

PERFORMANCE ANALYSIS OF GREEN SUPPLY CHAIN MANAGEMENT IN PT TIRTA INVESTAMA SUBANG

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ABSTRACT

Each link in the supply chain can lead to pollution, waste, and other hazards to the environment, so the concept of Green Supply Chain Management (GrSCM) began a trend to be implemented by the company. PT Tirta Investama is a manufacturer of Bottled Drinking Water, the brand "AQUA" the location of its plant in Subang, have applied the concept GrSCM since 2010. But until now, have not done an evaluation of the performance of companies that have been applied GrSCM. This study aims to analyze the performance of the company GrSCM with Key Performance Indicators (KPI) is the Internal environmental management, Green purchasing, Cooperation with customers, Eco-design, and Investment recovery.

Key words: *Green Supply Chain Management, Performance, Analytical Hierarchy Process, Green Purchasing, Eco-design.*

1. INTRODUCTION

No less than 40,000 industries operating in Indonesia and from year to year continues to show improvement. An increasing number of industries raises the issue of environmental impacts of industrialization, which is an increase in pollution resulting from each stage of the production process. Each group company is establishing a network of supply chain and between a network with other supply chain network is also interconnected. Each link in the supply chain can lead to pollution, waste, and other environmental hazards. Waste and emissions released by the supply chain has become a major source of environmental problems including global warming and acid rain (Bloemhof-Ruward et al., 1995).

The industry and consumer concern for the environment growing and the issue of the concept of environmentally sound industry have forced the industry to adjust to the concept of green industries in every business process, which then developed into a Green Supply Chain Management (GrSCM).

Green supply chain management requires many companies to continuously improve

the production performance of his company to comply with environmental regulations. The company has a variety of reasons for applying Green supply chain management, from simply reactive policies to proactive approaches to gain competitive advantage is to improve their competitiveness by improving their environmental performance. The impact is to increase the brand image of the company's concern for the environment.

Besides Green Supply Chain Management has become a rapidly growing industry trend in multinational giants such as Dell, HP, IBM, Motorola, Sony, Panasonic, and Toshiba are beginning to apply the concept of environmentally friendly (Zhu dan Sarkis, 2006).

PT Tirta Investama is a company that produces bottled water, the Aqua brand. Varian products are Aqua gallon, glass bottle 380 ml, plastic bottles 1500 ml, plastic bottles 600 ml, plastic bottles 330 ml and plastic cups 240 ml. PT. Tirta Investama has 16 plants and water source options spread across several regions of Indonesia. One factory is located in the Village District Darmaga Cisalak, Subang. Aqua Plant has four line (channel) water packaging capable

of producing an average of 1,500 gallons per hour.

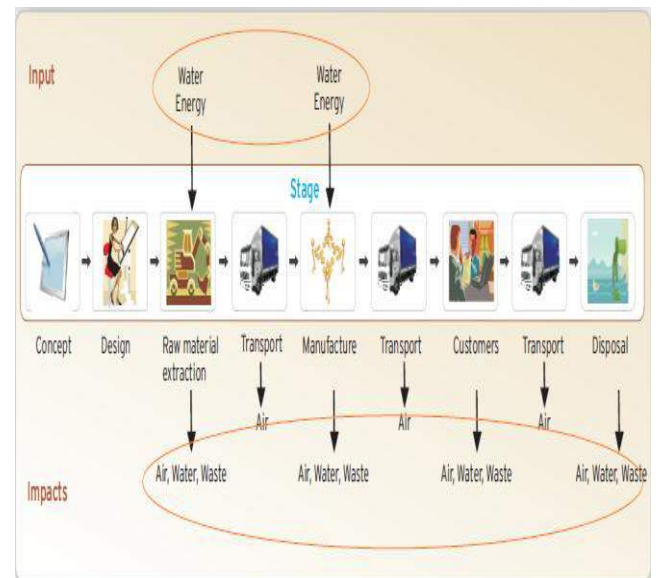
PT. Tirta Investama has implemented a Green Supply Chain Management since 2010, but to get a brand image as an environmentally friendly company also intended to keep the raw material (virgin material) extracted from underground water. Green supply chain management company that focuses on increasing the applied efficiency and synergy among business partners and companies, helping to improve environmental performance, minimize waste and achieve cost savings companies. Green Supply Chain Management involves the company, suppliers and distributors in environmental conservation programs. Until now, evaluation has not been done on the performance of Green Supply Chain Management has implemented the company. This study aims to analyze the performance of Green Supply Chain Management company with Key Performance Indicators (KPI) is the Internal environmental management, Green purchasing, Cooperation with customers, Eco-design, and Investment recovery.

