Home   About ISIEM   Previous Event ⌄   The Conference ⌄   Contact Page   🔍

ISIEM

International Seminar on Industrial Engineering & Management

6th International Seminars on Industrial Engineering and Management (6th ISIEM)

The purpose of this seminar is to provide an effective forum for distinguished invited speakers, academicians, engineers, professionals and practitioners coming from universities, research institutions, government agencies and industries to share or exchange their ideas, experience and recent progress in industrial engineering and management

Home   About ISIEM   Previous Event ⌄   The Conference ⌄   Contact Page   🔍   ➕

practice as well as to identify major trends in Industrial Engineering and Management field.

The main theme of this year seminar is "Sustainable innovation on enhancing industrial management, technology, and information". Under this theme, we explore innovation in industrial technology, information, and management concerning worldwide economic challenge. We also discuss approaches to collect, manage, and use any information efficiently and effectively, thus the results will be able to upgrade industrial competitiveness and value in facing the global challenges in industrial environment.

Keynote Speaker:

1. Predeep Nair, Plant General Manager Schneider Electric Manufacturing Batam . "Make the Most of Your Energy".
2. Prof. Dr. Rosnah Mohd. Yusuff , Universiti Putra Malaysia . "Innovations in Manufacturing for Sustainable Growth".
3. Prof Frits Blessing , Rotterdam University / Rotterdam Business School. "I have to change to stay the same".

The Participants

6TH ISIEM PROCEEDING COVER

QM – Quality Engineering & Management

No	Title	Author
1	Design Of Water Quality Model To Support The Indonesian Healthy Project	Ratih Setyaningrum, Dwi Eko Waluyo 📄 PDF QM-p1-5
2	Analysis Service of Satisfaction of Intercity Bus With IPA and CSI Method	Dyah Rachmawati L, Trismi Ristowati, Mohammad Khoeruddin 📄 PDF QM-p6-10
3	Quality Analysis Using Fmea Method On Assembly Processes Of Washing Machine (Case Study In Panasonic Manufacturing Indonesia)	Rifa Arifati, Ardika Rismayana 📄 PDF QM-p11-15

4	Pre Travelling Service Quality Analysis at Rail Station Commuter Jakarta-Bogor	Pudji Astuti. Winnie Septiani, Amal Witonohadi [PDF] QM-p16-20
5	Integrating Kansei Engineering And Customer Relationship Management To Improve Service Quality: A Case Study At Shopping Mall In Surabaya	Markus Hartono, Rosita Meitha, Grandy Ongkowijoyo [PDF] QM-p21-26
6	The Impact Of Perceived Service Quality on Customer Satisfaction And Loyalty: Case Study at Supermarket in Surabaya	Rosita Meitha Surjani, M.Arbi Hadiyat, Vanessa Gautama [PDF] QM-p27-33
7	Quantitative Approach to Measure Process Connectivity in Balanced Scorecard Model	Vivi Triyanti [PDF] QM-p34-41
8	Path Analysis To Assess Interaction Among Tracer Study Factors	Vivi Triyanti [PDF] QM-p42-47
9	Consumer Preferences and Quality Perception of Imported and Domestic Apple in Surabaya	I Gede Agus Widyadana, Tanti Octavia, Herry Christian Palit, Dick Felix Wibowo [PDF] QM-p48-53

Home   About ISIEM   Previous Event ⌄   The Conference ⌄   Contact Page   🔍

No	Title	Author
1	Knowledge Management System Model in DKI Jakarta Rice Supply Chain	Dadang Surjasa, Dedy Sugiarto, Binti Solihah, Nirdukita Ratnawati SCM-p1-8.2013
2	A Design Experiment To Evaluate The Effect Of Demand Pattern Into The Lot Sizing Performance	Arum Sari, Ulista Ferian SCM-p9-14.2013
3	Supply Chain Management Performance Measurements in Oil Company	Tiena Gustina Amran SCM-p15-23.2013
4	Applying Netlogo Simulation Model To Balance The Upstream Palm Oil Supply Chain	Syarif Hidayat, Mas'ud Ridwan SCM-p24-31.2013
5	Hybrid Model For Supplier Selection, Procurement, And Production	Catur Kurniawan, Nur Hildawati SCM-p32-40.2013
6	The Design Of Multi Role Web Based Supply Chain Simulation Game For Learning	Armand Omar Moeis, Rama Raditya, Akhmad Hidayatno SCM-p41-47.2013
7	Performance Analysis Of Green Supply Chain Management In Pt Tirta Investama Subang	Agus Purnomo SCM-p48-55.2013

