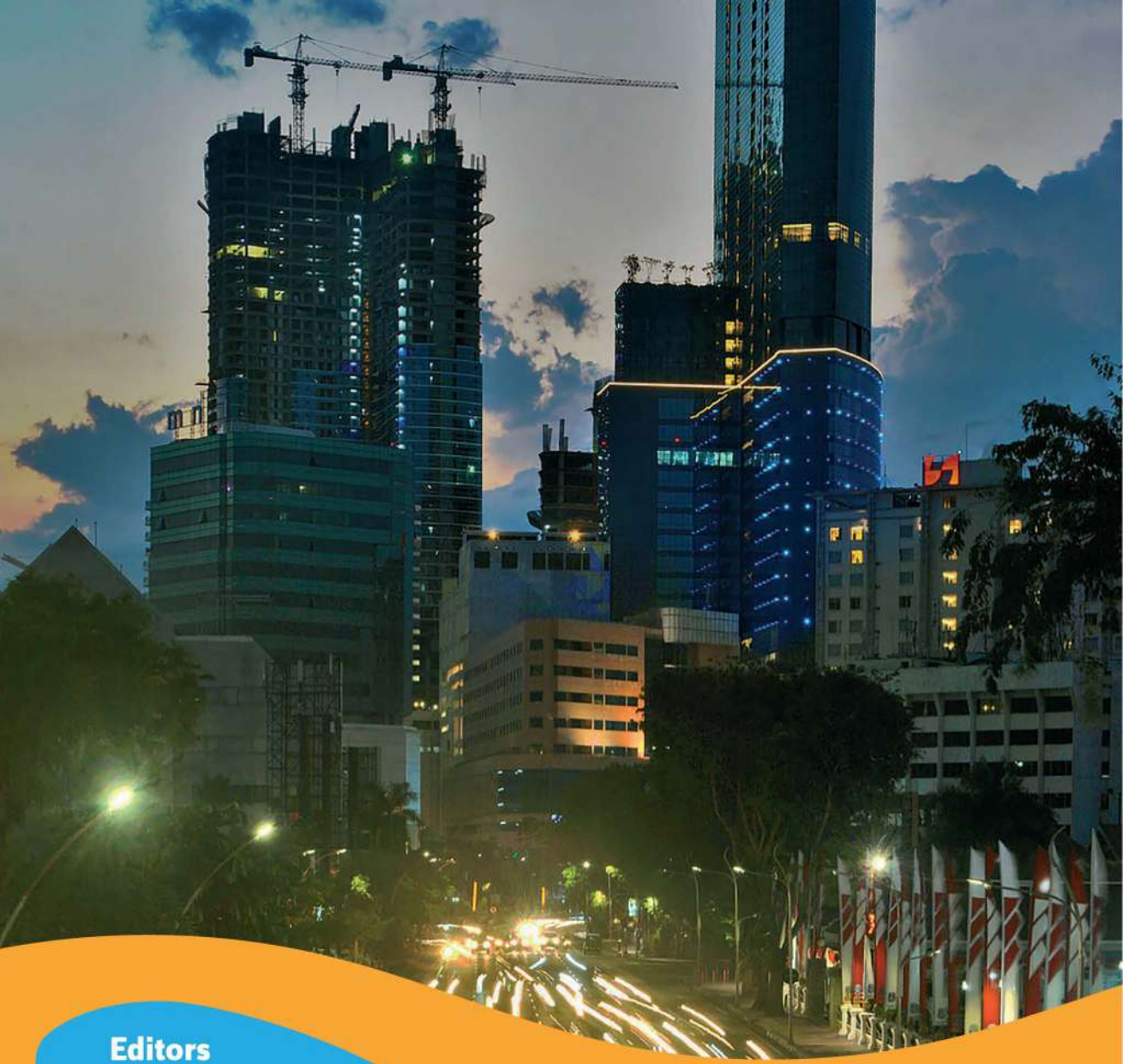

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Increasing Management Relevance and Competitiveness

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Increasing Management Relevance and Competitiveness

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Preface

International Conferences provide an excellent opportunity to bring together academics from different countries and backgrounds for the purpose of presenting their research results, critically discussing methodology and findings and improving the quality of research and the impact of the research on society and science. Furthermore, conferences enable the scientific community to create new networks, to foster relationships and extend their visibility.