2. THEORETICAL BACKGROUND

Green Supply Chain Management is a new study that appears in the traditional supply chain perspective. Supply chain revolution in the early 1990s has prompted the company to be environmentally conscious (Srivastava, 2007).

Green Supply Chain Management involves the traditional practices of supply chain management, integrating environmental criteria, or decision problems purchasing goods or services and long-term relationships with suppliers (Gilbert, 2000). The purpose of the green supply chain is to consider the environmental impact of all products and processes, including the environmental effects stemming from the goods / products and processes ranging from raw materials to finished products, and final disposal of these products (Gilbert, 2000).

Green supply chain management as the process of using environmentally friendly inputs and transform inputs into outputs that can be reused at the end of its life cycle, creating a sustainable supply chain (Penfield, 2007). Each link in the supply chain can lead to pollution, waste, and other environmental hazards. Here's the impact on the environment at every stage of the supply chain



Source : Penfield (2007)

Figure 1. The impact on the environment at every stage of the supply chain

Research topics environmentally friendly organization that has been published in the literature over the last twenty years is the concept: green design, green operations, reverse logistics, waste management and green manufacturing (Guide & Srivastava, 1998; Srivastava, 2007).

The concept of Green Supply Chain Management was first published in 1989 in the article Kelle and Silver (1989) who developed a forecasting system that is optimal for the organization to use the product estimate has the potential to be reused.

Thipparat (2011) introduced five key quantitative indicators to evaluate GrSCM consisting of: 1) Internal environmental management, 2) Green purchasing, 3) Cooperation with customers, 4) Eco-design , and 5) Investment recovery. Furthermore Thipparat (2011) outlines the indicators into

21 sub criteria which consists of: 1) Commitment of GSCM from senior managers, 2) Support for GSCM from mid-level managers, 3) Cross-functional cooperation for environmental improvements, 4) Total quality environmental management, 5) Environmental compliance and auditing programs, 6) ISO 14001 certification, 7) Environmental Management Systems exist, 8) Eco labeling of products, 9) Cooperation with suppliers for environmental objectives, 10) Environmental audit for suppliers' internal management, 11) Suppliers' ISO14000 certification, 12) Second-tier supplier environmentally friendly practice evaluation, 13) Cooperation with customers for eco design, 14) Cooperation with customers for cleaner production, 15) Cooperation with customers for green packaging, 16) Design of products for reduced consumption of material/energy, 17) Design of products for reuse, recycle, recovery of material, component parts, 18) Design of products to avoid or reduce use of hazardous products and/or their manufacturing process, 19) Investment recovery (sale) of excess inventories/materials, 20) Sale of scrap and used materials, and 21) Sale of excess capital equipment .

3. RESEARCH METHOD

Performance Analysis GrSCM using key indicators adopted Thipparat (2011). Of five key indicators are then broken down into 20 sub criteria organized into a hierarchy of valuation. The model hierarchy consists of three levels, namely:

Level 1: Goal or objective

Level 2: Criteria support goal

Level 3: An alternative to the prescribed criteria.

AHP (Analytical Hierarchy Process) developed by Saaty (1980) is used to determine the priority of the elements of the criteria as weight / contribution of these elements to the decision-making purposes. AHP determines the priority with pairwise comparison method. Priority is determined based on the views of experts and interested parties to the decision. In the pairwise

comparison matrices, judgment using a scale of 1-9. Logical consistency is the consistency of the answers of the respondents to prioritize the elements, is a fundamental principle that will determine the validity of the data and results of decision-making. For the calculations used in this study AHP software Expert Choice 11.

Steps to resolve this study are presented in Figure 2 below.