8	Model For Supply Chain Network Design with Profit Balancing Consideration	Harwati, Muhammad Ridwan Andi Purnomo **PDF** SCM-p56-61.2013
9	The Influence of Supply Chain Management to Product Quality at PT XYZ in Jakarta	Andi Wijaya, Richard Andrew **PDF** SCM-p62-66.2013
10	Production Planning Control to Minimize Production Cost	Nunung Nurhasanah, Riyana Susanti **PDF** SCM-p67-74.2013
11	Measurement Supply Chain Performance Using Metric of SCOR Model (Case Study : Automotive Component Manufacturing)	Nofi Erni **PDF** SCM-p75-80.2013
12	Designing Green Supply Chain Management In Cocoa Agroindustry : Problem Identification And Profiling	Iphov Kumala Sriwana, Yandra Arkeman, Dahrul Syah, Marimin **PDF** SCM-p81-89.2013
13	Spare Parts Distribution Route Planning with Saving Matrix Method at PT.XYZ	Iphov Kumala Sriwana, Sylvia Madusari, Nurulita Aulia Sari **PDF** SCM-p90-94.2013

OR – Operation Research

No	Title	Author
1	Crashing Project Schedule Network with Methods Selection	Ismail H. Asrul

Home   About ISIEM   Previous Event ⌄   The Conference ⌄   Contact Page   🔍

		PDF OR-p1-9.2013
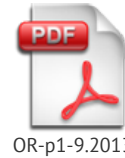
ER – Ergonomics

No	Title	Author
1	The Analysis of The Effect on Physical Environment Factor for Noise and Luminous to Accuracy Score on Reading and Colors Matching	Wahyukaton PDF ER-p1-6.2013
2	Optimum Design of 1 -DOF Anthropomorphic Thumb Considering Grasping Motion for Indonesian Low-Cost Prosthetic Hand	Tyo Prasetyo, Susy Susmartini, Ilham Priadythama PDF ER-p7-12.2013
3	The Cutting Ampoule Design Inovation to Develop Safety and Helath Patient	Yuwono B Pratiknyo, Anita Purnamayanti PDF ER-p13-18.2013
4	Design Measurement for Manufacturing Ergonomic Value of an Automotive Part Using The Total Ergonomic Approach Model	Tiena G. Amran, Nataya Charoonsri Rizani, Herawan Setio PDF ER-p19-28.2013
5	Train Derailments In Indonesia – A Study Using Human Factors Analysis and Classification System	Citra Wanurmarahayu, Hardianto Iridiastadi PDF ER-p29-34.2013
6	Designing Workbench on The Sawmill Station to Reduce Physical Load at Surya Mas Factory	Lamto Widodo, Andres, Fransisca Lipin

		PDF ER-p35-41.2013

DSS – Decision Support System and Artificial Intelligence

No	Title	Author
1	Database Management System Application (Case Study: Twisbless)	Raymond Bahana, Hans Kristian PDF DSS-p1-8.2013
2	A Design Of Learning Management System Using Adaptive Recommendation Method	Jinsuk Yang, Kyoungsu Oh, Sangjun Lee PDF DSS-p9-13.2013
3	Customer Relationship Management Information System Development In PT. Citra Van Titipan Kilat	Fransiskus Adikara, Ricky Fauzi PDF DSS-p14-20.2013
4	Occlusion Detection Of Virtual Target For Augmented Reality	Gyeyoung Kim , Changjin Suh, Sangjun Lee, Soowon Lee PDF DSS-p21-26.2013
5	The Emergence of User Requirement Risk In Information System Development for Industry Needs	Fransiskus Adikara, Benhard Sitohang, Bayu Hendradjaya PDF DSS-p27-33.2013

