THE ANALYTIC NETWORK PROCESS OF INDONESIA'S BIOETHANOL: FUTURE DIRECTION OF COMPETITIVE STRATEGY AND POLICY

Pendekatan Analytic Network Process untuk Bioetanol Indonesia: Strategi dan Kebijakan Kompetitif pada Masa Mendatang

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ABSTRAK

Peningkatan permintaan terhadap minyak bumi telah mengakibatkan perdebatan sehubungan dengan pemanasan global dan cadangan minyak dunia yang semakin menipis. Meskipun harga minyak dunia mengalami fluktuasi, ada kecenderungan meningkat setiap tahunnya. Bioetanol dianggap sebagai salah satu bahan bioethanol pengganti bahan bakar minyak karena dapat diperbaharui dan ramah lingkungan. Indonesia termasuk salah satu negara di dunia yang berupaya untuk mengembangkan industri ini sejak tahun 2006. Sampai dengan tahun 2011, realisasi perencanaan pemerintah mengalami kesulitan. Tujuan penelitian ini adalah untuk menentukan faktor-faktor yang mempengaruhi daya saing industry bioethanol serta menentukan strategi daya saingnya. Penelitian dilakukan sejak April sampai dengan Desember 2010 di enam kota, dengan menggunakan *Analytic Network Process* atau ANP. Dalam kerangka ANP terdapat empat kategori yaitu permasalahan, solusi alternatif, kebijakan dan strategi. Hasil akhir menunjukkan bahwa tebu merupakan bahan paling berpotensi untuk dikembangkan, adanya permasalahan koordinasi dalam peningkatan daya saing, pemangku kepentingan, dan dalam pengembangan jenis industri ini.

Kata kunci : *bioethanol, strategi kompetitif, analisis proses jejaring*

ABSTRACT

Increased consumption of fossil fuel has been an escalating debate related to its limited deposit and global warming issue. Recently, the oil price tends to rise. Bioethanol has been considered as an alternative substitute for fossil fuel because it is renewable and environmentally friendly. Indonesia plans to develop the bioethanol industry since 2006 but until 2011 it has not been realized yet besides its well planned blue-print and target.

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This study is aimed to determine factors affecting the competitiveness of the bioethanol industry as well as to select a competitive strategy. Data collection was conducted from April to December 2010 in six cities. Analytic Network Process (ANP) was used as a method in this study. There were four categories, namely problems, alternative of solutions, policies, and strategies. Results from the development of bioethanol competitive industry framework suggested that: (1) sugarcane is considered the most potential resource for bioethanol raw material, (2) government's lack of coordination is the main problem for developing competitiveness, and (3) a new bioethanol blueprint policy with a through stakeholder strategy to increase competitiveness of the bioethanol industry in Indonesia is needed.

Key words : *bioethanol, competitive strategy, Analytic Network Process*

INTRODUCTION

The impact of global warming had caused world temperature to increase up to six degree Celcius in the long run (IPCC, 2007), severe weather changes from the arctic melting until heavier and stronger storms, floods and droughts. The major cause of global warming was the emission resulted from fossil fuel consumption. World summit Kyoto Protocol had tried to resolve this problem, however it had never succeeded to have significant solutions addressing the problems.

Even though emission from fossil fuel was one of the causes of global warming, world consumption has been increasing every year. World oil production has been declining over years, but due to higher demand, the world oil price continues to rise.,Overall, 80 percent of the total world energy supply depends on fossil fuels, coal, gas and petroleum based oil (IPCC, 2007). In the first quarter of 2011, world oil price reached $120/barrel. Fu (2008) shows that the price of world oil was influenced by several factors, including the amount of oil production that continues to fall because of limited oil deposit, steady world oil consumption and other factors such as political unrest in the middle east. It had been predicted that world oil price would even reach $1,000/ barrel in 2020 (IPCC, 2007). High and growing consumption of energy increases the need for cleaner production technologies, thereby raising the demand for agro-energy and biofuels (de Camargo Barros *et al.,* 2010). High world oil price caused countries around the world to find alternative energy which are renewable and eco-friendly. Biofuel in general can replace the usage of gasoline, reduce CO_2 emission, protect the environment, and activate agricultural fallow land (Lee *et al.*, 2007).

