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STRATEGY DEVELOPMENT TOWARDS INTERNATIONAL RECOGNITION ON GREEN PORT PRACTICES IN PT TERMINAL TELUK LAMONG

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STRATEGY DEVELOPMENT TOWARDS INTERNATIONAL RECOGNITION ON GREEN PORT PRACTICES IN PT TERMINAL TELUK LAMONG

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ABSTRACT

The development of the container port business has increased the competitiveness among the ports. The international concerns towards green practices and sustainability has bring the market into the awareness of implementation of green practices in the business of container ports. The international concerns have made ports across countries to implement green practices. The international recognition on green practices has become valuable product to be achieved by container ports. PT Terminal Teluk Lamong (TTL) as the first green port in Indonesia has set the goal to become the first green port in Indonesia to receive the international recognition in green practices. The Green Port Awarding System (GPAS) that are provided by Asia Pacific Economic Cooperation, has been aimed by TTL. The problem arises when PT Terminal Teluk Lamong cannot determine the current condition of the green practice performance, therefore cannot determine the right strategy to achieve the GPAS. This research aims to solve the problem by first design the performance measurement system based on the GPAS indicator performances by determining the right key performance indicators for each of the indicators. Analytical Network Process is used to determine the importance of every indicator to be used in the design of scoring system The performance measurement is used to assess the current green practice performances of TTL. Traffic Light System is used to set the category of performance indicator based on its performance. The Gap Analysis will be done to determine the gap between the current green practices performance with the desired condition in the future. The result of the Gap Analysis is used to develop the strategy to close the gap, increasing the performance of green practices. The strategy is set to help TTL achieve the GPAS in the near future. The research help PT Terminal Teluk Lamong to make strategize more effectively towards the International recognition on green practices.

Key Words: Green Port Award System, Key Performance Indicators, Analytical Network Process, Traffic Light System, Gap Analysis, Strategy Development

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PREFACE

The author thanks God for the blessing and companion through the research so that the research and the report can be done appropriately. The research with the title of "Strategy Development Towards International Recognition On Green Port Practices in Pt Terminal Teluk Lamong" is done as the final project to fulfil the author's obligation to Department of Industrial Engineering as the requirement to complete the study.

The completion of final project can be accomplished, because of the assistance of other parties. The author would like to thank:

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In the making of the report, the author has done the best to complete the report. However, should there be any flaws in the making of the report, the author would be pleased to hear it for the improvement in the future research. The author hope

that this report can benefit the readers in adding knowledge in the field of Industrial Engineering.

Surabaya, July 2018

Author

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CHAPTER 1
INTRODUCTION

This chapter discuss about the background, problem formulation, research purposes, research benefits, the limitation and assumptions, and the report outline.

1.1 Background

Indonesia is one of the largest archipelago in the world. Indonesia has two third of its ocean bigger than the land. Indonesia has coastlines in almost all of its islands with total length of 81.000 km. Indonesia's vast wide area of sea hold big potentials for future use. The government has realized that the unique geographical condition of Indonesia, give yet another challenge to develop the management system to support the economy.

Indonesia with its islands has its own challenges in logistics. The movement of goods and services in Indonesia depend heavily on the management of transportation system. The logistic cost in Indonesia is reported up to 23,5% of Indonesia's Regional Gross Profit (Rahman, 2017). That is why the government has to keep improving the logistic sector to accelerate the economy. One of the aspect in Logistic is the Port. Sea transportation hold the key in the movement of goods and services across the archipelago. There several function of port according to Lasse (2014), which are: 1.) Gateway to the economic activities; 2.) Place for exchange between transportation mode; 3.) to support the industry and trade; 4.) Place for distribution, production, and consolidate cargo; 5.) Connectivity in sea transportation network. The role of port in logistic can show us how important it is for the government to continue develop it from time to time.

The importance of port in the logistics has made Indonesian government to continue develop modern port. These development is meant to answer the challenges and increasing demands in the future. The increasing demand in the freight delivery in east Indonesia has made Tanjung Perak Port has reached its maximum capacity.