6	A Progress in Business Intelligence Implementation in CRM (Customer Relationship Management), SCM (Supply Chain Management) And Quality Management	Rina Fitriana, Marimin, Taufik Djatna [PDF] DSS-p34-43.2013
7	Evaluation of The VRP Completion with Developing Hybrid Genetic Algorithm Using Fuzzy Logic Controller Model	Yogi Yogaswara [PDF] DSS-p44-53.2013
8	Proposed Of Decision Policy Model Development For City Logistics Stakeholders	Yogi Yogaswara, B. Kombaitan, Idwan Santoso [PDF] DSS-p54-62.2013

IM – Industrial Management

No	Title	Author
1	Customization of Open Source Enterprise Resource Planning System	Muhammad Ridwan Andi Purnomo, Luthfina Ariyani [PDF] IM-p1-6.2013
2	The Technology Implementation in Academic Processing to Achieve Effectiveness and Efficiency Of Information (A sharing from The Private University in Bandung)	Elizabeth Tiur M. [PDF] IM-p7-12.2013
3	Description and Review Existing Knowldege Management Framework, System, Technology and Architecture	Riya Widayanti [PDF] IM-p13-27.2013

Home   About ISIEM   Previous Event ⌄   The Conference ⌄   Contact Page   🔍

4	Implementation of Evaluation Model and Supplier Performance Scorecard in Selecting Supplier	Johan Oscar Ong, Merry Erliani 📄 PDF IM-p28-38.2013
5	The Marketing Mix Strategy Based On Consumer Behavior Analysis at Taxi Max Cipaganti In Surabaya	Esti Dwi Rinawiyanti, Rosita Meitha, Ira Mayasari 📄 PDF IM-p39-46.2013
6	Catastrophe Model for Analyzing Behaviour of Development Policies In Indonesia	Dadan Umar Daihani 📄 PDF IM-p47-55.2013
7	Understanding Accounting Franchise, Guidance by Franchisor and Going Concern of Franchise Company in Bandung	Liza Laila Nurwulan, R. Mochammad Noch, Elsaf Kurniawan 📄 PDF IM-p56-65.2013
8	Five V's in Customer's Perspective	Richard Andrew, Andi Wijaya 📄 PDF IM-p66-73.2013
9	Services Improvement with Triz and TOPSIS Method	Feliks Prasepta S.Surbakti, Lenard 📄 PDF IM-p74-80.2013
10	Defining The Collaborative Key Performance Indicators in Performance Management	Marsellinus Bachtiar

		IM-p81-87.2013
11	Designing Map Strategy Performance Measurement Functional Units Organization Method Based on The Balanced Scorecard (Case Study XYZ University)	Ahmad Chirzun, Mohamad Sulkhan IM-p88-95.2013

PS – Production System

No	Title	Author
1	Optimization of A Shock Absorber Assembly Line Using Simulation	Iwan A. Soenandi PS-p1-5.2013
2	Design of Lean Production System Using Integrated Value Stream Mapping Approach	Yadrifil, Irvanu Rahman, Faisal Akbar PS-p6-11.2013
3	Identification Performance And Machine Failure of Manufacturing System Based On OEE And FMEA Methods (Case Study On PT. APF)	Jazuli, Angga Laksitama, Adelia Dini Meinarwati PS-p12-17.2013
4	Automated Multi-View Visual Inspection and Grading System For Shrimp	Yudha Prasetyawan, Putu Dana Karningsih, Lucky Sabrina Adluna PS-p18-25.2013
5	Maintenance Task Design And Spare Part Inventory Policy For An Evaporation Sub System	Yudha Prasetyawan, Weny Yuliana Sari

