

RESEARCH

Green Technology Roadmapping: A Case Study In Fast Moving Consumer Good (FMCG) Companies In Indonesia

Nur Laili

Center for Science and Technology Development Studies, Indonesian Institute of Sciences

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* Correspondence:

Building A PDII-LIPI
4th Floor, Jl. Jend. Gatot
Subroto No. 10, Jakarta
Selatan 12710
E-mail:
nur.laili@lipi.go.id

Abstract

Degradation of environmental quality has become a global issue in the last decade. Industrial activity is one of the major causes of climate change and global warming. Governments in several countries have developed policies to reduce carbon emissions from industrial activity. The development and the use of innovative green technology products can be an alternative to reduce the impact of global warming due to carbon emissions from the industry. Adoption of green technology in the FMCG industry has become an interesting issue since it deals with the optimization of production costs and reduction of product prices that characterize the FMCG industry. This paper presents an overview of the adoption of green technology in the FMCG industry in Indonesia. A case study was conducted in one of the largest FMCG companies in Indonesia. The application of green technology is presented in the form of a technology roadmap for ten-year period between 2010 and 2020. The results showed that the adoption of green technology is the company's response to government policies and international regulations related to the environmental issues. The whole supply chain units of the company both internal and external, are involved in the adoption of green technology, while the technology itself comes from external source. The adoption of green technology has given some benefits to the company in the form of a decrease of environmental impacts caused by carbon emissions and hazardous waste. Another benefit is the adoption process increases the efficiency of production cost from economizing water and electricity uses. The indirect benefit from the adoption of green technology is the increasing company competitiveness through technological mastery and strong position of product in national FMCG market.

Keywords: green technology, FMCG industries, technology roadmap

I. Introduction

Degradation of environmental quality has become a global issue in the last decade. Climate change and global warming becomes the concern of governments in several countries. Carbon emission is one of green house gases contributing to global warming. The greatest producers of carbon emission are industry and transportation sectors. Concomitant with the life cycle of its production, industrial activities produce carbon emission, starting from raw material extraction, production processes, transportation and distribution, to product waste from consumption activity by consumers (Bocken and Allwood, 2012). This means carbon emission is produced along the entire

industrial supply chains. Therefore, the efforts of reducing industrial carbon emission cannot be focused only on the end product, but should also be focused on the entire industrial supply chains, from raw material provision to disposal of hazardous waste processes involved in the entire internal business processes of a company (Sundarakani *et al.*, 2010).

Governments in several countries have developed policies to reduce carbon emissions, produced by industrial activities within their territory. The response of industry to these policies, i.e. an improvement in the form of eco-friendly technology adopted in each process of industrial supply chains is known as green technology concept. Development and use of innovative green

technology product can be an alternative to reduce the impact of global warming due to carbon emission from the industry (Ismail *et al.*, 2013). Initially, green technology concept in industry was developed to fulfill the demand of government regulation on carbon emission. Later development showed that the adoption of green technology in industry did not only have an effect in reducing industrial carbon emission, but could also give a benefit for the company in the form of competitive advantage. A research on this fact has been conducted to 375 retailers in Japan with the result showing that retailer adopting green store utilisation and green transportation has been proven superior to competitors not adopting green technology concept (Tang *et al.*, 2011). Other research was also conducted by analyzing data from 4000 manufacturers in seven OECD countries, showing that development of green technology by manufacturer has the benefit of pushing innovation and increasing companies' reputation and competitiveness in the market (Testa and Iraldo, 2010).

Fast moving consumer goods (FMCG) industry is one of the industries producing carbon emission during its life cycle. The production of carbon emission from FMCG industry starts from raw material extraction to product packaging waste, after consumption. Perceived from its characteristics, FMCG industry is heavily influenced by the dynamics of consumer needs, including the growth of population, which results in the increase of FMCG product demand. The higher the demand, the more the industry must produce, which means the more carbon emission produced. The increase of carbon emission is not only a result of an increase of production process activities, but also an increase of activities at supply chains of FMCG industry, for example activities at retailer (Quinn, 2009).

Green technology concept is beginning to be adopted by FMCG industry, including in Indonesia. The adoption of green technology in FMCG industry becomes interesting since it is connected to the optimization of production cost and reduction of product price which characterizes FMCG industry (Sarkis, 2003). As an illustration, if FMCG industry lowers its carbon emission by changing its product packaging to a more eco-friendly ones, there will be a dilemma concerning the product price. Using the eco-friendly packaging will raise the production cost, (compared to the use of standard packaging); and consequently will raise the product price. On the other hand, the product price competition in FMCG industry sector is vital and becomes a competitive advantage of a company; thus the adoption of green technology must involve economic calculation and stakeholder interests.

This paper presents an over view of the adoption of green technology in FMCG industry in Indonesia. A case study was conducted in one of the largest FMCG companies in Indonesia. The adoption of

green technology is presented in the form of a technology roadmap for ten-year period between 2010 and 2020. This roadmap will illustrate the implementation and planning of green technology in companies with multi layer structure connection in adopting green technology, both internally and externally. Next there will be analysis on the effect and benefit gained by companies from adopting green technology process. The discussion on the results of green technology roadmap is conducted by examining and evaluating green technology adoptions and policies in Indonesia.