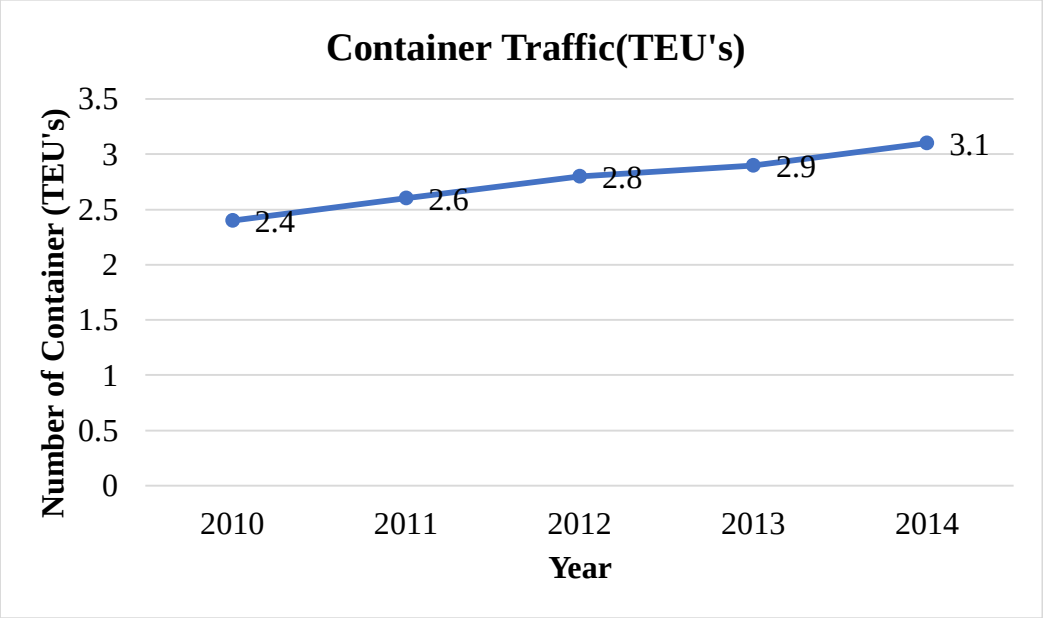

Figure 1.1 Container Traffic of Port Tanjung Perak
(source: www.pelindo.co.id)

The overload of capacity in Tanjung Perak Port, has made Pelindo III to established new port in 2014. The new port is designed to serve as facility that increase the logistic performance of east Indonesia and will further escalate the economy. This port is named as PT Terminal Teluk Lamong. The Terminal Teluk Lamong (TTL) is a port that is equipped with automation machine that can increase its productivity, safety and reliability. TTL has claimed to be the first green and automatic technology port in Indonesia.

As the first port in Indonesia with automatic technology and green concept, Terminal Teluk Lamong has the potential to be developed even more. Terminal Teluk Lamong is also designed to be able to serve ships with international standard. TTL can receive up to 80 thousand DWT ships. The management of Terminal Teluk Lamong commitment to the environmentally friendly business has made great opportunity for the entry of commercial ships from various countries. The eco-friendly business is believed to also made the operational costs to be reduced. TTL receives dry bulk and container goods. The specific goods that can be received also support its vision as green port. These qualities are important to raise the competitiveness of TTL in the national and global market.

The commitment towards green practices in TTL is in fact, a response to the calling of green development by the United Nation. The United Nation has introduced 17 Sustainable Development Goals to be carried out across nations. These 17 Sustainable Development Goals are encouraged to be implemented in countries around the world. The shift of business environment, affected by these sustainability concept, has made changes in the market. The International market now value more the products that can promote sustainability. These changes on the market, has made companies and governments across nations to provide more opportunities for eco-friendly innovations. The environment friendly concept has become the goals for companies and governments

TTL commitment towards green practices is one of the commitment from the government, in order to create more sustainable logistics. The green practices will focus on reducing the effect of port establishment to the environment. By doing so, the government hope to create a healthier and safe environment around the port. The establishment of TTL is done to encourage the sustainability in ports business in Indonesia and also Asia. It is also important to be the leader of innovation in green practices of logistics. The green port is also aimed to be the gate to more demands coming from countries that values green practices.