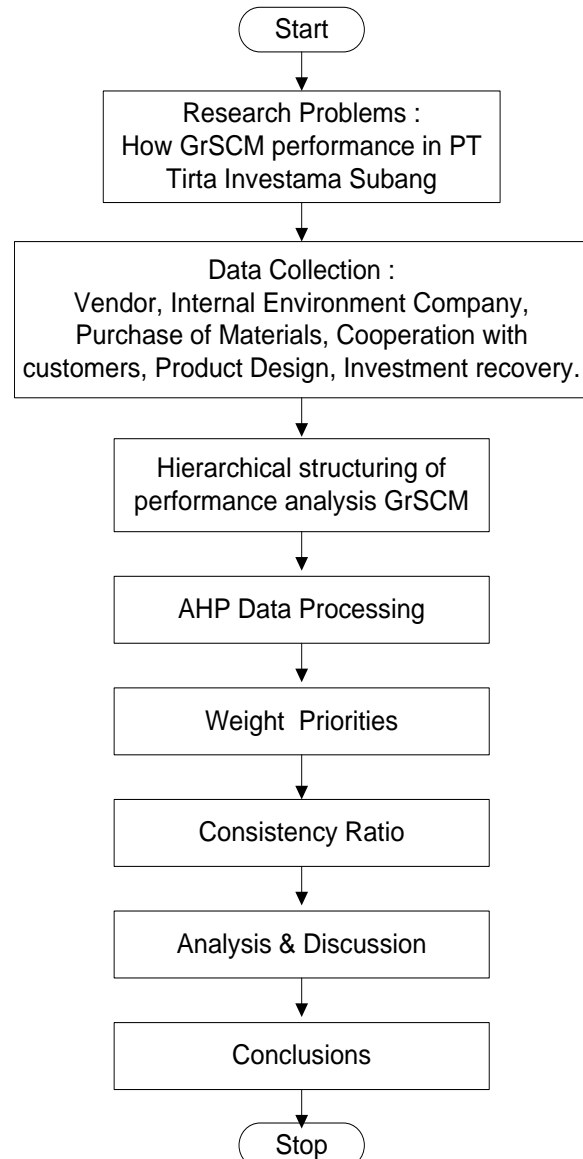
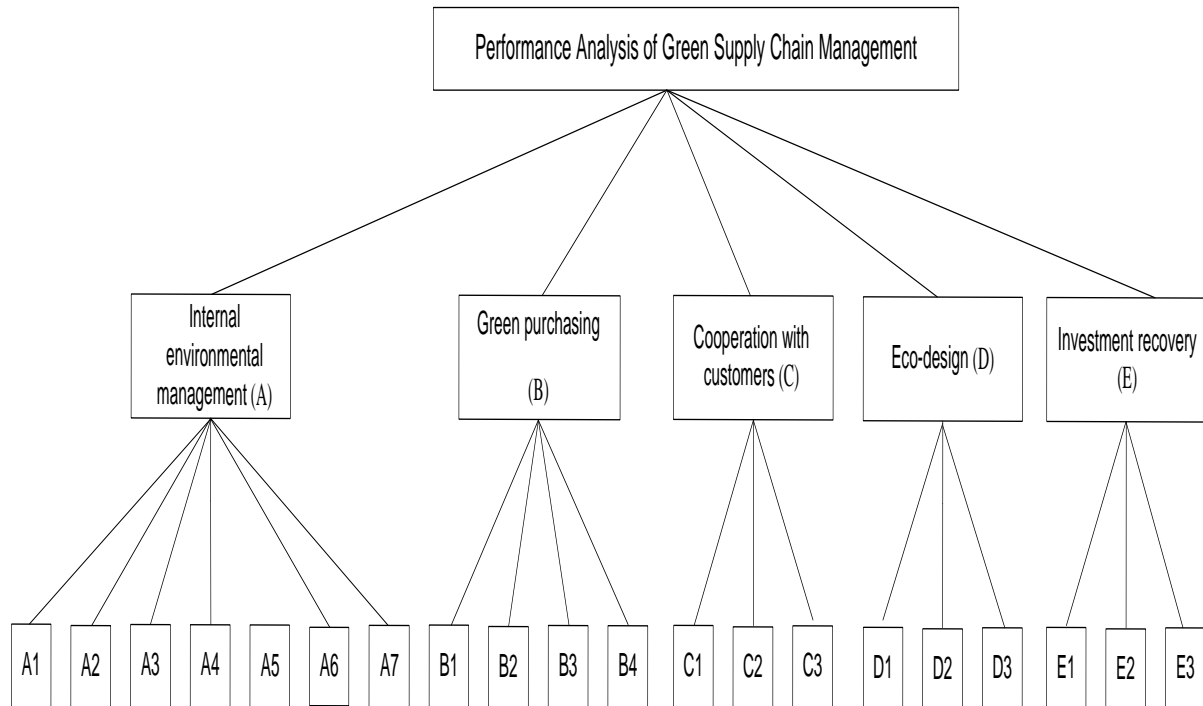