II. Method

Technology Roadmap

Technology Roadmap is a vital device to collaborate technological planning for an industry. In technology roadmap, the course of planning and development policies of the company's technology is systematically pictured. The development of a company's technology roadmap is firmly connected to company's investment decision. The result of technology roadmap can be a company's guidance in order to compose a more effective and optimum investment planning, especially investment in technology. Employing the guidance taken from technology roadmap, a company will be able to identify the main product-need which will direct the selection of technology and the decision of research and development. The main feature in composing technology roadmap is the company's needs. Therefore, technology roadmap is the right approach to identify, evaluate, and select technology alternatives that can fulfill the need of the company (Garcia, 1997).

Technology roadmap developed in this paper is a company-scaled roadmap focused on the green technology that has been adopted and will be developed in the company. the data used are secondary data originated from the company and supporting data connected to the composition of roadmap such as governmental policies related to green technology in the company. The time horizon in the roadmap is for 20 years. The framework of technology-roadmap-development employed in this paper refers to the roadmap framework developed by Phaal and Muller (2009).

Technology roadmap structure is composed by two main dimensions namely time frames and multi layer (Phaal and Muller, 2009). Time frames is usually pictured horizontally, divided into five ranges namely condition at present, short-term, medium-term, long-term and company's vision of the future. For industries with fast technology development, such as electronic industry, the technology roadmap is usually composed with short-term time horizon, while for other industries, such as infrastructure, the technology roadmap is usually composed with long-term time horizon. Further explanation of time frames can be viewed in

Tabel 1. Time Frames In Technology Roadmap Development

Timeframe	Time range	Key variable
The past	Condition at present	Knowing company's condition at present, mainly to identify which factors are influential in leading the company to its present condition.
Short-term	1 year	A vital horizon in a roadmap; here the roadmap is a planning, soon to be realized and will get full support of budget and resources from the company.
Medium-term	3 year	Related to company's strategic planning, usually contains selection of technology to be developed in the future.
Long-term	10 year	A bridge between medium-term strategy and company's vision. This horizon contains uncertainties and scenario for company's technology in the future. It gives illustration of business and market, potentially developed in the future.
Vision	>10 year	It contains aspiration of the organization and company's courses in long term.

Sources : edited from Phaal and Muller (2009)

table 1.

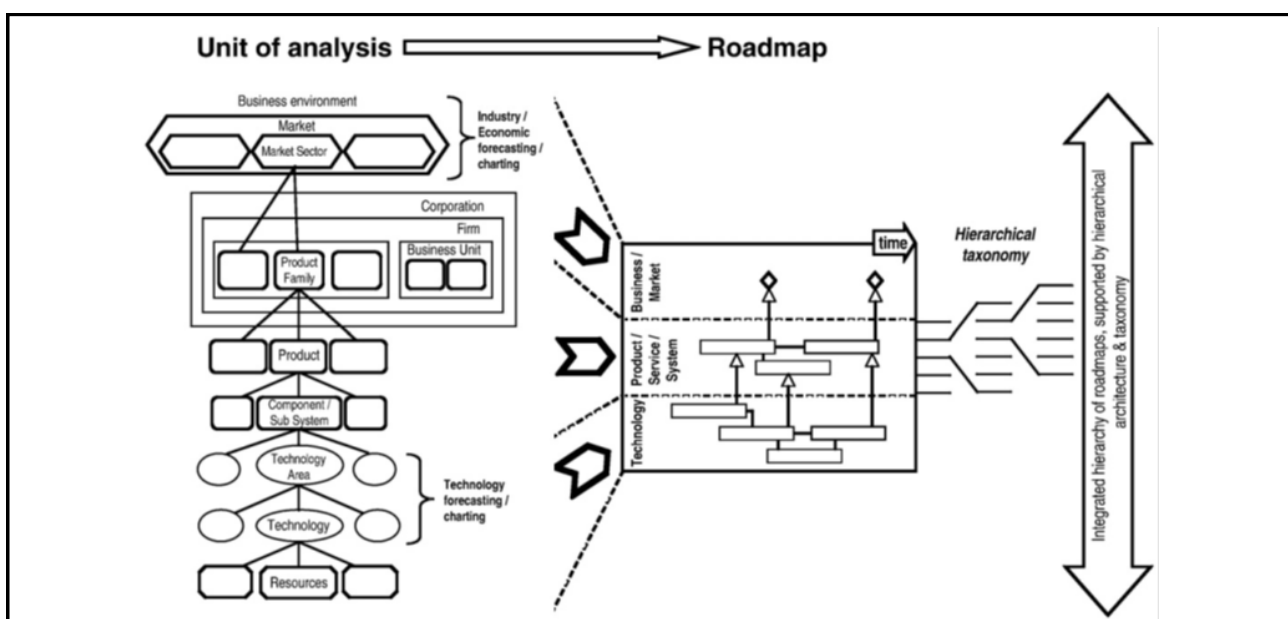
The second dimension is multi layer structure which can be generally divided into three layers, namely market and business layer, products/service/system layer, and technology layer. The structure of multi layer dimension in technology roadmap is shown in Figure 1.

Company's General Picture

This paper develops a technology roadmap of one of the largest FMCG companies in Indonesia with 60% market share from the total market share of FMCG industry in Indonesia. This company has 40 brands and has existed since 1933 in Indonesia. Viewed from its resources, this company has 4,796 employees. The company has eight factories for production and 385 distributors supporting the distribution and marketing of its product.