The commitment of TTL management to uphold the green practices in the business has to be proven through the performance in the day to day basis. The control system has to be made by TTL to ensure its Green Policies that has been established will be carried out to the work environment, and operational activities. To do this, TTL has to established green practice performance measurement. TTL currently does not have such system and therefore cannot shows its strength in green practices compared to other conventional ports and green ports. TTL has problem in establishing the system because it is the first green port in Indonesia, and therefore has to make adjustment from international standard, the environmental conditions in Indonesia, and regulations from Indonesian government.

There are numbers of Green Ports initiatives around the world that has implemented green practice performance measurement. One of the initiatives is the EcoPorts of Europe. The European Sea Ports Organization (ESPO) was initiated in 1997 but was formally established in 2011. The ESPO regulations were first

introduced in the 1994. The code of practices is made to develop the standards of ISO. The ESPO continue to grow. The European organization has made 22 countries participates, with 91 members of ports in total. The ESPO help its member to self-diagnose its own port to understand the value of their green port performance. The ESPO also made certification to Port that has shown excellent performance with the Port Environmental Review System.

Asia Pacific Economic Cooperation (APEC) also has shown its concern in the development of green port. The APEC Port Services Network (APSN) that was established under the auspices of APEC in 2008, function to bring together the port and port-related industries with senior representatives in APEC member economies. The APSN has developed a program called the Green Port Award System (GPAS) as a green evaluation system for ports in the APEC region. GPAS represent the effort by APSN to further promote the advancement of technology and sustainability in ports belong to the countries of its members.

The first GPAS award was presented to 7 ports from 4 countries. The countries in which the port has received the GPAS are China (Ningbo Zhousan Port Co., Ltd.; Qinhuangdo Port), Thailand (Bangkok Port), Singapore (Jurong Port; Port of Singapore), Malaysia (Port Klang; Port of Tanjung Pelepas). The award that is given has been considered as international recognition for these ports. These recognitions will be valuable in entering new market from other countries.

It can be seen from the data that Indonesian ports have not received any international recognition, either from ESPO or APSN. This of course will be problems in the long run. The market penetration of TTL for the international market can be further increased with such recognition. The claim for the green commitment can also be validated through the award and certification. This will give more importance for TTL to pursue for international recognition. In this case, TTL has already set the target to pursue for the GPAS Award by the APSN.

GPAS has provided the performance framework as the goal in developing the port green practices. The framework in developing the green port is set as the goal. The GPAS performance system is based on three primary Indicators: Commitment and Willingness, Action and Implementation, and Efficiency and

Effectiveness. Each of these Primary Indicator will have secondary indicators that are defined by several reference standards.

The pursue of GPAS, will help Terminal Teluk Lamong to understand the international standard on green practices. The goal that is set, the indicators that follows, the initiatives to be implemented in the system. Setting the goal in achieving the international recognition, will be challenging but inevitable. Terminal Teluk Lamong will have to assess its green practice and aim to develop it with the GPAS as the goal.

The problem arises when TTL cannot evaluate its current green performance. Because of its inability to measure its current performance, TTL cannot define the gap between its current performance with the target of future performance as defined by the GPAS. Therefore, Terminal Teluk Lamong has to established the green performance measurement system first. Below is the GPAS performance indicators.