Home   About ISIEM   Previous Event ⌄   The Conference ⌄   Contact Page   🔍

			PS-p26-32.2013
6	Analysis of Factors Affecting Throughput Rate in Flexible Manufacturing System with Automated Guided Vehicle System	Teuku Yuri M. Zagloel, Romadhani Ardi, Lusyane Eko Tantri	PS-p33-39.2013
7	Insertion Heuristic for The Single Row Layout Problem in Flexible Manufacturing Systems	Tjutju Tarliah Dimyati	PS-p40-45.2013
8	Optimization Of MIDI Synthesizer On The Illustration Of Movie Music	Pandan Pareanom Purwacandra, Ferry Wahyu Wibowo	PS-p46-51.2013
9	Implementation Theory of Constraint on CFM56-3 Aircraft Engine Maintenance	Untung Mahargo B. P., Hardianto Iridiastadi, E. Nina S. Y., Zulfa F. I	PS-p52-59.2013
10	The Implementation Of Lean Six Sigma Method in Production Process of Underwear Rider R333B at PT. XYZ	Johnson Saragih, Rahmi Maulidya, Diana Jane Halim	PS-p60-65.2013
11	The Effect Of Demand Behavior Of Automotive Glass Manufacturer On Cost of Good Sold And Logistics Performance Through System Dynamics Approach	M. Nurman Helmi	PS-p66-71.2013

12	The Proposed Layout Design Using Factory Systematic Layout Planning Method at PT. Jasa Laksa Utama	Lina Gozali, Silvi Ariyanti, Leowendo Putrajaya **PDF** PS-p72-76.2013
13	Remodelling The Maintenance Performance Management System	Rivan Syamsurijal Biya, Triwulandari S. Dewayana, Nora Azmi **PDF** PS-p77-83.2013
14	Analysis of Outer Tube Casting Product Reject Using Computer Aided Engineering	Ahmad Juang Pratama **PDF** PS-p84-90.2013
15	Solving Assembly Line Balancing Problem Using Genetic Algorithm Technique with Partitioned Chromosome	Nora Azmi, Iman Yahya Azzubaidi, Sumiharni Batubara **PDF** PS-p91-98.2013
16	Production Scheduling Optimisation Using Genetic Algorithm in PT. Progress Diecast	Lily Amelia, Aprianto **PDF** PS-p99-105.2013
17	Applying Theory of Constraint and Bottleneck Scheduling Approach to Solve Production Capacity Problem	Sumiharni Batubara, Rahmi Maulidya, Mega Rahma Pertiwi **PDF** PS-p106-111.2013
18	Improvement Of Kanban System Based On Theory of Constraint	Rahmi Maulidya, Iveline Anne Marie, Kevin

PS-p112-119.2013

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CONTACT INFO

Industrial Engineering Department, Universitas Trisakti - Indonesia, Jl. Kyai Tapa No. 1 Jakarta 11440
Phone: +62215663232, Ext. 8407
Mobile: +62 811-8402-905
Email: secretariat@isiem.net
Web: isiem.net

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

Agus Purnomo

Department of Industrial Engineering, Faculty of Engineering Pasundan University
Bandung, Indonesia
E-mail : agsprnm@gmail.com

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 Hierarcy 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
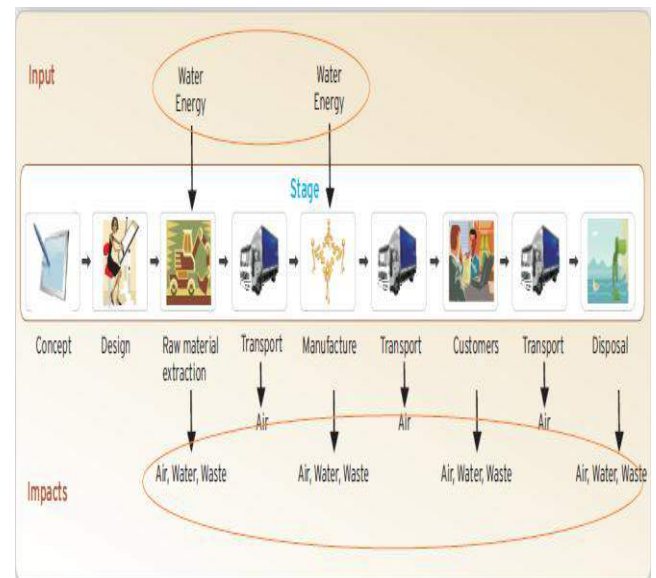
Source : Penfield (2007)
Figure 1. The impact on the environment at every stage of the supply chain

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.