Figure 2. Stages of problem solving research

While the hierarchical structure is used to analyze the performance of Green Supply Chain Management in PT Tirta Investama Subang presented in Figure 3.



- A1 = Commitment of GrSCM from senior managers
- A2 = Support for GrSCM from mid-level managers
- A3 = Cross-functional cooperation for environmental improvements
- A4 = Total quality environmental management
- A5 = Environmental compliance and auditing programs
- A6 = ISO 14001 certification
- A7 = Environmental Management Systems exist
- B1 = Eco labeling of products
- B2 = Environmental audit for suppliers' internal management
- B3 = Suppliers' ISO14000 certification
- B4 = Second-tier supplier environmentally friendly practice evaluation
- C1 = Cooperation with customers for eco design
- C2 = Cooperation with customers for cleaner production
- C3 = Cooperation with customers for green packaging
- D1 = Design of products for reduced consumption of material/energy
- D2 = Design of products for reuse, recycle, recovery of material, component parts
- D3 = Design of products to avoid or reduce use of hazardous products
- E1 = Investment recovery (sale) of excess inventories/materials
- E2 = Sale of scrap and used materials
- E3 = Sale of excess capital equipment

Figure 2. Structure Hierarchy Analysis Model for Performance Analysis of Green Supply Chain Management

4. RESULT AND DISCUSSION

Flow Supply Chain Aqua Product PT Tirta Investama Subang, from the supplier to the customer and empty bottles revised to the company presented in Figure 4.