Table 1. 1 The Performance Indicator of GPAS Award

Primary Indicator	Secondary Indicator	Reference Standard
Commitment and Willingness	Green Port Awareness and Willingness	Green Strategy or Development Plans
		Green Support Funding
		Green Annual Report
		Others
	Green Port Promotion	Green Training Program
		Green Promotion Campaign
		Others
Action and Implementation	Clean Energy	Using renewable resources
		Using of LNG
		Using Cold Ironing
		Others
	Energy Saving	Using Energy-Saving Devices & Technologies
		Optimizing Power Supply Systems
		Others
	Environmental Protection	Air Pollution Prevention
		Noise Control
		Waste Treatment
		Others
	Green Management	Green Environment Management System
		Green Performance Assessment
		Others

Table 1. 2 The Performance Indicator of GPAS Award

Primary Indicator	Secondary Indicator	Reference Standard
Efficiency and Effectiveness	Energy Saving	Energy Consumption Reduction
		Renewable Energy Increment
		Others
	Environmental Protection	Air Quality Improvement
		Noise Control Result
		Liquid & Solid Pollution Control
		Others

(source: GPAS)

Establishing the green performance measurement system based on the indicators of GPAS will include determining the importance of each indicator, the respective key performance indicators for each of the indicator, establishing the target of the performance, and determining the current performance based on the historical data and report.

The green performance measurement that is established, will help Terminal Teluk Lamong that currently has no such green performance measurement system. Terminal Teluk Lamong may perceived the result of the performance assessment as the current condition of green practices. The Gap analysis can be done once the current condition has been identified, by setting the desired condition as the completion of the award from GPAS. This method will be needed in order to assess the gap between the current performance, and the fulfillment of GPAS standard.

The result of the gap analysis will help Terminal Teluk Lamong to develop the right strategies in order to achieve the Green Port Award System as part of the international recognition. Research need to be done to be able to determine the right strategy to increase the green performances, in the right timeframe and by using the right resources. This research aims to solve the problem of TTL in determining these strategies.

1.2 Problem Formulation

The problem that will be solved is how to design the measurement system to identify the current green performance level of PT Terminal Teluk Lamong in order to develop strategy to achieve international recognition in green port practices.

1.3 Purposes

Below are the purposes of the final project:

1. Design green performance measurement system according to international standard reference.
2. Design Key Performance Indicators for green performance measurement.
3. Evaluate current green performance based on the established measurement system.
4. Develop strategy to improve the green performance level.

1.4 Benefits

1. Establish green performance measurement system that can be implemented.
2. Terminal Teluk Lamong can understand the current green performance referring to international standard.
3. Terminal Teluk Lamong would be able to strategize effectively towards international recognition.

1.5 Limitation and Assumption

Below are the limitation and assumption for the final project:

1.5.1. Limitations

Below are the limitations to the final project:

1. The data provided are gathered from the report of year 2016-2017.

1.5.2. Assumptions

Below are the assumptions to the final project:

1. The data gathered represent the condition of the company.
2. There are no policy changes in the condition of the system along the final project timeline.

1.6 Report Outline

This sub chapter will explain about the content of each chapter in the report. There are 6 chapters which are Introduction, Literature Review, Methodology, Data Collection and Process, Data Analysis and Interpretation, and Conclusion.

CHAPTER 1 INTRODUCTION

The introduction explains about the background of the problem, the problem formulation, purposes of the final project, benefits of the final project, limitations and assumptions on the final project, and also the outline of the report. The introduction is aimed to give clear understanding on the importance of the research as solution to the problem in the company.

CHAPTER 2 LITERATURE REVIEW

This chapter explains about the theories that are used by the author to solve the problem in the research. The literature review will explain about Green Port Definition, Analytic Network Process, Performance Measurement, Key Performance Indicator, Scoring System, Traffic Light System, Gap Analysis.

CHAPTER 3 METHODOLOGY

This chapter explains about the steps needed to be done in the research. The research steps are done according to the methodologies to keep the research structured and effective. The methodology is made based on the previous research that is adapted with the need of current research.

CHAPTER 4 DATA COLLECTION AND PROCESS

This chapter will explain the data gathering and processing that is done to solve the problem. The data that are gathered are used to design the performance measurement system, the scoring system, the traffic light system, the gap analysis, and also the strategy development

CHAPTER 5 DATA ANALYSIS AND INTERPRETATION

This chapter will explain about the analysis that has been made for the result of the performance measurement system design, the scoring system, and traffic light system. The analysis will provide better understanding on the result of the data processing. These analyses will be used to give recommendation and conclusion to the problem

CHAPTER 6 CONCLUSION AND SUGGESTION

This chapter will explain about the conclusion that has been made by the author about the problem. The result of the research will be explained based on the result of the gap analysis of the performance and the target. Suggestion is given to improve future research and the implementation for the company.