World bioethanol production in 2012 is expected to reach 20 billion gallons and will grow by 5% from 2008 to 2012. The United States is the largest producer of bioethanol from corn, followed by Brazil as the producer of bioethanol from sugar cane. In the US the estimated subsidies to the biofuel

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industry will reach US$19 billion/year by 2022 (Kebede *et al.,* 2009). The Brazilian bioethanol sector has attracted foreign direct investment due to low production cost and abundance of sugarcane feedstock (Er, 2011). India has been developing biofuel industry since 2003 where molasses is used as a source for bioethanol, but with inconsistent production and supply, restrictive policies and availability of molasses and the high cost of production (Gopinathan and Sudhakaran, 2009).

Indonesia is a country with a large amount of fertile lands. There are almost 30 potential plants that could be used for renewable energy. While fossil fuel production in the country continues to decline, consumption tends to increase. In 2006 the government along with the Blue Print of Energy Mix produced Presidential Decree No. 5/2006 regarding Energy Mix Policy by 2010 which includes a roadmap in the development of biofuel industry. Presidential Decree No.10/2006 established national team of renewable energy that consists of all representatives of institutions and organizations. *Mix Energy Policy* includes energy for household, industry and commercial transportation. The government has provided funds amounting to Rp 200 trillion for the first five years in which a portion of that amount will be used for the development of alternative energy-producing plants, such as palm oil, castor and cassava. The government had also raised Rp 12.2 trilion investors for the biofuel industry (BKPM, 2008), where the number of registered domestic company (PMDN) were 31 business units with a value of Rp 8 trillion, while Foreign company (PMA), it was 28 companies worth about U.S. $ 464 million (Waluyo, 2007). However, in 2010, PT Molindon Raya, the only company that has been continuously supplying bioethanol to PT Pertamina, had stopped supplying to this state company and switched to export the product abroad.

The purpose of this study is to formulate the strategy for developing competitive Indonesia's bioethanol competitiveness and to identify the inhibiting and supporting factors to develop bioethanol industry in Indonesia.

Analytic Network Process: Bioethanol Strategy Framework

Due to a large variety of potential raw materials for bioethanol, this research was limited to cover only six type of raw materials namely sugarcane, corn, cassava, sweet potato, sago and sweet sorghum. The Analytic Network Process (ANP) method identifies the whole general competitive situation of the bioethanol industry in Indonesia. This method is used instead of the Analytic Hierarchy Process (AHP) to identify the industry. The power of the ANP lies in its use of ratio scales to capture all kinds of interactions and make accurate predictions, and, even further, to make better decisions (Saaty, 1996). It allows interactions and feedback within clusters (inner dependence) and between clusters (outer dependence). Feedback can better capture the complex effects of interplay in human society. The ANP provides a thorough framework to include clusters of

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elements connected in any desired way to investigate the process of deriving ratio scales priorities from the distribution of influence among elements and among clusters.

Due to the complication of elements involved in the industry, which are not only hierarchy effects but also affect and be affected by other elements as well, the ANP method was considered a better method to identify strategies to be developed for the competitiveness of the bioethanol industry. Experts chosen were from government institutions, research and education as well as private companies. These experts are major players in the bioethanol industries and a member of the Bioethanol Association. Their insight opinions were used to construct the general framework for the competitive bioethanol industry in Indonesia.
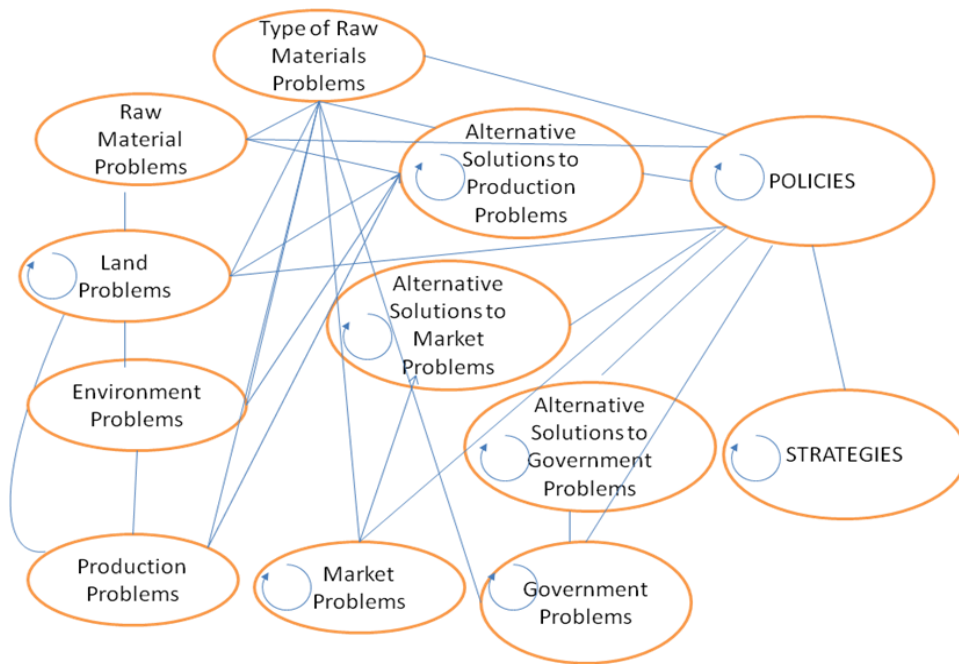