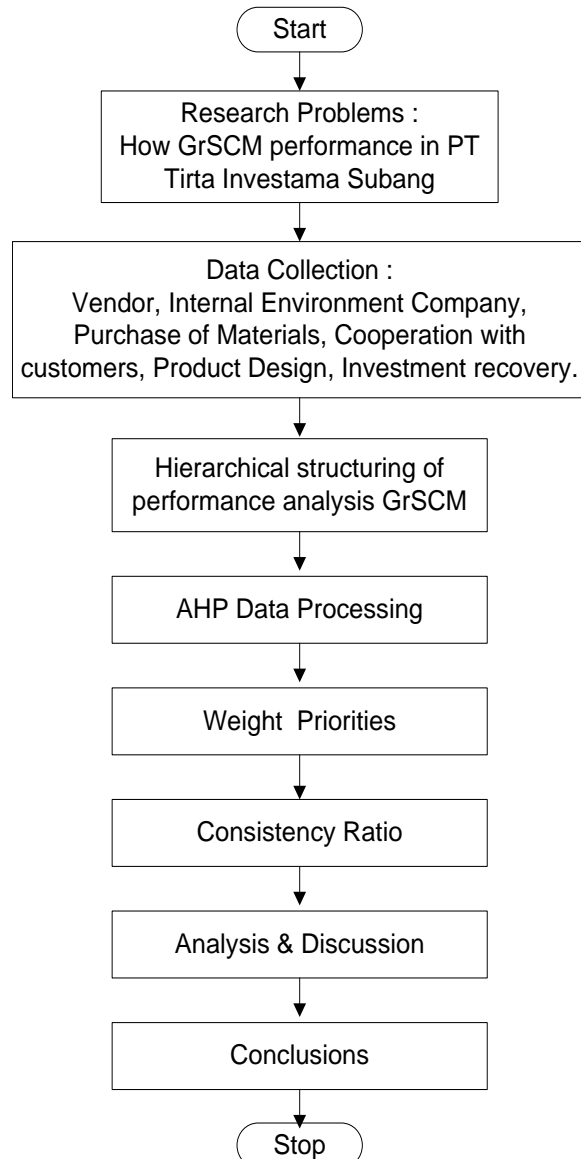Steps to resolve this study are presented in Figure 2 below.