CHAPTER 2
LITERATURE REVIEW

This chapter discuss about the theories that are used by the author. The theories that are relevant to the research are the Green Port Definition, Analytic Network Process, Performance Measurement, Key Performance Indicator, Scoring System, Traffic Light System, Gap Analysis.

2.1. Green Port Definition

The concept of "Green Port" development is the integration of the environmental friendly method of port activities, operations and management (Badurina, Cukrov, & Dundovic, 2017). Seaports are connecting world through the maritime transport network. They promote International trade and support the global economic growth. However, seaports are the most common point of entry anthropogenic environmental pollution through the activities of maritime transport. The environmental concerns regarding the port system are very diverse. Researches are done across the world to define the factors that are important to be developed by ports. Seaports are trying to achieve a green status by introducing new technologies and renewal systems for energy production in the port infrastructure.

Table 2. 1 Factor Priorities throughout 1996-2013 I European Ports

No	1996	2004	2009	2013
1	Port Development (water)	Port Waste	Noise	Air Quality
2	Quality of water	Dredging Operations	Air Quality	Port Waste
3	Dredging	Dredging Operations	Seaport Waste	Energy Consumption
4	Dredging operations	Dust	Dredging Operations	Noise
5	Dust	Noise	Dredging Operations	Waste from The Ship
6	Port Development - landside	Air Quality	Relations with the Local Community	Relations with the Local Community

Table 2. 2 Factor Priorities throughout 1996-2013 I European Ports (con't)

No	1996	2004	2009	2013
7	Landside Pollution	Danger Cargo	Energy Use	Dredging Operations
8	Habitat Degradation	Storage	Dust	Dust
9	Amount of Traffic	Port Development - Landside	Port Development - Water	Port Development - Landside
10	Industrial Wastewater	Discharge of Ship's Bilges	Port Development - Landside	Quality of Water

Priorities have changed the ranking of factors important in the development of green ports overtime. The location of the ports also changes the priorities in the development of port in the region. This is caused by the different kind of issues that are going on different countries and regions. The fact that there are different priorities and needs in the development of green port, have increased the importance of research on the facts.

The green port represents the model of sustainable port development, which not only meet demands of the environment but also increases the port's economic interests. The term green port is important to be embedded into the plan of developing the port. The inclusion of green port concept is significant for technological improvements in the production of energy efficiency which enables the coordination of environmental protection and sustainable economic development.

2.2. Performance Measurement

Performance is about doing the work and result that is achieved from the work Armstrong and Baron (1998). Performance is the result or achievement of individual in its entirety in fulfilling a task with regards to the possibility, such as work standard, target or objective or designated criteria that has been agreed upon (Veithzal, 2005). Performance measurement is a level of accomplishment in doing the job and the ability to achieve goal that has been set individually or communal, performance itself can be state good and success if the goal that is aimed can be achieved accordingly. (Gibson, Ivancevich, Donnelly, & Konopaske, 2003).

Performance measurement is the tool used by management to increase the quality of decision making. Performance measurement is done to ensure wether the decision making has been done objectively. Performance measurement help management to control and evaluate the performance of the company and compare it to the plan that has been established, evaluating and therefore bring improvement to the company for the next period.

Mulyadi & Setiawan (1999) said that performance measurement can give advantage such as:

- Manage organizational operations effective and efficient way through motivation for personnel maximally.
- Help decision making that relates with employee rewarding system such as promotion, transfer, and stoppage.
- Identify the relation and personnel development to provide selection criterion and evaluate the personnel training needs
- Provide the system to distribute reward and achievement

The changing trends in the business to focus more on the customer, has made it essential for a good performance indicator to conform to these criteria (Yuwono & Ichsan, 2006)

1. Based on each activities and organization characteristic with customer perspective
2. Evaluation of activities using validated means of performance measurement
3. conform to all aspect of performance activities that affect customer, resulting in comprehensive measurement.
4. give feedback to help the organization to understand the problems that has the potential to be solved and improved.