Figure 1. Indonesia ANP Bioethanol Strategy Framework
(Based on Experts Opinions)

Each factors in the framework should be carefully determined, whether they relate to each other, affect the other or only be affected by certain factors. The whole inhibiting factors of the bioethanol industry in Indonesia have to be accounted and then be redesigned to understand the relationship between each factor. Every opinion from the experts, past research studies, theories and data were synthesized to construct a workable framework.

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Construction of the framework took three months. The framework was retested by the experts to determine whether it is appropriate to capture the whole situation of the competitive bioethanol industry. Figure 1 shows the final ANP framework of the bioethanol industry in Indonesia, consisting of four categories including problems, alternative to solutions, policy and strategy. The experts were asked for answering the pairwising comparison questions, which were later calculated together, and checked for later agreement for consistency, determining the final strategy formulation outcome.

Pair wise comparison used was based on a nine point ratio scale developed by Saaty (2005) which shows expert judgments and preferences (Table 1).

Table 1. Nine Point Scale of Numerical Ratings (Based on Expert Judgements and Preference)

Numerical Rating	Expert Judgment and Preference	Remarks
1	Equally important	Two attributes contribute equally to the attribute at the higher decision level
3	Moderately more important	Experience and judgment slightly favor one attribute over another
5	Strongly more important	Experience and judgment strongly favor one attribute over another
7	Very strongly more important	Experience and judgment strongly favor one attribute over another, its dominance has been demonstrated in practice
9	Extremely more important	Experience and judgment extremely favor one attribute over another and it is of the highest possible order of affirmation

Source: Saaty (2005)

Problems of Bioethanol Industry

Contraints in the bioethanol development industry were classified into seven groups, namely types of raw material, problems of raw material, land, production, environment, market and government. Types of raw material were then divided into sugarcane, cassava and corn, while raw material problems were divided into raw material unavailability and quality inconsistency. Land problems were divided into unavailability of land, geographical difficulties and infrastructure lacking. Production problems were divided into non-ideal size and technology choice problems, while environment problems were divided into input and output problems. Market problems were divided into price uncertainty, consumer unawareness, low world fossil fuel price and world bioethanol import

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trap. Government problems were divided into government unawareness, lack of supporting regulations, producer and consumer incentives and miscoordination.

Table 2 shows the results within each problem cluster. For example, corn (0.635) has more problems than cassava (0.242) or sugarcane (0.123) as a source for bioethanol. While the second column shows the results of the whole problems. Among all constraints, government miscoordination has the highest problem (0.041), followed by low world oil fossil fuel price (0.038) and price uncertainty (0.038). During the time when this research was being conducted, world oil fuel price was around US$ 70/barrel, and the price received by industry for bioethanol was about Rp 6,000 per liter. Sugarcane was considered the most potential source of bioethanol compared to cassava and corn, when related to other problems involved such as availability, consistency, infrastructure and government support. A separate cost analysis results support the ANP outcome where cost of producing sugarcane is lower than cassava or corn

Table 2. ANP Scores for Competitive Bioethanol Industry Problems in Indonesia, 2010