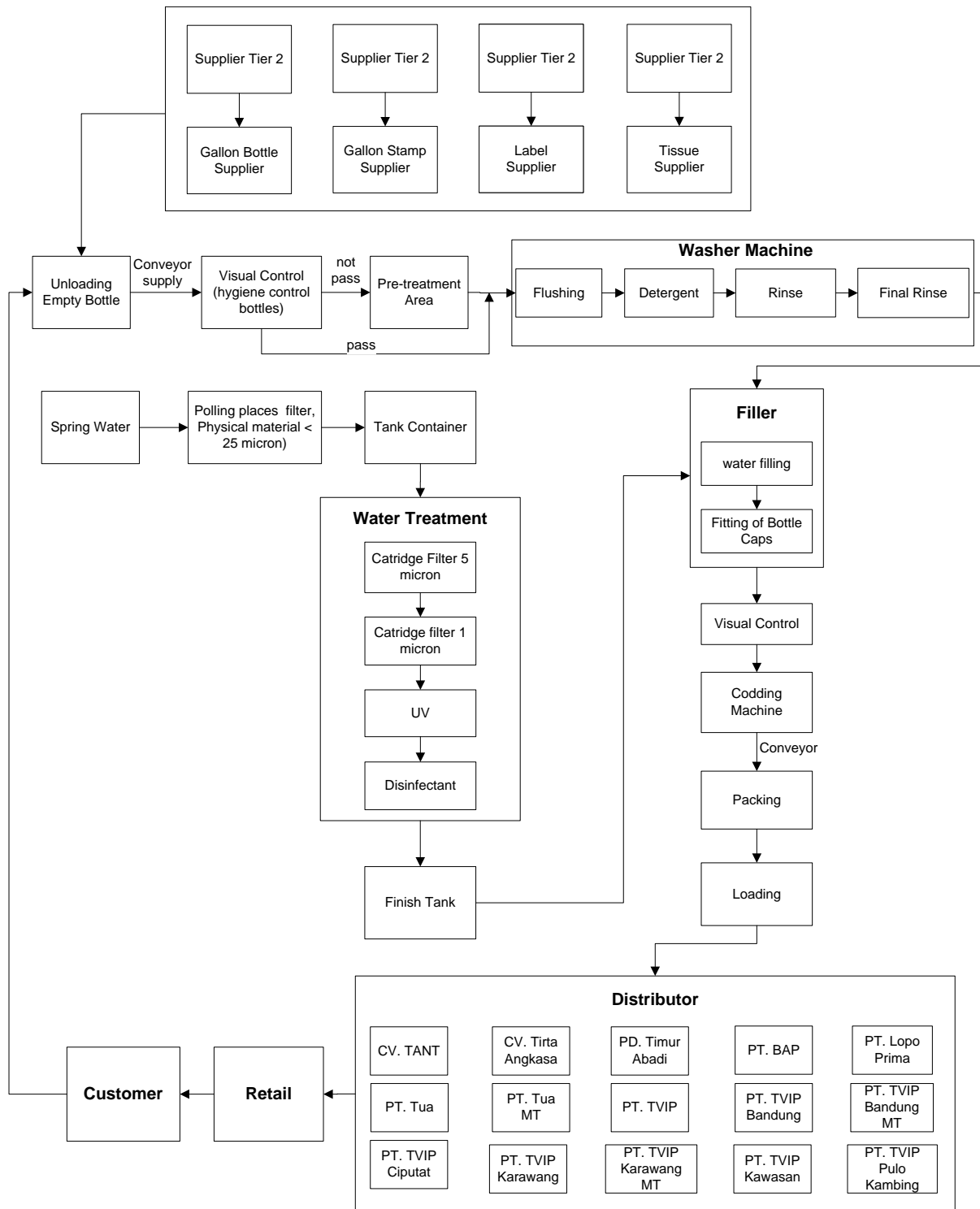


Figure 4. Flow Supply Chain Aqua Product PT Tirta Investama Subang

Green Supply Chain Performance Measurement Management conducted a series of indicators that are made in the questionnaire form pairwise comparison matrix. This questionnaire was filled by the experts in the company of Performance Manager, PPIC Plant Manager and

Purchasing Manager. The weight of each expert assessments for each of the indicators into one value by using the Geometric Mean calculation which is a function of the processing Combine the software Expert Choice 11.0. Examples of Geometric Mean calculation with the

software Expert Choice 11.0. presented in Figure 5.

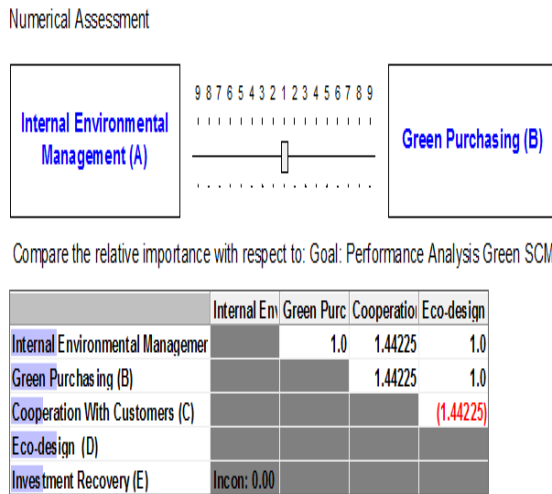


Figure 5. Example calculation of Geometric Mean

Meanwhile, to obtain the weight of each criterion and alternative, use the menu both local and global priorities in the software Expert Choice 11.0, and processing results are presented in Figure 6. Expert assessment results (Figure 6) shows that there are three criteria that have high performance, namely:

- 1) Internal environmental management, which is the management of a variety of things related directly to the activities of the company, whether in the form of Resource, Capabilities and Core competencies. These criteria are assessed by the experts has been successfully implemented in companies with good (high weight rating), for the following reasons:
 - a. Commitment of GrSCM from senior managers and mid-level managers.
 - b. Has done training for the employees of the companies core competencies of green supply chain management.
 - c. The existence of applying these concepts that are Green (energy and water saving efforts)
 - d. Companies focus on continuous improvement in products and service to customers.
 - e. Has done some audit programs relating to the environment (ISO 9001, Green Audit and ISO 22000).

