship between SEMP and (OP) 174

5.12.6 Test for moderating effect of environmental regulation (ER) on the relationship between SEMP and (EP) 176

5.13 Summary 177

CHAPTER SIX - DISCUSSION AND CONCLUSION 181

6.1 Introduction 182

6.2 Overview of the research 185

6.3 Recapitulations of the Findings 186

6.4 Discussion of the findings 187

6.4.1 Discussion of the effects of antecedents of SEMP on SEMP 186


## LIST OF TABLES

<table>
<thead>
<tr>
<th>Tables</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Summary of the drivers of sustainable environmental manufacturing practices used by previous authors</td>
<td>51</td>
</tr>
<tr>
<td>4.1 Summary of Measurement and Scales</td>
<td>115</td>
</tr>
<tr>
<td>4.2 Summary of the pilot test reliability analysis of constructs</td>
<td>119</td>
</tr>
<tr>
<td>4.3 Selection of sample from the ISIC grouping</td>
<td>125</td>
</tr>
<tr>
<td>5.1 Distribution and Retention of Questionnaires</td>
<td>133</td>
</tr>
<tr>
<td>5.2 Descriptive statistics for Early and late respondents</td>
<td>137</td>
</tr>
<tr>
<td>5.3 Independent Sample T-Test for Equality of means</td>
<td>139</td>
</tr>
<tr>
<td>5.4 Variable Coding</td>
<td>131</td>
</tr>
<tr>
<td>5.5 Test of Multicollinearity</td>
<td>137</td>
</tr>
<tr>
<td>5.6 Demographic characteristics of the respondents of the study</td>
<td>141</td>
</tr>
<tr>
<td>5.7 Demographic characteristics of company</td>
<td>143</td>
</tr>
<tr>
<td>5.8 Descriptive Analysis of Constructs</td>
<td>145</td>
</tr>
<tr>
<td>5.9 Confirmatory factor analysis results</td>
<td>146</td>
</tr>
<tr>
<td>5.10 The Convergence and Reliability Analysis</td>
<td>152</td>
</tr>
<tr>
<td>5.11 Item Loading and Cross Loading</td>
<td>154</td>
</tr>
<tr>
<td>5.12 Discriminant Validity</td>
<td>157</td>
</tr>
<tr>
<td>5.13 Results for the direct hypotheses</td>
<td>162</td>
</tr>
<tr>
<td>5.14 Effect size of the relationship between the antecedents and SEMP</td>
<td>165</td>
</tr>
<tr>
<td>5.15 Construct Crossvalidated redundancy value</td>
<td>166</td>
</tr>
<tr>
<td>5.16 Summary of hypotheses testing for the moderating effects</td>
<td>174</td>
</tr>
</tbody>
</table>
5.17 Summary of the research hypotheses test
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Summary of the schedule waste generated between 2002 and 2010 in Malaysia</td>
<td>3</td>
</tr>
<tr>
<td>1.3 Percentage of BOD5 Pollutant between 2007 and 2011</td>
<td>5</td>
</tr>
<tr>
<td>Source: Department of Environment (2012)</td>
<td></td>
</tr>
<tr>
<td>2.1 Triple bottom line principle of sustainability (Elkington, 2007)</td>
<td>30</td>
</tr>
<tr>
<td>3.1 Research/Theoretical Framework of the Study</td>
<td>82</td>
</tr>
<tr>
<td>5.1 Histogram Showing Multicolinearity Diagnostics</td>
<td>138</td>
</tr>
<tr>
<td>5.2 PP plots for the Multicolinearity Diagnostics</td>
<td>139</td>
</tr>
<tr>
<td>5.3 Revised Model of the Study</td>
<td>159</td>
</tr>
<tr>
<td>5.4 Algorithm model for the direct relationships</td>
<td>163</td>
</tr>
<tr>
<td>5.5 Simple model with a moderating effect (Source: Henseler &amp; Fassot, 2010)</td>
<td>167</td>
</tr>
<tr>
<td>5.6 PLS product indicator approach (Source: Helm et al., 2010)</td>
<td>169</td>
</tr>
<tr>
<td>5.7 Moderating effect of PB on SEMP and FP</td>
<td>171</td>
</tr>
<tr>
<td>5.8 Moderating effect of PB on SEMP and OP</td>
<td>172</td>
</tr>
<tr>
<td>5.9 Moderating effect of perceived benefit on the relationship between</td>
<td></td>
</tr>
<tr>
<td>SEMP and operational performance</td>
<td>173</td>
</tr>
<tr>
<td>5.10 Moderating effect of PB on SEMP and EP</td>
<td>174</td>
</tr>
<tr>
<td>5.11 Moderating effect of ER on SEMP and FP</td>
<td>175</td>
</tr>
<tr>
<td>5.12 Moderating Effect of ER on SEMP and OP</td>
<td>176</td>
</tr>
<tr>
<td>5.13 Moderating effect of ER on SEMP and EP</td>
<td>177</td>
</tr>
</tbody>
</table>
5.14 Moderating effect of environmental regulation on the relationship between SEMP and operational performance 178