Problems	Normalize	Limiting
Type of Raw Material		
Cassava	0.242	0.009
Corn	0.635	0.024
Sugar Cane	0.127	0.005
Raw Material		
Quality Inconsistency	0.250	0.004
Unavailibility	0.751	0.011
Land		
Geographical Difficulties	0.242	0.006
Lack of Infrastructure	0.412	0.010
Land Unavailability	0.346	0.009
Production		
Non Ideal Size	0.702	0.015
Technology Choice Problems	0.298	0.006
Environment		
Input Problem	0.575	0.014
Output Problem	0.425	0.011
Market		
Customer Unawereness	0.140	0.015
Low World Price Fossil Fuel	0.351	0.038
Price Uncertainty	0.351	0.038
World Bioethanol Import Trap	0.157	0.017
Government		
Lack of Proper Regulation	0.230	0.027
Miscoordination	0.343	0.041
No Producers and Consumers Incentives	0.163	0.019
Unawereness	0.263	0.031

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Alternative Solutions of the Respective Problems

Alternative solutions were classified into 11 groups namely optimization of production, lands utilization, zero waste, bioethanol cluster, local producer incentives, fair price, consumer demand, government awareness, government active role for the industry, government coordination and government solution to develop, and supporting regulations. Industry clusers are geographical concentrations of competitive firms in related industries that do business with each other and that share needs for common talent, technology and infrastructure (Porter, 1990).

Even if government miscoordination problem was considered higher than market problems, the result shows that producer incentives and fair price for producers were more important as alternative to solve the competitive bioethanol industry problems (Table 3).

Table 3. Alternative Solution Results for Competitive Bioethanol Industry Problems in Indonesia, 2010

Alternative Solutions	Limiting
Local Producer Incentives	0.035
Fair Price for Producers	0.035
Government Awareness	0.032
Good Government Coordination	0.030
Government Active Role	0.027
Utilization of Lands	0.026
Developing and Supporting Proper Regulations	0.024
Creating Consumer Demand	0.022
Optimazation of Raw Material	0.018
Bioethanol Cluster	0.017
Zero Waste Alternative Solutions	0.010

Subsidy from the government of Rp 1,000 per liter of bioethanol produced was considered still too low by producers. Bioethanol contains a higher octane than fossil fuel therefore it can be used to replace lead as an octane enhancer in petrol. The blending of bioethanol and gasoline, will oxygenate the mixture that can burn more efficient and reduce emission pollutions. Brazilian government has issued an estimated subsidy of $ 3 billion per year to produce bioethanol from sugar cane from the early 1980s (Er, 2011). While in the USA, estimated subsidies to the biofuel industry will reach US$19 billion/year by 2022, for example by lowering the ethanol tax from $ 0.52 to $ 0.51 per gallon from 2005 to 2007. Producer push has changed into consumer demand pull condition (Kebede *et al.*,

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2009). The government of India imposes import tariffs of 186 percent for ethanol product from overseas to protect its domestic bioethanol industry (Gopinathan and Sudhakaran, 2009). World bioethanol production in 2012 is expected to reach 20 billion gallons and will grow by 5% from the year 2008 to 2012, where the US is the largest producer of bioethanol from corn, followed by Brazil as the producer of bioethanol from sugar cane (World Energy Outlook, 2008).

Future Policy Direction

Porter (1990) stated that the environment of the industry, such as government role is crucial in the process to build competitiveness. Hutson (2006) studied the impact of government policies on shrimp competitiveness industries between India and Thailand. The study concluded that Thailand more competitive because the government is very active supporting the industry compared to India. Ernst (2000) found that small size companies in Taiwan had some disadvantages, such as constraints of new innovations and limited scope of technological spillovers; limited knowledge and capital base. However, the government policies in Taiwan had facilitated the initial market entry for small companies and upgrading, causing small scale companies in Taiwan to flourish.