- f. Has implemented ISO 14001 (environmental management standards)

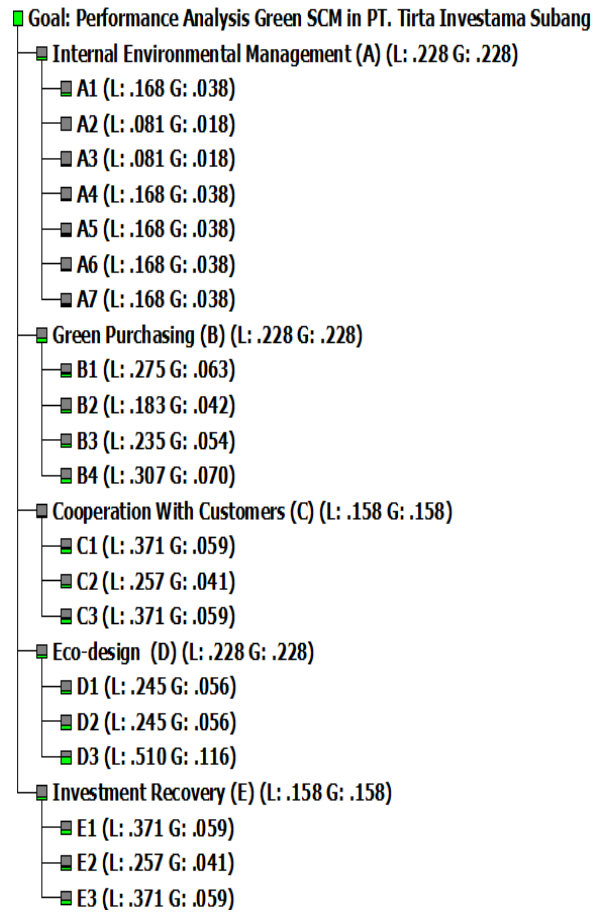


Figure 6. The weight of each criterion and alternative performance GrSCM

- 2) Green purchasing, a business process in the procurement of materials for the production process by taking into account aspects of environmental criteria. These criteria are assessed by the experts has been successfully implemented in companies with good (high weight rating), for the following reasons:
 - a. The company has done ecolabeling on products.
 - b. Applying stringent selection against its suppliers, where suppliers must have ISO 14000 certification and have the cooperation with suppliers to tier-1 and-2 for the purpose of environmental friendliness.
- 3) Eco-design, a product design in the product development stage to reduce the impact on the environment, these criteria

assessed by the experts has been successfully implemented in companies with good (high weight rating), for the following reasons:

- a. Aqua 5 gallon bottles used is returnable bottles, so the 5 gallon bottles designed for life for 2 years in order to reduce the consumption of bottle making it environmentally friendly.
- b. Cover and contents of the product Aqua designed with constituent chemical composition of green chemistry in accordance with SNI.
- c. In the design of Aqua 5 gallon bottle cap going dematerialization (reducing component) by removing the plastic seal, so the process is successful in reducing the use of plastic.

Meanwhile, there are two criteria that have low performance, namely:

- 1) Cooperation with customers, developed in pre-sales activities and post sales distribution channels. These criteria are assessed by the experts has not been successfully implemented in companies with good (low weight rating), for the following reasons:
 - a. Pre-Sales, the distribution of products to consumers still using trucks which do not meet the standard criteria for environmentally friendly vehicles. Whether it's for the vehicle from the factory to the distributor center or from the center to the retail distributor-retail / shops.
 - b. Post-sale, the amount of 5 gallon Aqua bottles are not sterile because consumers used to refill water and this affects the age expire 5 gallon bottles and 5 gallon bottles disposal of broken arbitrarily.
- 2) Investment recovery, an activity aimed at restoring water resources, production facilities and equipment. These criteria are assessed by the experts has not been successfully implemented in companies with good (low weight rating), as they are not achieving the target of conservation areas cover around the plant as well as the inadequacy of human resources

assigned to protect the environment around the plant.

5. CONCLUSION

Conclusions of this research are:

- 1) Performance of Green Supply Chain Management has been good for Internal criteria for environmental management, Green purchasing, and Eco-design. To ensure improved performance of Green Supply Chain Management, the company has implemented an Environmental Management System (EMS) based on ISO 14001 standard.
- 2) The Green Supply Chain Performance Management is still low, that the criteria for Cooperation with customers, and Investment recovery.

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