The 2nd Global Conference on Business Management and Entrepreneurship (GCBME) 2017 is an annual conference co-hosted by Department of Management, Faculty of Economics & Business, Universitas Airlangga and Business Management Education Program, Faculty of Business and Economics Education, Universitas Pendidikan Indonesia. The theme of GCBME 2017 is increasing management relevance and competitiveness.

The theme inspired by the concern of Sumantra Ghoshal that bad management theories are destroying good management practices. Before that, the dichotomy between rigor and relevance is always becoming a hot topic in the management field. This conference aims to answer the following question: How might we accomplish a reconciliation of rigor (academic) and relevance (practitioner) standards to offer organizational competitiveness?

I expect this conference raises two important things in the discussion room and proceedings (based on Corley and Gioia, 2011): First, theories used in this conference should be problem driven—that is addressing a problem of direct, indirect, or long-linked relevance to practice, rather than narrowly addressing the (theoretical) "problem." Second, the fact that we are a profession (academia) studying another profession (management), therefore it needs balancing between theoretical contribution managerial implications. By doing that, I believe that our research and discussion in this conference could offer something useful for practitioners (thus increase its competitiveness) while at the same time contribute to the development of our management field.

I am looking forward to seeing you in GCBME in the near future.

With warmest regards,
Prof. Badri Munir Sukoco, PhD
GC-BME 2017 Conference Chair

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Efficiency and total-factor productivity in the manufacturing industry in 33 provinces of Indonesia

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ABSTRACT: This study emphasizes the importance of controlling escalation of emissions in the current decade. In addition, the study focuses on efficiency techniques and the Total-Factor Productivity (TFP) of manufacturing industry in 33 provinces in Indonesia. This research was conducted by utilizing Data Envelopment Analysis (DEA). The input variables were labor, energy consumption and investment, and the output variables were GDP, SO_2 and NO_2. The Malmquist–Luenberger (ML) productivity index was used to measure changes in productivity of observation data using undesirable variables as input or output. The result is based on operational efficiency; at the end of the observation (2015), 17 provinces were in a state of operational inefficiency with efficiency scores in the range of 0.750–0.999. Meanwhile, in the results for technical efficiency, there was a trend for increasing technical efficiency in manufacturing industry in 19 provinces. Thus, it can be concluded that the majority of manufacturing industries in Indonesia are efficient, while only a few provinces can increase their productivity by increasing desirable output while reducing the growth rate of undesirable output production.

Keywords: Efficiency, Productivity, Industry, DEA

1 INTRODUCTION

Energy use in the industrial sector contributes to emissions in many countries, especially developing countries. The greater the energy use, the greater the amount of emissions produced. At first, the relationship between this energy and the environment was not a major concern. Now, however, environmental conditions are making their own demand for all countries to pay attention to energy utilization in the process of economic development in order to achieve economic sustainability. Hence, all of them can be regarded as an integrated process, which will implicitly encourage growth in the production and consumption of energy.

Sustainable economic development itself is a balance between the factors of energy, economy and environment. Among these three factors, energy is the most influential factor in economic growth, and economic growth also depends on the use of energy for economic development of the country. When economic growth is accelerating and maximizing all possible energy sectors, then, in the process of this economic growth, natural resources, including energy resources, are used on a large scale and create emissions on a large scale too. Therefore, the existence of economic development policy that takes into account environmental conditions is very necessary.

Previous studies concerning energy have been varied: one area has been efficiency measurement. Thus, previous studies have attempted to measure the magnitude of energy efficiency in terms of output produced. However, the research, such as that by Korhonen and Luptacik (2004), Sueyoshi and Goto (2010), and Sueyoshi et al. (2010, 2013), has only covered particular provinces in some countries. Therefore, the study of energy efficiency in relation to output in each province in a country needs to be far more prolific.