2.3. Key Performance Indicator

Key Performance Indicator is the indicator or measurement that is used to measure the achievement of performance to the respective strategic objective (Luis, 2007). Key performance indicators are made by organization that has already design the goals and its respective strategies. The KPI will help organization to

quantify their performance and its position regarding to its goals. Good performance indicator of a strategy has to conform to these aspects (Pella, 2008):

- Ability of the organization to communicate their strategy for measures.
- The selected measure adequately focuses on the strategic issue.
- The indicators are quantifiable, can be evaluated objectively through respective formula.
- The indicators are quantifiable, reliable, and repeatable. The frequency of updates are meaningful, and meaningful targets for improvement are established.
- External benchmarking is feasible and/or desirable.
- Has validity of measures for the system.
- The data and resources are available.
- The cost of measures does not exceed the benefit of measure.

2.4. Analytic Network Process

The Analytic Network Process (ANP) is a generalization of the Analytic Hierarchy Process (AHP). The basic structure is an influence network of clusters and nodes contained within clusters. The feedback structure does not have the top-to-bottom form of a hierarchy but looks more like a network, with cycles connecting its components of elements, and with loops that connect a component to itself. (Saaty, 2006)

To make tradeoffs among the many objectives and many criteria, the judgments that are usually made in qualitative terms are expressed numerically.

A network has clusters of elements, with the elements in one cluster being connected to elements in another cluster (outer dependence) or the same cluster (inner dependence). a hierarchy is a special case of a network with connections going only in one direction. There are two kinds of influence: outer and inner. In outer influence compares the influence of elements in a cluster on elements in another cluster with respect to a control criterion. In inner influence on compares the influence of elements in a group on each one.

Table 2. 3 Fundamental Scale

Fundamental Scale	
1	Equal Importance
3	Moderate Importance of One Over Another
6	Strong or Essential Importance
7	Very Strong or Demonstrated Importance
9	Extreme Importance
2,4,6,8	Intermediate Values

(Source: Saaty,2006)

Below are the steps to do the ANP according to Saaty:

1. Describe the decision problem in detail including its objectives, criteria and subcriteria, actors and their objectives and the possible outcomes of that decision. Give details of influences that determine how that decision may come out.
2. Determine the control criteria and subcriteria in the four control hierarchies one each for the benefits, opportunities, costs and risks of that decision and obtain their priorities from paired comparisons matrices.
3. Determine the most general network of clusters (or components) and their elements that apply to all the control criteria. Use the identical label to represent the same cluster and the same elements for all the control criteria.
4. For each control criterion or subcriterion, determine the clusters of the general feedback system with their elements and connect them according to their outer and inner dependence influences. An arrow is drawn from a cluster to any cluster whose elements influence it.
5. Determine the approach you want to follow in the analysis of each cluster or element, influencing (the preferred approach) other clusters and elements with respect to a criterion, or being influenced by other clusters and elements. The sense (being influenced or influencing) must apply to all the criteria for the four control hierarchies for the entire decision.
6. For each control criterion, construct the supermatrix by laying out the clusters in the order they are numbered and all the elements in each cluster both vertically on the left and horizontally at the top. Enter in the appropriate

position the priorities derived from the paired comparisons as subcolumns of the corresponding column of the supermatrix.