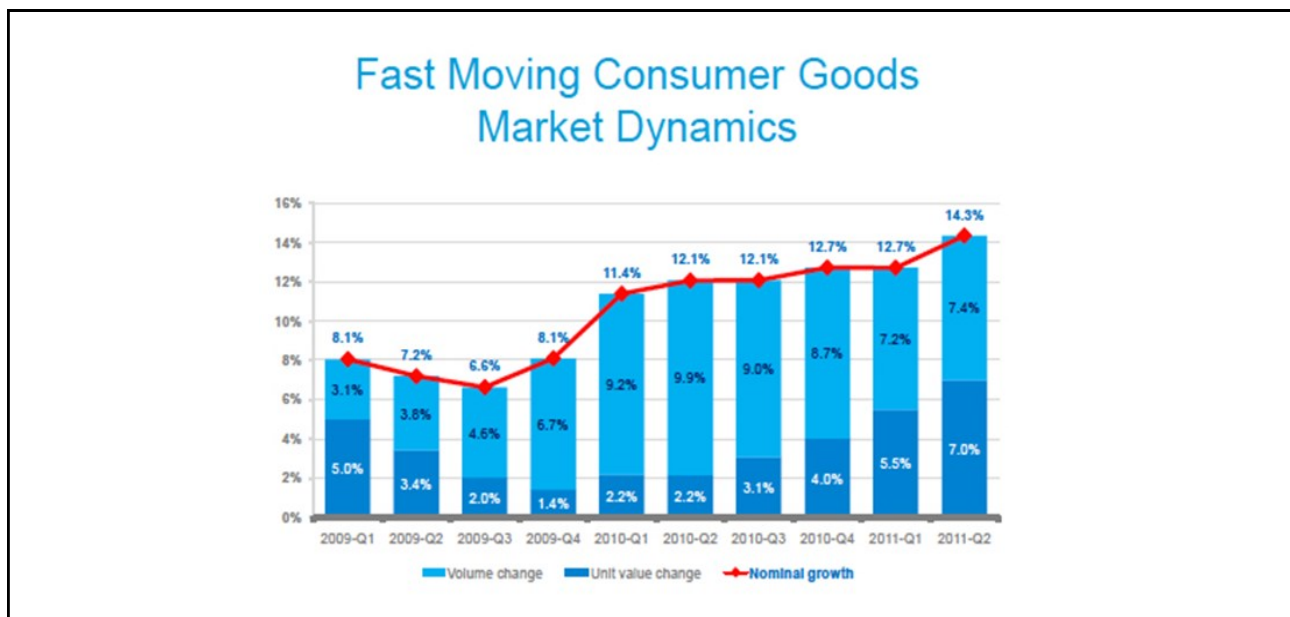
III. Development of FMCG Industry In Indonesia

FMCG industry produces people's daily need products. The consumption of FMCG industrial products reaches the entire society strata without regard to income level or economic degree. In general, the consumers of FMCG products are so many; they are potential market-targets of this industry. FMCG industry in Indonesia endeavors to reach low income society strata by producing needed goods at attainable price for them. FMCG market in Indonesia is very competitive and dynamic, both in price competition and product innovation. FMCG products are notably varied since FMCG companies in general diversify their products continually. The diversification of FMCG products is among others for cosmetic products. In 2004, up to 744 companies are recorded to join the Cosmetic Company



Sources : Phaal and Muller, 2009

Figure 1. Multi layer structure in technology roadmap.



Sources: Nielsen, 2011

Figure 2. The Development of FMCG in Indonesia from 2009-2011.

Association (Clay, 2005).

Result of the Nielsen Company Survey shows a quite strong FMCG market development in Indonesia between 2009 and 2011. In nominal, FMCG market grew consecutively up to 4.7%, 8.1%, and 11.6% from 2009 to 2011. Meanwhile in volume, FMCG market grew up to 1.4%, 6%, and 6.5% for the same period. For 2012, Indonesia FMCG market value is estimated to grow up to 13% in nominal. The size of demography and the increase of “middle class” group in society make Indonesia a quite potential retail market. At the moment, the “middle class” group of society is estimated to contribute up to 44% of FMCG shopping (Nielsen, 2011). In general, the development of FMCG industry is caused by the increase in the whole consumption, as well as by the social dynamics of Indonesian people, like urbanization that increases the consumption of FMCG products.

The growth of FMCG industry is stimulated by several factors, namely the growth of Gross Domestic Product (GDP), growth of population, growth of capital income, alteration of people lifestyle and government policy (Malhotra, 2010). For example, the growth of FMCG market is correlated to the growth of GDP. The increase in GDP will generally be followed by the increase of consumption in society, primarily the consumption of personal care products and household care products. Figure 2 shows that the growth of FMCG industry follows the growth of GDP in Indonesia between 2009 and 2011.

FMCG characteristics can be viewed from two perspectives, consumer and market actor perspectives. From consumer perspective, FMCG characteristics are shown by high frequency of

product buying, low dependency, and cheap price. From producer perspective, the characteristics are high selling volume, the use of extensive distribution channel, and high supply turnover.

FMCG (Fast Moving Consumer Good) products can be categorized into three categories, namely personal care, household care, and food and beverages. Examples of personal care product are toothpaste, shampoo, cosmetics, and perfume; examples of household care are detergent and insecticide; and examples of food and beverages are soft drinks, tea, and coffee.