The present research focuses on the operational efficiency and efficiency of technique in the manufacturing industry in 33 provinces in Indonesia. Analysis of an industry will be more effective if the Total-Factor Productivity (TFP) is also assessed. In essence, TFP is the growth in output that cannot be explained by the growth in inputs. TFP is assessed through the use of the Malmquist–Luenberger (ML) productivity index, which measures environmentally sensitive changes in productivity through the use of undesirable variables as inputs and/or outputs within Data Envelopment Analysis (DEA). The input variables are labor, energy consumption and investment, and the output variables are GDP, SO_2 and NO_2. Thus, this research formulates the following research questions: what are the operational efficiency levels, technical efficiency levels and TFP of manufacturing industries in 33 provinces in Indonesia when undesirable outputs exist?

2 RESEARCH METHODOLOGY

2.1 *Operational efficiency*

Operational Efficiency (OE) is designed using non-radial measurement models. Thus, the level of inefficiency is determined through the slack of each Decision-Making Unit (DMU). OE ignores the undesirable output in the measurement (Sueyoshi et al., 2013). The non-radial mathematical model used in the measurement of OE is as follows:

$$\begin{aligned}
&\text{Maximize } \sum_j^m = {}_1R_i^x \, d_i^x + \sum_r^S = {}_1R_r^g d_r^g \\
&\text{such that } \sum_R^S = {}_1X_{ij,g} + d_j^x = X_{ik} (i = 1,\ldots,m), \\
&\sum_j^n = {}_1g_{rj\,\lambda j} - d_r^g = g_{rk} \ (r = 1,\ldots,s), \\
&\sum_j^n = {}_1\lambda_j = 1, \\
&\lambda_j \geq 0 \ (j = 1,\ldots,n), d_i^x \geq 0 \ (i = 1,\ldots,m), \\
&d_r^g \geq 0 \ (r = 1,\ldots,s)
\end{aligned} \tag{1}$$

After calculating Model (1), the OE can be obtained by the calculation:

$$OE = 1 - \left(\sum_{i=1}^{m} R_i^x d_i^{x*} + \sum_{r=1}^{s} R_r^g d_r g* \right) \tag{2}$$

Thus, the slack of each DMU in OE measurement can be obtained by calculating Model (1). This model calculates the inputs and desirable outputs, but does not include undesirable output variables.

2.2 *Total-Factor Productivity Change (TFPC) and Technical Efficiency Change (TEC)*

The approach used in this research is a quantitative one using DEA and determining TFP Change (TFPC) and Technical Efficiency Change (TEC) of inputs and outputs in each country using the ML productivity index, which is the measurement of productivity and technical efficiency when DMUs produce undesirable output. Chung et al. (1997) used this index to measure marginal productivity from observational data that uses undesirable variables as input or output. If ML > 1 it means that efficiency increases and DMUs generate desirable output and reduce production of undesirable outputs. If ML = 1, the productivity is constant and there is no change; if ML < 1, it indicates declining levels of DMU productivity (Aparicio et al., 2013). Based on the model of previous research, the authors use a slightly adapted version of the model of Aparicio et al. (2013). The change involves adding the following element to the model:

$$Y^{1,b}\lambda \geq y^{2,b}{}_o - \beta y^{2,b}{}_o$$

Thus, the Malmquist model used in this study is:

$$\begin{aligned}
&\text{Maximize } \beta, \lambda \\
&\text{such that } X^1\lambda \leq X^2 o \\
&Y^{1,g}\lambda \geq y^{2,g}{}_o + \beta y^{2,g}{}_o \\
&Y^{1,b}\lambda \geq y^{2,b}{}_o - \beta y^{2,b}{}_o \\
&\text{Max}\left\{ y^{t,u}{}_i \right\} \geq y^{2,b}{}_o - \beta y^{2,b}{}_o \\
&\lambda \geq 0
\end{aligned}$$

where $\text{Max}\{y^{t,u}{}_i\}$ is the maximum number of observations of each undesirable output (SO_2 and NO_2) during the observation period (Aparicio et al., 2013, 2015).