Policies for the competitive bioethanol industry maybe classified into five groups namely new bioethanol development blueprint, regulations to support local producers, regulations for developing consumer demand for bioethanol and regulations to reduce carbon emissions. The results shown in Figure 2 indicates that the bioethanol industry requires a new bioethanol development blueprint to replace the existing blueprint and also additional policy and regulations to support local producers.
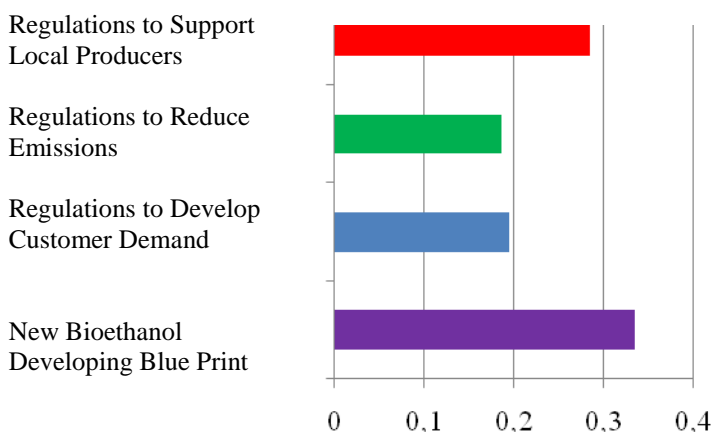

Figure 2. Policy for Competitive Bioethanol Industry in Indonesia

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Anticipative Strategy for Enhancing Bioethanol Industry

According to Porter (1990), strategy means deliberately choosing a different set of activities to deliver a unique mix of value. Porter argues that strategy is about competitive position, about differentiating yourself in the eyes of the customer, about adding value through a mix of activities different from those used by competitors. Strategy formulation is the development of long-range plans for the effective management of environmental opportunities and threats, in light of corporate missions, specifying achievable objectives, developing strategies, and setting policy guidelines (Wheelen and Hunger, 2008). A clear and reasoned strategy including its road map to competitive advantage is very important to achieve an industry's goal and objectives. Lao *et al.* (2011) studied on factors affecting strategy for success supply chain of manufacturing in Hong Kong. Karbuz and Sanli (2010) found that in Turkey, a well-developed industry energy strategy requires a nonlinear and multidimensional thinking to being able to develop the country's economy.

Strategy for the bioethanol competitive industry were divided into five groups, namely strategy to develop a complete stakeholder, strategy to create an institution of renewable energy, strategy cluster, creating demand pull strategy for consumers and strategy for producer incentives. The results can been seen in Figure 3.
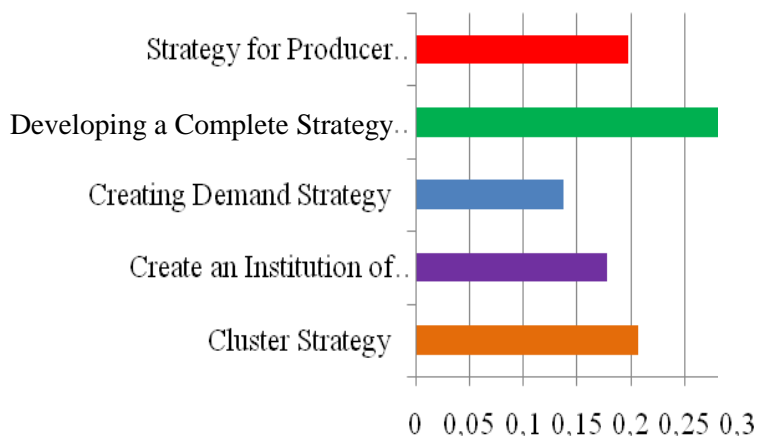

Figure 3. Strategy for Enhancing the Competitive Bioethanol Industry in Indonesia

As for the strategy, developing a complete stakeholder and cluster were considered the most important for the bioethanol industry, since the whole stakeholders are these who actively involved in the industry (Figure 3). If the

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government produces blueprint and regulations without the support from other stakeholders, there will be more constraints to appear. Cluster strategy is also considered important, because bioethanol industry could be more competitive if it is used either in small scale (in scattered areas, such as cassava) but with an integrated systems, or in large scale industries , such as sugar cane companies.

CONCLUDING REMARKS

The ANP results showed that sugarcane was considered the most potential type of raw materials for bioethanol industry. However, government miscoordination, lack of producer incentive and uncertainty of price received by producers were the major problems of the bioethanol industry.

To develop bioethanol industry, the most important policies are to develop a new blue print which has been adopted to recent condition of the industry, as well as more support policies from the government to induce local producers. A complete stakeholder combined with support to local producers and cluster strategy should be developed to expand the bioethanol industry in Indonesia.

Further studies need to be conducted on factors affecting cluster concentration development. An example is the Merauke Integrated Food and Energy Estate (MIFEE).

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