Commercial expense in FMCG industry is as high as commercial expenses in other industries. FMCG industry in general advertises their products with the intention of keeping product brand perception, launching new product, and winning market competition. FMCG industries in average spare a budget up to 10% - 15% from net selling for commercial expense (Nielson Media Research, 2003). This implies that the brand power of a product is a strength, providing competitiveness for companies in market competition. Apart from commercial expense, FMCG industry also allocates special budget for market research whose main goal is to catch information concerning the needs and wants of consumer from a product. Furthermore, market research is also used by FMCG industry to study the company's position in FMCG market share.

IV. Green Technology Roadmap

Production activities carried out by industries will evoke negative impact to environment. Environmental impact does not emerge only in production activities, but also in consumption

activities that generate garbage and wastes. This environmental issue demands industry to better consider environmental impact in its production planning and activities. Green technology concept emerges as an alternative in minimizing environmental impact from industrial activities. Green technology is defined as a product, tool or system which meets the criteria of minimizing environmental degradation, green house gas (GHG) emission, and a technology that is much safer to use and capable to improve environmental quality, as well as a conversion towards renewable energy use (KETTHA, 2011).

In Indonesia, the government has a great concerns of environmental issues and it is actualized in several regulations, issued by concerned ministries. On the other hand, the stakeholders of industry also start to be aware of this environmental issues by developing company's internal policies, regulating environmental issues. These internal policies regulate that the company will be more responsible towards environment both in process and product to comply with existing regulations and maintain its product image in the market and accomplish potential competitive advantage (Tsai *et al.*, 2013). Initiation of green technology adoption also occurs in industries in Indonesia, among others in FMCG industry. This paper will examine the adoption and planning of green technology in one of the largest FMCG companies in Indonesia, in the form of technology roadmap for ten-year period between 2010 and 2020.

The development of green technology roadmap in this paper refers to technology roadmap

framework with multi layer structure, developed by Phaal and Muller (2009). Based on the result of analysis, there are four company's internal layers and three company's external layers involved in the adoption of green technology in the company. The four company's internal layers are company policies, products, resources and technology. The three company's external layers are international regulation, government policies, and market. These seven layers involved in adoption of green technology can be seen in Table 2.

Result of analysis shows that the development of green technology in the company is influenced by international regulation and the government policy related to the efforts of minimizing environmental impact from company activities. In the company of the case study, there is a direct and indirect causality between international regulation and government policy as the external layer of the company, with the development of green technology by the company. These regulation and policy are responded by the company's board of directors and managerial level in the form of several internal policies. The development of green technology in the company is based on the vision to be achieved by the company in 2020, namely the sustainable manufacturing. The result of green technology roadmap for ten years in the company in this case study is shown in Figure 2.

Production Cost Efficiency from Green Technology Adoption

The adoption of green technology in the company is carried out gradually in accordance with the

Table 2. Company's Layers In Adoption of Green Technology

Layer	Definition	Function
International regulation	Product and process-standardization and international agreement, transpired for industry with environmental issue content	Reference for the development of green technology in the company
Government policy	Government policies related to environmental impact	Minimum need to be fulfilled by company, related to the limit of industrial impact to environment
Board of directors and managerial level in the form of company's policy	Company's internal policy and program in the framework of green technology adoption to minimize environmental degradation caused by company activities	Stipulation of adopting green technology that must be carried out by each division in company, including setting company investment decision
Market	Consumers of FMCG products in Indonesia	Green technology users
Product	Company's products in the form of food and beverages, personal care and household care	A media for green technology implementation
Resources	Company resources, involved in the adoption of green technology, consisting of industry supply chain, R&D unit, factory, and offices	A media for green technology implementation, R&D unit in particular has the function of developing and generating the green technology needed by the company
Technology	New or upgraded technology that is more eco-friendly in the company	The Green technology planned and developed by company