3 RESULT

Attachment 1 (Table 1) shows the distribution of OE scores of manufacturing industry for 33 provinces in Indonesia. The table shows the names of the provinces which had an efficiency score of 1, meaning that they were in operationally efficient condition. Provinces showed inefficiency if their score was less than one (< 1), assuming Variable Return to Scale (VRS).

Attachment 1 (Table 1) shows that, in 2012, 12 of the 33 provinces in Indonesia were in operationally efficient condition, while 17 of the provinces were in optimally efficient condition to the production of manufacturing industry. The table shows that another 17 provinces have not utilized their resources, capital and human, to achieve operational efficiency in their manufacturing industry sector. In 2015, the number of provinces experiencing improved efficiency increased to 16.

Attachment 1 (Table 2) shows the distribution of the changes of technical efficiency (index of technology) for 2012–2013 from the manufacturing sector of 33 provinces in Indonesia. In the Table 2 above, efficiency is divided into three classes, namely, efficient, inefficient and very inefficient. It can be seen that there were 14 provinces classified in the efficient group for 2012–2013, increasing to 19 provinces for 2013–2015. On the other hand, the number of provinces in the inefficient and very inefficient groups showed a decline during the period of observation, 2012–2015. For example, there was a decline in the number of provinces, from ten to nine, in the inefficient category (0.750–0.999), while the level of very inefficient (0.5–0.7499) provinces also experienced a decline too, which means that several provinces in the manufacturing industry sector managed to improve their technical efficiency score.

In 2012–2013, there were nine provinces with technically inefficient conditions in the manufacturing industry sector, but this reduced to four provinces in 2013–2014 and continued to decrease until the end of the observation, when only two provinces were inefficient in the manufacturing industry sector.

Table 1. Operational efficiency of manufacturing industry for 33 provinces in Indonesia.

Operational efficiency score	2012	2013	2014	2015
1.00 (Efficient)	1. Riau	1. Riau	1. Riau	1. West Sumatra
	2. Bengkulu	2. Jambi	2. Jambi	2. Riau
	3. Lampung	3. South Sumatra	3. Bengkulu	3. Bengkulu
	4. Jakarta	4. Bengkulu	4. Lampung	4. Lampung
	5. West Java	5. Lampung	5. Riau Islands	5. Jakarta
	6. Central Java	6. Riau Islands Jakarta	6. Jakarta	6. West Java
	7. East Java	7. West Java	7. West Java	7. Central Java
	8. Banten	8. Central Java	8. Central Java	8. East Java
	9. East Nusa Tenggara	9. Special Region of Yogyakarta	9. East Java	9. Banten
	10. North Sulawesi	10. East Java	10. Banten	10. East Nusa Tenggara
	11. Gorontalo	11. Banten	11. East Nusa Tenggara	11. North Sulawesi
	12. West Sulawesi	12. West Sulawesi	12. Sulawesi Utara	12. Gorontalo
	13. Maluku	13. Maluku	13. West Sulawesi	13. West Sulawesi
	14. North Maluku	14. North Maluku	14. Maluku	14. Maluku
	15. West Papua	15. West Papua	15. North Maluku	15. North Maluku
			16. West Papua	16. West Papua
0.750–0.999 (Inefficient)	1. Aceh	1. Aceh	1. Aceh	1. Aceh
	2. North Sumatra	2. North Sumatra	2. North Sumatra	2. North Sumatra
	3. West Sumatra	3. West Sumatra	3. West Sumatra	3. Jambi
	4. Jambi	4. Bangka Belitung	4. South Sumatra	4. South Sumatra
	5. South Sumatra	5. Bali	5. Bangka Belitung	5. Bangka Belitung
	6. Bangka Belitung	6. West Nusa Tenggara	6. Special Region of Yogyakarta	6. Riau Islands
	7. Riau Islands	7. West Kalimantan	7. Bali	7. Special Region of Yogyakarta
	8. Special Region of Yogyakarta	8. Central Kalimantan	8. West Nusa Tenggara	8. Bali
	9. Bali	9. South Kalimantan	9. West Kalimantan	9. West Nusa Tenggara
	10. West Nusa Tenggara	10. East Kalimantan	10. Central Kalimantan	10. West Kalimantan
	11. West Kalimantan	11. Central Sulawesi	11. South Kalimantan	11. Central Kalimantan
	12. Central Kalimantan	12. South Sulawesi	12. East Kalimantan	12. South Kalimantan
	13. South Kalimantan	13. Sulawesi Tenggara	13. Central Sulawesi	13. East Kalimantan
	14. East Kalimantan	14. Papua	14. South Sulawesi	14. Central Sulawesi
	15. Central Sulawesi		15. Sulawesi Tenggara	15. South Sulawesi
	16. South Sulawesi		16. Papua	16. Sulawesi Tenggara
	17. Papua			17. Papua