7. Perform paired comparisons on the elements within the clusters themselves according to their influence on each element in another cluster they are connected to (outer dependence) or on elements in their own cluster (inner dependence Comparisons of elements according to which element influences a given element more and how strongly more than another element it is compared with are made with a control criterion or subcriterion of the control hierarchy in mind.
8. Perform paired comparisons on the clusters as they influence each cluster to which they are connected with respect to the given control criterion. The derived weights are used to weight the elements of the corresponding column blocks of the supermatrix.
9. Compute the limit priorities of the stochastic supermatrix according to whether it is irreducible (primitive or imprimitive [cyclic]) or it is reducible with one being a simple or a multiple root and whether the system is cyclic or not.
10. Synthesize the limiting priorities by weighting each idealized limit vector by the weight of its control criterion and adding the resulting vectors for each of the four merits: Benefits (B), Opportunities (O), Costs (C) and Risks (R). There are now four vectors, one for each of the four merits. An answer involving marginal values of the merits is obtained by forming the ratio BO/ CR for each alternative from the four vectors.
11. Determine strategic criteria and their priorities to rate the four merits one at a time. Normalize the four ratings thus obtained and use them to calculate the overall synthesis of the four vectors. For each alternative, subtract the costs and risks from the sum of the benefits and opportunities. At other times one may subtract the costs from one and risks from one and then weight and add them to the weighted benefits and opportunities.
12. Perform sensitivity analysis on the final outcome and interpret the results of sensitivity observing how large or small these ratios are.

2.5. Scoring System

Scoring system is the next step after the target determination of each Key Performance Indicator (KPI) and agreed upon by the company. The scoring system is done because KPI is a multi-dimensional measurement to it has different dimension, such as the day unit or weight. Scoring system will measure KPI in uniform measurement dimension, the percentage. in the scoring system there are methods to identify each KPI performance, which are the higher is better, lower is better, and zero-one. This method is used to understand the achievement value of each KPI according to each target.

These 3 type of value identification has different meaning to it. Higher Is Better shows that the increase of KPI score, will lead to better performance. The Lower is Better mean the decrease of KPI score will lead to better performance. The Zero-one means that the score will have value of 100 when the value of performance is 0/1, and it will be scored 0 when the actual value is not equal to 0/1.

2.6. Traffic Light System

Traffic Light System is the continuation of scoring system. After the scoring system has been designed, each of the KPI will be categorized based on the respective KPI score. The categorization function to help company to identify the level of importance in improvement of each KPI, to reach the target performance. Traffic Light System is a system that relate closely with the scoring system (Alda, Siregar, & Ishak, 2013). There are 3 type of colors that is used as reference in categorizing KPI, which are red, yellow and green. Table 2.3 will show the information for each of the category and its value

Table 2. 4 The Traffic Light System Scoring

No	Color	Information	Value
1	Red	Performance indicator show that gap between target and performance is still wide, so it will need improvement	<4
2	Yellow	Performance indicator show that the target is close to be achieved, so it need to be supervised intensively	Between 4 and 7
3	Green	Performance indicator show that the target is achieved, so there is no need for improvement but still need to be supervised	>7

(Source: (Alda, Siregar, & Ishak, 2013))

2.7. Gap Analysis

The gap analysis process formalizes the assessment of the organization's business strategy to be consistent with the requirement of its current and expected future environment, its capabilities to be consistent with business strategy being pursued and its performance from the existing business strategy to be acceptable to its key stakeholder. Gap analysis is a tool that organizational managers use to work out the strategic tasks to be undertaken in order to move from its current state to a desired, future state (Hubbard, John, & Peter, 2015).

There are three types of gap analysis according to the Hubbard, John, & Peter, which are the Environment-business strategy gaps, Capability-business strategy gaps, and the organization performance-business strategy gaps. The research will focus on the business strategy-organization performance gap analysis.

The business strategy-organization performance gap comprises the gap between the level of performance of the organization and its existing business strategy. It identifies the key goals or objectives from the strategy of the organization. It then records the organization's current performance against each goal. If the goal has been identified clearly, the result is easy to record by comparing it against the goal, indicating the degree to which the organization is underperforming or over performing against the goal. The over performance result in 'positive' gap, providing the opportunity for the organization to leverage its performance, or to rebalance its efforts away from that area towards filling negative gaps. The second aspect of assessing the performance of the business strategy is to formally identify the organization's expectation and then measures the gap between actual performance and each expectation.