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.
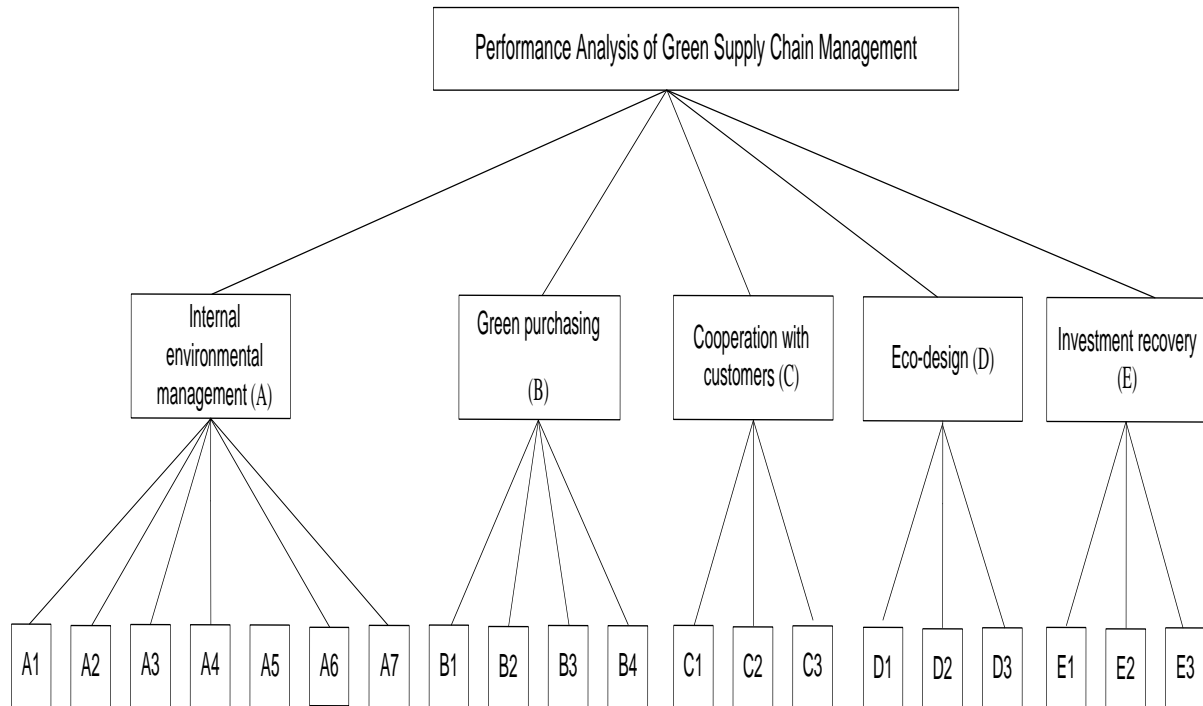
A1 = Commitment of GrSCM from senior managers
A2 = Support for GrSCM from mid-level managers
A3 = Cross-functional cooperation for environmental improvements
A4 = Total quality environmental management
A5 = Environmental compliance and auditing programs
A6 = ISO 14001 certification
A7 = Environmental 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.
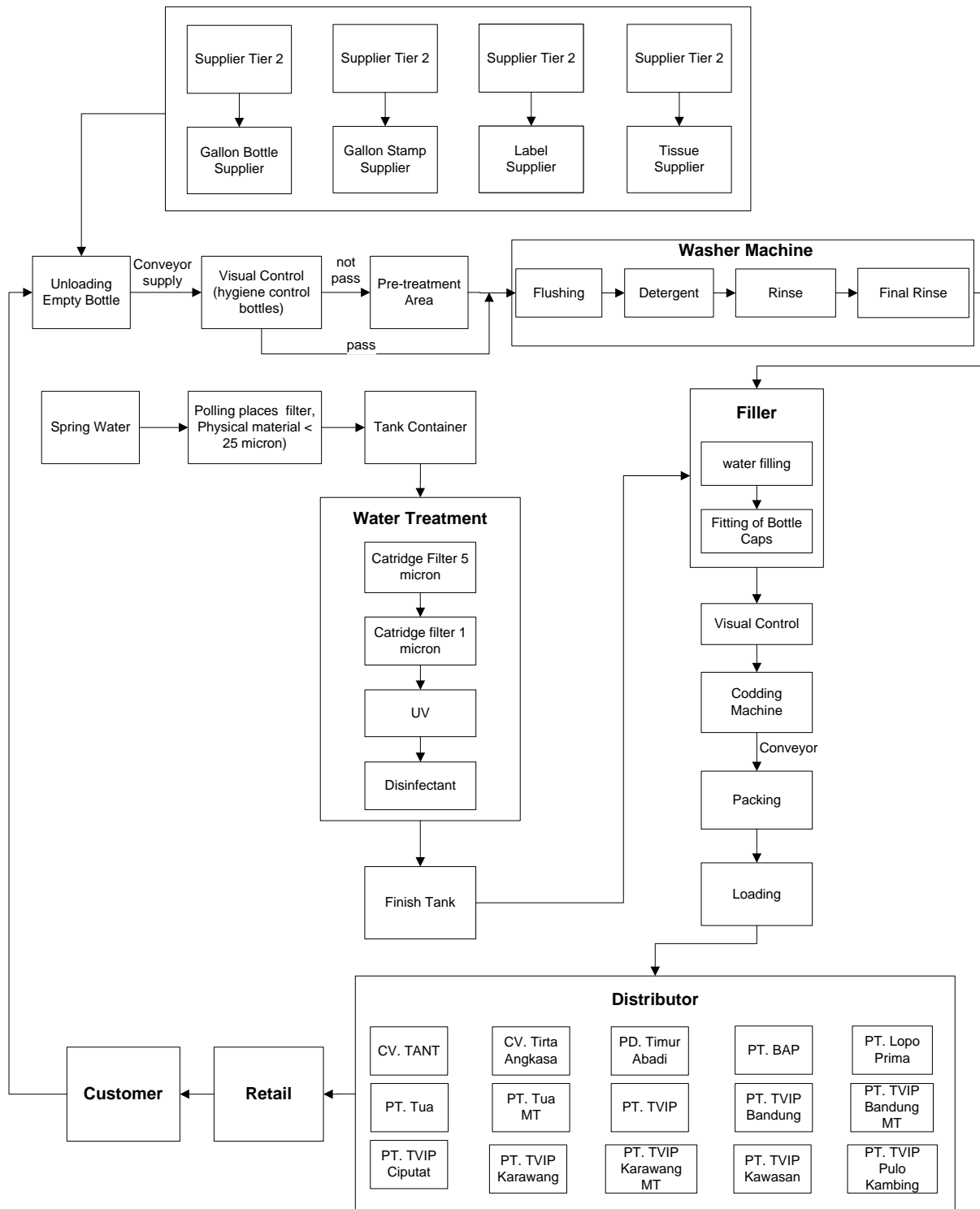
Figure 4. Flow Supply Chain Aqua Product PT Tirta Investama Subang