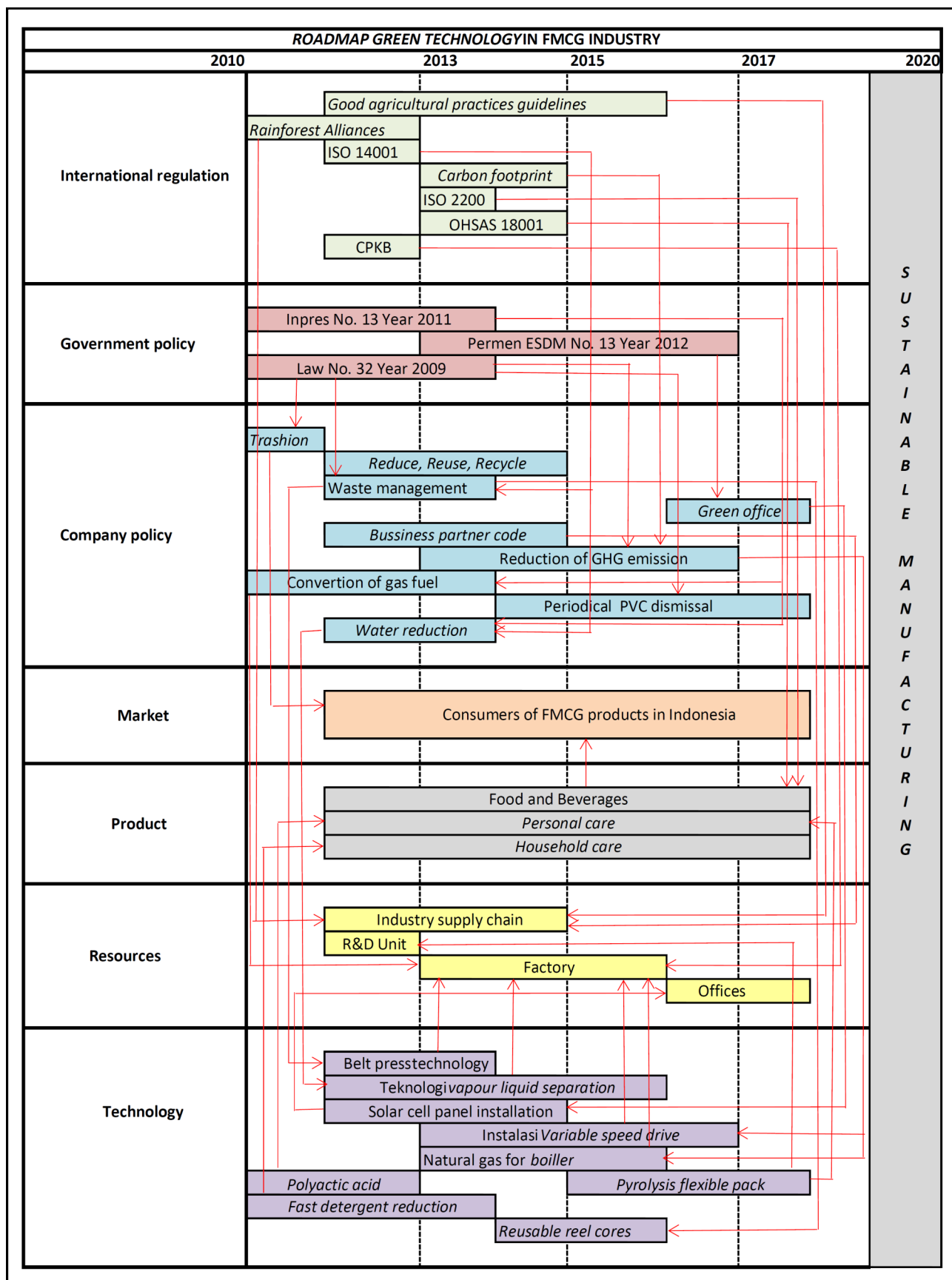


Figure 2. Green Technology Roadmap.

planning of company programs. The main goal of green technology adoption is sustainable manufacturing process that has minimum impact to

environment. Apart from environmental aspect consideration, the company also sees sustainable manufacturing process from economic aspect. The

implication of this, apart from the benefit in the form of environmental impact minimization, the adoption of green technology also gives economic benefits for the company. One of these economic benefits is production cost efficiency from the adoption of green technology.

Production cost efficiency is shown by cutting off the cost spent by the company in production process. In roadmap structure in Figure 2, the production cost cut is generated by technology layer in the company. The cost saving is analyzed from cost reduction by using green technology, compared to previous technology. The adoption of green technology in production floor is carried out gradually for ten years. Production cost efficiency can be analyzed from green technology adoption for the first three years, namely between 2010 and 2013.

To evaluate green technology adoption as a whole, the company applies Environment Management System (EMS) program. One of the activities carried out in EMS is auditing green technology adoption in the production process, particularly economic evaluation. One example of production cost efficiency is shown by the result of EMS audit in Table 3. The application of belt press technology, vapour liquid separator and solar cell panel installation allows the company to reduce the use of water and electricity that when assessed economically is amounted to 160,000 euros annually in total.

Increase of Company Competitiveness from Green Technology Adoption

Company competitiveness is company capability in winning market competition. Company competitiveness can derive from the advantage or uniqueness it possesses that competitors do not have in the market. World Economic Forum (2013) defined one of industry competitiveness indicators is the readiness and commanding of technology and product efficiency in the market. The readiness and commanding of technology of a company include technology superiority, commanded and applied by

company both in managing and performing production process. This section will discuss how green technology adoption can increase company competitiveness through technology superiority and product efficiency in the market.

Green technology is defined as a technology capable of minimizing environmental impact emerged from technology utilization. The use of a more eco-friendly technology will surely give advantage for industry mainly in the reduction of carbon emission and hazardous waste. Associated with company competitiveness, green technology adoption can be classified as an indicator for technology advantage of the company. Technology advantage in this matter is defined as a more eco-friendly technology, when company competitors still adopt the technology without any focus on environmental impact. The result of this case study shows that green technology adoption is a process of adopting technology derived from an external source. The company gradually invests through strategic planning to replace old technology with more eco-friendly technology (green technology).

The reduction of carbon emission and hazardous wastes are the benefits desired by the company by adopting green technology. So far the company through EMS program has continually been conducting quantitative measurement of several parameters of carbon emission and industrial wastes. Reduction of carbon emission and industrial wastes can be seen by comparing the result of 2009 measurement when the company had not adopted green technology with the result of 2010 measurement when the company had adopted green technology. The result of this comparison shows a significant reduction of environmental impact from green technology adoption, as shown in Table 4. For chemical oxygen demand (COD) parameter, hazardous waste, SO₂ emission and CO₂ emission, there are significant reductions from between 25% to 73.70%; while for non-hazardous waste and recyclable waste parameter there is an increase. This implies that green technology adoption is proven