5.15 Model showing the moderating effect of perceived benefits and environmental regulation 179

6.1 Model of SEMP on firm performance 203

6.1 Model of SEMP on firm performance 200
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE</td>
<td>Average Variance Extracted</td>
</tr>
<tr>
<td>BNM</td>
<td>Bank Negara Malaysia</td>
</tr>
<tr>
<td>BOD$_5$</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>CES</td>
<td>Compendium of Environmental Statistics</td>
</tr>
<tr>
<td>CFA</td>
<td>Confirmatory Factor Analysis</td>
</tr>
<tr>
<td>CMV</td>
<td>Common Method Variance</td>
</tr>
<tr>
<td>CR</td>
<td>Composite Reliability</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Environment</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Investigation Agency</td>
</tr>
<tr>
<td>EP</td>
<td>Environmental Performance</td>
</tr>
<tr>
<td>EQA</td>
<td>Environmental Quality Act</td>
</tr>
<tr>
<td>ER</td>
<td>Environmental Regulation</td>
</tr>
<tr>
<td>ESTS</td>
<td>Environmental Statistics Time Series</td>
</tr>
<tr>
<td>FMM</td>
<td>Federation of Malaysian Manufacturer</td>
</tr>
<tr>
<td>FP</td>
<td>Financial Performance</td>
</tr>
</tbody>
</table>
GDP  Gross Domestic Product
GHG  Greenhouse Gas
GoF  Goodness of Fit
ISIC  International Standard industrial Classification
ISO  International Standard Organization
MIP  Malaysia Investment Performance
NIMRC  Nottingham Institute of Innovative Manufacturing Center
NRBV  Natural Resource Based View
OECD -  Organization for Economic Co-operation and Development
OP  Operational Performance
PB  Perceived Benefits
PC  Public Concern
PLS-SEM  Partial Least Square Structural Equation Modelling
RBV  Resource Based View
SEM  Structural Equation Modelling
SPSS  Statistical Package for Social Sciences
STML  School of Technology Management and Logistics
UUM  Universiti Utara Malaysia
CHAPTER ONE
INTRODUCTION

1.1 Background of the study

The beginning of the new millennium witnessed an increasing awareness of the impact of manufacturing firms on the environment, thereby enhancing the implementation of sustainable manufacturing practices that prevents environmental degradation (Seidel, Shahbazpour & Siedel, 2007; Millar & Russel, 2011; Anis & Nurul, 2012). Various labels such as environmentally conscious manufacturing (Richards, 1994) or Green manufacturing (Rusinko, 2007) have given birth to the concept of sustainable environmental manufacturing practices which is aimed at minimizing the environmental impact linked to manufacturing activities. Manufacturing firms contribute positively to economy in term of gross domestic product (GDP) and employment opportunities, but their operational activities have detrimental impacts on the environment.

Environmental problem has been linked to the operational activities of manufacturing firms (Gutowski, Branham, Dahmus, Jones, Thiriez, & Sekulic, 2009). Traditionally, association exists between manufacturing firms and the undesirable environmental negative impacts (Frosch & Gallopoulos, 1989; Despeisse, Ball & Evans, 2012). As such, environmental practices have thereby become a vital global issue that creates challenges for the society and manufacturing practitioners (Jovane, Yoshikawa,
The contents of the thesis is for internal user only
REFERENCES


213


226


ESTS (2012). *Environmental Statistics Time Series Malaysia*, ISSN 2289-2060


Oturum 2. sunumu, 52 sunu dosyas, stanbul: Kadir Has Üniversitesi, Kadir Has Kampüsü (Cibali) D Blok-Sinema A Salonu


Organization for Economic Corporation Development [OECD], (1987) annual report