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.

Numerical Assessment
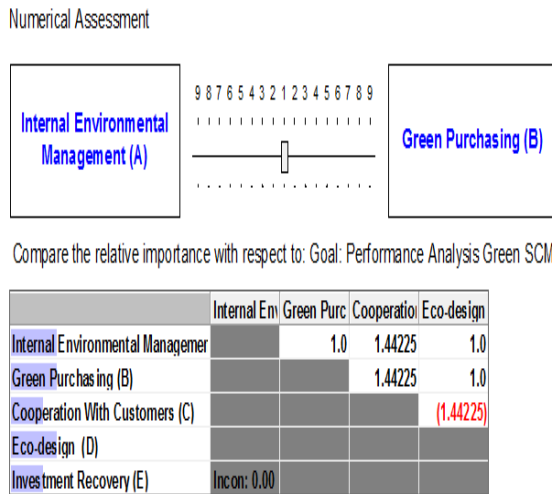
Figure 5. Example calculation of Geometric Mean

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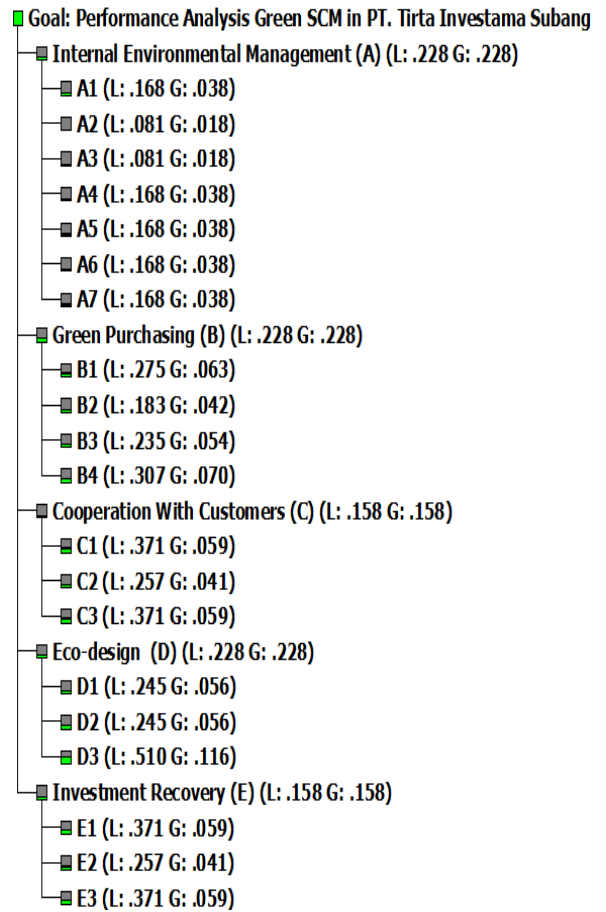
Figure 6. The weight of each criterion and alternative performance GrSCM

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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AUTHOR BIOGRAPHIES

Agus Purnomo is a lecturer in Department of Industrial Engineering, Faculty of Industrial Technology, Pasundan University, Bandung. He received his Master of Industrial Engineering from Institut Technology Bandung in 1997, and obtained his PhD in 2008 at the Padjadjaran University, field of Operations Management. His research interests are in the area of Logistics Management, and Supply Chain Management. His email address is agsprnm@gmail.com

CERTIFICATE

Present to:

Agus Purnomo

as

Presenter

6th INTERNATIONAL SEMINAR ON
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*"Sustainable innovation on enhancing
industrial management, technology, and information"*

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