Table 3. Production Cost Efficiency as a Result of Green Technology Adoption

Technology	Process	Implication	Production Cost Efficiency
Belt press	production waste management of personal care products	Reduction up to 50% of water used in managing hazardous waste. Sludge cake produced is recycled as raw materials by the cement manufacturing company.	Company can save up to 160,000 euros annually.
Vapour liquid separator	Personal wash factory	Liquid steam separation in drying machine technology allowing reduction of hot steam used (conserving water and energy)	
Solar cell panel installation	Processing factory in Rungkut	Reduction of electricity use up to 16,335 GJ annually	

Source: Edited from the result of interview (2013)

Table 4. The Reduction of Carbon Emission and Industrial Wastes

Parameter (kg/ton)	Year		Differential	Description
	2009	2010		
Total COD	0.92	0.69	25%	down
Hazardous waste	7.52	1.98	73.70%	down
Non hazardous waste	5.65	6.07	7.40%	up
Recycled waste	12.79	21.84	70.76%	up
Boiler Sox (as SO ₂)	0.026	0.011	57.69%	down
CO ₂	147.9	126.6	14.40%	down

Source: Edited from Environment Management System (EMS) Report of Company x (2011)

capable of minimizing negative impact to the environment.

The second World Economic Forum (2013) indicator, used to analyze company competitiveness, is product efficiency in the market. As a company enjoying the largest FMCG market share in Indonesia, the company has long-term view in composing company's strategic steps including investing in green technology adoption. The result of case study shows that green technology adoption is capable of giving advantage to the company, primarily in the acceptance of their products in the market. Analysis is conducted on the marketing of one of the company's personal care products, namely skin cleansing and soap. The company's roadmap in Figure 2, for international regulation layer in particular, shows that the company has adopted one of the international regulations namely PCMM (proper cosmetics manufacturing methods). PCMM regulation is a regulation covering the quality and safety of cosmetic products. The company applies this principle among others in producing skin cleansing. The company makes sure that the skin cleansing products they produce meet the health standard, both from raw materials and production process aspects. The company includes these details in their product packaging as one of their marketing strategies. The result of market survey conducted by the company on their skin cleansing products is shown in Figure 3.

The diagonal line in Figure 3 illustrates the acceptance of a certain product brand in the market. Whether a product is well accepted and has good market share or not is seen from the desirability index dan perceived relative price index, and is illustrated as being above the diagonal line. The company's skin cleansing products are shown by the two dots circled by red line. The result of this survey shows that those skin cleansing products are above the diagonal line which means they are well accepted and have relatively good market shares. In the result of this survey, there is also an analysis on the reasons why consumers choose these skin cleansing products. The main factor is attainable price and quality, and when examined further, it is because the company provides guarantee of safety

and health of these skin cleansing products. However, it will take further analysis on the connection between PCMM application and product competitiveness in the market since both do not show a direct causality connection.

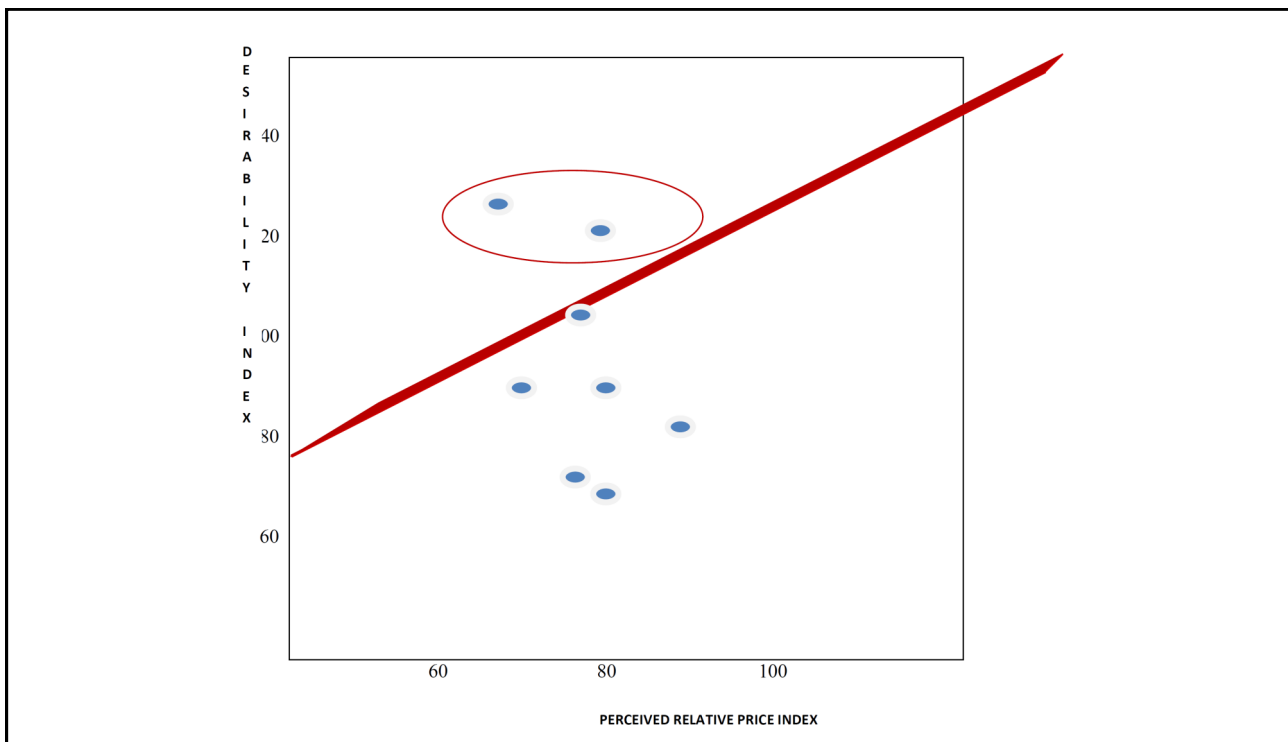
V. Discussion

Discussion is conducted to analyze the result of roadmap in Figure 2. The analysis is conducted in two frames, namely evaluation of green technology adoption in the company and government policy concerning green technology in Indonesia.