In the observation year 2012–2013, North Sulawesi experienced technical inefficiency, but successfully increased its efficiency score in the 2013–2015 observation to become fully technically efficient with an efficiency score of 1. Aceh also experienced a similar trend; in 2012–2013, Aceh exhibited a very inefficient condition with an efficiency score of 0.5964, but massively improved its technical efficiency scores in 2013–2014 to score 1.1632 and 1.3793 in 2014–2015. The increasing trend in technical efficiency was experienced by several provinces in Indonesia and, among the members of the inefficient or very inefficient group that became efficient during the years of observation are DI Yogyakarta, North Sumatra, North Maluku, Sumatra Barat, East Java, West Kalimantan and Papua.

Other provinces seem able to increase their technical efficiency in the manufacturing industry sector too, but unfortunately this change was not significant and the provinces have remained technically inefficient. Such provinces include South Kalimantan, Central Kalimantan and Central Sulawesi. However, some provinces experienced a decrease in their technical efficiency score in the manufacturing industry sector. For example, in

Table 2. Technical Efficiency Change (TEC) of manufacturing industry for 33 provinces in Indonesia.

Operational efficiency score	Year 2012–2013	Year 2013–2014	Year 2014–2015
1.00 (Efficient)	1. Riau	1. Aceh	1. Aceh
	2. Jambi	2. North Sumatra	2. West Sumatra
	3. Bengkulu	3. Riau	3. Riau
	4. Lampung	4. Jambi	4. South Sumatra
	5. Riau Islands	5. Lampung	5. Lampung
	6. Jakarta	6. Bangka Belitung	6. Jakarta
	7. West Java	7. Riau Islands	7. West Java
	8. Central Java	8. Jakarta	8. Central Java
	9. Yogyakarta	9. West Java	9. Yogyakarta
	10. Banten	10. Central Java	10. East Java
	11. EastNusa Tenggara	11. East Java	11. Banten
	12. West Sulawesi	12. Banten	12. EastNusa Tenggara
	13. North Maluku	13. East Nusa Tenggara	13. North Sulawesi
	14. West Papua	14. North Sulawesi	14. South Sulawesi
		15. South Sulawesi	15. Gorontalo
		16. Gorontalo	16. North Maluku
		17. West Sulawesi	17. West Papua
		18. West Papua	18. Papua
		19. Papua	19. West Kalimantan
0.750–0.999 (Inefficiency)	1. South Sumatra	1. West Sumatra	1. Jambi
	2. East Java	2. Bengkulu	2. Bangka Belitung
	3. Bali	3. Jogyakarta	3. Bali
	4. West Nusa Tenggara	4. Bali	4. WestNusa Tenggara
	5. South Kalimantan	5. West Nusa Tenggara	5. Central Kalimantan
	6. East Kalimantan	6. West Kalimantan	6. South Kalimantan
	7. North Sulawesi	7. Central Kalimantan	7. East Kalimantan
	8. South east Sulawesi	8. East Kalimantan	8. Central Sulawesi
	9. Gorontalo	9. South east Sulawesi	9. SouthEast Sulawesi
	10. maluku	10. maluku	
0.5–0.7499 (very inefficient)	1. Aceh	1. South Sumatra	1. North Sumatra
	2. North Sumatra	2. South Kalimantan	2. Maluku
	3. West Sumatra	3. Central Sulawesi	
	4. Bangka Belitung	4. North Maluku	
	5. West Kalimantan		
	6. Central Kalimantan		
	7. Central Sulawesi		
	8. South Sulawesi		
	9. Papua		