Evaluation of Green Technology Adoption in the Company

Adoption of green technology in the company is a process of adopting technology from outside the company. the process of adopting a new technology in a company usually takes a long time (Geroski, 2000). The company must conduct a learning process on the new, to be adopted technology before they can take advantage of this new technology optimally. The result of this study shows that the company has comprehended the need to do the learning process in adopting the green technology that will replace the old technology in the company. It is shown from the strategic planning conducted by the company by setting ten-year span to adopt green technology in several company divisions. This planning is firmly related to investment decision since green technology adoption requires investment whose feasibility should be first analyzed.

Examined from the technology source, the company chooses to use technology from outside the company. Company's R&D division does not develop green technology, but focuses on developing new products that economically have higher added value to the company since they have the potential of drawing higher profit. Hussinger (2010) stated similar argument that in an environment with fast technology alteration, the adoption of technology and knowledge from outside the company becomes vital and can provide benefit for the company.



Source: Marketing Division, Company X

Figure 3. The result of market placement survey of skin cleansing products.

Technology adopting process is conducted by buying machines and production and post-production instruments from vendors outside the company, such as belt press machine and VLS from vendor from Germany. In adopting green technology, the company focuses more on the technology in production process, waste management, and office operational activities, while green technology content on the product has not existed yet.

From managerial part, it shows in Figure 2 that green technology adoption in the company is set through the company's internal policy layer. This implies that the application of eco-friendly technology, minimizing negative environment impact, is company's focus and has full support of the management. In adopting the process of a technology, support from the management to the new technology is a must so that the adopting process of the technology can give significant benefit to the company (Fernandes *et al.*, 2006). Company internal policy to adopt green technology does not only involve management, but also involves company resources layer in Figure 2. The company resources involved is not only the company's internal part, but also external part. Company internal resources consist of R&D unit, factory, and office facilities, while company external part consists of the entire parts of company supply chain, from farmer as raw material supplier, distributor and retailer, to consumers as the product's end users. Farmer as company supplier adopts good agricultural practice guidelines. Even consumer is involved in the

company waste recycling activity which is called Trashion. This Trashion program gives benefit for consumer in the form of extra income.

The company's main goal in adopting green technology is to minimize negative impact from the company's industrial activity to the environment. It has been explained in introduction section how carbon emission and global warming issues have become the industry's concern. Green technology Adoption is proven successful in reducing carbon emission and hazardous waste as is explained in Table 4. However, as a FMCG company that controls 60% of market share in Indonesia, the company surely has profit orientation too from this green technology adoption. Adoption of new technology, apart from being technological advanced step, is also an investment decision that should be analyzed for its economic feasibility.

Huang (2011) believes that a company adopting new technology has the potential to increase company's performance and achieve competitive advantage. This can also be applied to the company in this case study, by achieving benefit in the form of more efficiency in production cost by adopting green technology. Adoption of green technology gives benefit in the form of reduction of water and electricity use both in production process and waste management process. The reduction of water and electricity implies reduction of production cost according to economic law; reduction of production cost gives potential to the company to raise profit or lower the price to increase sales.

Apart from production cost efficiency benefit as a direct benefit of adopting green technology, the result of this case study also identifies a second benefit like the increase of the company's competitiveness. The company's competitiveness is increasing, seen from two indicators namely technology commanding ability and product efficiency in the market. Green technology Adoption provides learning process for the company in commanding and application of the new technology that other companies in the market has not mastered yet. The company's competitiveness is also increasing, seen from the market share of the products produced by adopting green technology. This is shown from the survey result of desirability index and perceived price index of the products as shown in Figure 3. Previous researches using technology roadmap method also stated that the adoption of new technology conducted with strategic planning can give added value and increase competitiveness (Setiawan, 2012). However, it will take further study to analyze the increase of competitiveness related to effect of adopting green technology since both do not show direct causality connection. Increase of market share potential of green technology products is caused by the competitive price and company's marketing ability factors.

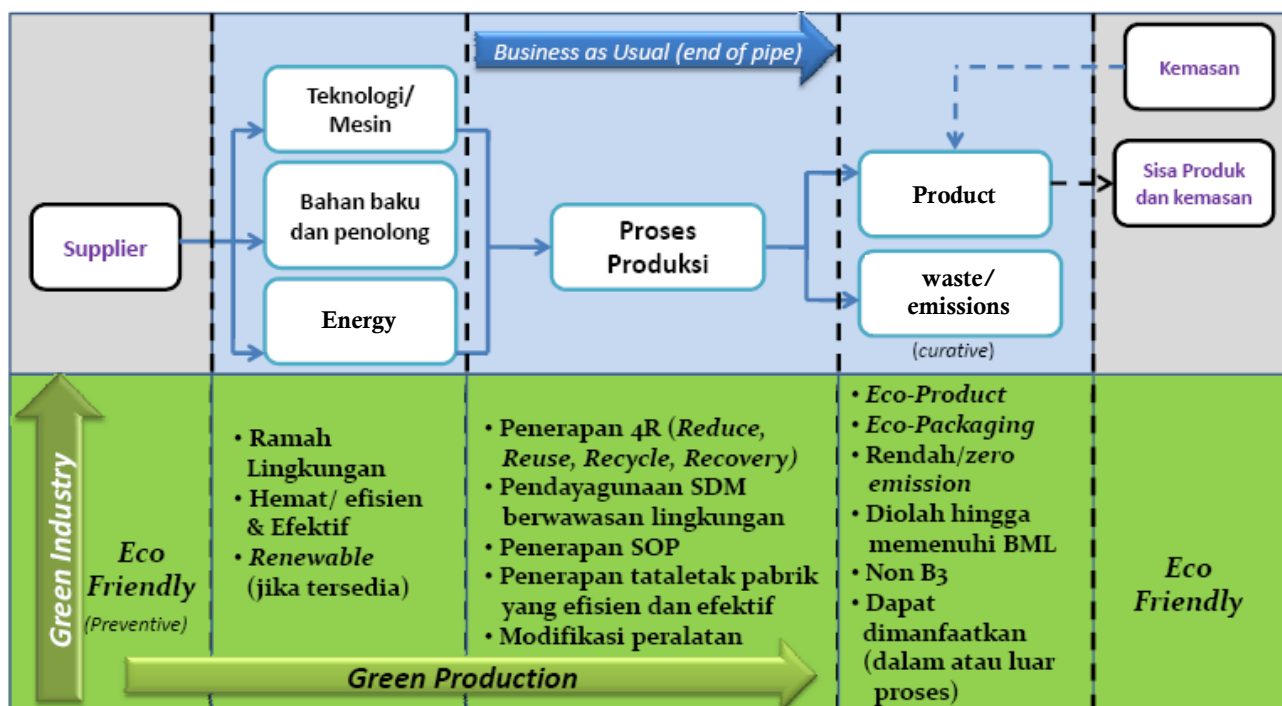
Green Technology policy in Indonesia

As has been explained in the introduction section, carbon emission and global warming issues have come into attention, including in industry sector.

International agreement on carbon foot print has pushed governments to develop policies regulating environmental impact, from industrial activities in particular. Green technology policy in Indonesia is legally based on the Presidential Decree No. 28 Year 2008 on National Industry Policy. One of the things regulated in this policy is how to build industry with sustainable development concept. Sustainable development concept can be seen from three aspects, namely social, economy, and environment. This policy features green industry development concept by adopting green technology as one of its components.

FMCG industry is one of the industries contributing to carbon emission and green house gases. Other industries are cement industry, steel industry, pulp and paper industry, ceramic industry, petrochemical industry, fertilizer industry, and textile industry. Indonesia has committed to lower green house gases emission up to 26% in 2020. One of the steps taken is by applying green industry development concept. It can be seen in Figure 4 that sustainable green industry is built by involving the entire supply chains, from supplier to packaging waste management. Green technology is a main component in developing green industry.

The result of this case study, in one of FMCG companies, shows how this company has applied sustainable green industry development concept. Figure 2 shows how green technology adoption is conducted as a whole in all roadmap layers, both internal and external company. The company responded to the policy and regulation on green technology, both local policy and internal



Source: Working program of BPKIMI, Ministry of Industry (2012)

Figure 4. Green industry development concept.

regulation. The company's respond to policy and regulation is shown by identifying various appropriate green technologies first, then by adopting the new technology. For example, the company responded to the Decree of the Minister of Energy and Mineral Resources Year 2012 by implementing green office concept in factory's facilities and offices in Rungkut and Surabaya. This adoption of green technology is proven capable of generating reduction of water and electricity use in the company.

Government policy on green industry development is not only applied to large industry, but also to small and medium businesses. Adoption of new technology including green technology has the consequence of certain investment and cost during learning process and transition of the new technology. This problem is usually encountered by small and medium businesses, hence they tend to maintain the technology they command at present although it still has negative impact to environment. Government has tried to overcome this problem, among others by providing eco-friendly machine grant. The use of eco-friendly machines is conducted through the restructuring of machineries for textile and textile product, footwear and sugar cane industry program (BPKIMI Kemenperin, 2012). This program gives significant impact in the form of energy saving and productivity increase. This impact is similar to the impact of adopting green technology in this case study in FMCG company. This implies that proper adoption of green technology can give benefit to the industry both in reducing environmental impact and economic added value.

VI. Conclusion and Recommendation

In this case study, in one of the FMCG companies in Indonesia, it can be concluded that green technology adoption is the company's respond to government policy and international regulation related to environment. Green technology adoption involves the company's entire supply chains, both internally and externally, while the technology itself comes from outside the company. Green technology adoption gives benefit to the company in the reduction of environmental impact such as carbon emission and hazardous waste. Other direct benefit is the increase in production cost efficiency through the reduction of water and electricity use. Indirect benefit of the new technology adoption is the increase of company's competitiveness through the commanding of technology and good position of product in national FMCG market.

The writer recommends further research related to investment decision in green technology adoption. Moreover, it takes a further study to analyze the impact of adopting green technology to product acceptance in the market since both do not have direct causality relationship. This is because product acceptance in the market is influenced by

the product price and company's marketing strategy factors.

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