observation year 2012–2013, North Sumatra was extremely inefficient with a score of 0.5015, but was classified as very inefficient for 2014–2015 with a score of 0.6479. This indicates that North Sumatra did not have a sustainable policy for determining the optimum input–output combination in the manufacturing industry production process. Had North Sumatra experienced an increasing score in 2013–2014 it would have indicated that, in these observations, the province had managed to combine the use of input–output in the manufacturing industry sector, so that it could achieve technical efficiency. However, unfortunately, in the years 2014–2015, there was a policy change by the managerial system in the use of input–output, such that it had the highest technical inefficiency. The same thing was experienced by the province of Maluku.

3.1 *The Total-Factor Productivity Change (TFPC) of manufacturing industry for 33 provinces in Indonesia*

The first TFP measurement result is technical efficiency change (TEC). TEC is the growth rate in efficiency of the DMU from the current year (t) to the next year ($t + 1$), as measured from the change in technical efficiency assuming Constant Returns to Scale (CRS). However, in the Malmquist models used

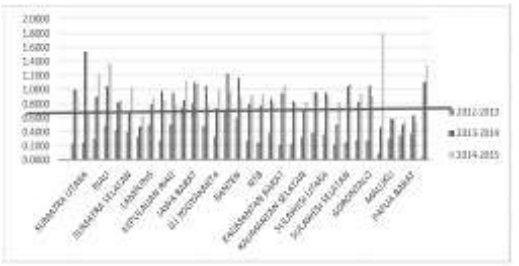

Figure 1. Total-factor productivity change (TFPC) in manufacturing industry for 33 provinces in Indonesia.

by the author, the results are divided into TFPC and TEC. In this study, the author used the Malmquist–Luenberger Index, which is a measurement of productivity and technical efficiency when a DMU produces undesirable output (Chung et al., 1997).

Figure 1 shows that for the period 2012–2013, none of the provinces in Indonesia could reach ML > 1. This means that, during the period, the Indonesian manufacturing industry was degraded, mainly in terms of suppressing the production of emissions. This was caused by incorrect use of technology to optimize productivity in Indonesia's manufacturing industry. In the period 2013–2014, eight provinces were able to increase productivity and achieve ML > 1; the best of these was North Sumatra with a ML score of 1.5395. This indicates that North Sumatra, in these observations, managed to increase productivity by suppressing the production of emissions and improving good outputs in its manufacturing industry.

Unfortunately, in the period 2014–2015, 23 provinces in Indonesia degraded their productivity in the manufacturing industry sector. North Sumatra was one of them, experiencing a drastic reduction in its ML with a final score of 0.6677. In contrast to Sumatra, West Sulawesi experienced a significant productivity improvement. In the period 2012–2013, West Sulawesi only achieved a score of 0.0966, but this rose to 0.4605 in the period 2013–2014, and then increased rapidly with the highest productivity score of all at 1.7978. This indicates that West Sulawesi has been precise in its use of technology in the production process of the manufacturing industry sector, as supported by the high ML index, which indicates that the province succeeded in increasing desirable output along with reducing undesirable output production.

4 CONCLUSION

There were 17 provinces observed in a state of operational inefficiency, with scores in the range 0.750–0.999. This indicates low optimal control of provincial governments in relation to the manufacturing sector. However, in technical terms, the majority of manufacturing industries are efficient; in fact, only a few provinces can increase their productivity by increasing desirable output while reducing undesirable output. This indicates that the implementation and control (law enforcement) by local government in relation to the implementation of environmental policy in the manufacturing industry need to be further improved.

This suggests that the government can encourage the majority of industries to achieve efficiency in technical issues by increasing the use of proper technology and environmentally friendly production processes. Furthermore, investment in the technology sphere is important. Nevertheless, capital insensitivity can diminish the volume of labor through dismissal; hence, investment is assumed be a balance between capital insensitivity and labor insensitivity. Ultimately, productivity can also be increased as well as reducing unemployment.

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