2.8. Cost Effectiveness Analysis

Cost Effectiveness Analysis (CEA) is a measure of the total cost of providing a service per unit of output provided. Cost Effectiveness Analysis is often used in the pharma economic to compare two or more medical interventions that gives different impact. The analysis can measure the cost and the impact, giving the user the ability to determine medical intervention that is most effective for the goal of the intervention (Rascati & K.L., 2009).

CEA is a two-objective problem in which a decision maker chooses an alternative with the goal of (i) maximize effectiveness and (ii) minimize cost (Vinayak, 2017).

$$CE\ ratio = \frac{Total\ cost\ of\ implementing\ program}{Total\ impact\ of\ program\ on\ specific\ outcome}$$

CE ratio while has been used in healthcare, is also used in the supplier determination. Vinayak has proposed the model in using the CEA in determining supplier based on its KPI in the Supply Chain Operation Reference model. The model can be used to evaluate whether preparation strategies are economical.

2.8. Previous Research

There are previous researches on the subject on Green Port Performances in the world. Below are the comparisons of previous research on Green Port Performances:

Table 2. 5 The Previous Research on Green Port

No	Research Topic	Author	Year	Focus	Methodology	Objective
1	Evaluation of Green Port Factors and Performance: A Fuzzy AHP Analysis	Chiu, Rong-Her ; Lin, Le-Hiu; Ting, Shih-Chan	2014	Establish Green Performance Factor	AHP, Fuzzy AHP	To set the green port priority factor, and assess the performance of ports
2	Green Performance Criteria for Sustainable Ports in Asia	Lirn, Taih-Cherng; Wu, Yen-Chun Jim ; Chen, Yenming	2013	Determine key factor and comparison of Green Performance	Survey, AHP	To measure Asian ports' green performance
3	Sustainable Port Infrastructure, Practical Implementation of the Green Port Concept	Pavlic, Bostjan; Cepak, Franka; Peckaj, Marko; Kandus, Bogomil	2014	See the result of investment in infrastructure to green port concept	Self-Assessment, Investment Analysis	To see the result of investment in infrastructure and its effect on Green Port

Table 2.6 The Previous Research on Green Port (cont'd)

No	Research Topic	Author	Year	Focus	Methodology	Objective
4	Green Supply Chain Performance Measurement using Fuzzy ANP-based Balanced Scorecard: A Collaborative Decision-making Approach	Bhattacharya, Arijit; Mohapatra, Priyabrata; Kumar, Vikas	2013	The Performance Assessment of Green Port	Balance Scorecard, Fuzzy ANP	To construct Performance Measurement for Green Port
5	Green Port Strategy for Sustainable Growth and Development	LAM, Jasmine; Voorde, Edy	2012	Strategy Development based on Stakeholder needs	Qualitative Research of Stakeholder Needs	To construct Strategy for Sustainable growth and development of Green Port
6	Toward Sustainable ASEAN Port Development: Challenges and Opportunities for Vietnamese Ports	Saeyeon ROH, Vinh V. THAI; Yiik Diew WONG	2016	Strategy Development based on Port Authorities	Survey, Literature Review	To determine the main development factor in sustainable port

The previous research shows that Green Port Performance Factor assessment is done with the Multi Criteria Decision Making methodology. The assessment of alternative ports is done with the Fuzzy Analytic Hierarchy Process method. Research also focus on determining the key criteria to be used in indicator of performances. The method used to help defined and prioritize these indicators is the Analytic Hierarchy Process.

The Strategy development for Green Port Performances on the other hand, is based on investment analysis and qualitative research. The research for Sustainable Port Infrastructure covers the feasibility study of new infrastructure within the Port. The result of green performance is only observed as the result of building the infrastructure. The second research of strategy development, The

Green Port Strategy for Sustainable Growth and Development, analyze the goal of the strategy based on the needs of the stakeholder.

There is no research that has focus on developing strategy in gaining any international recognition. This research aims to fulfill the gap research of developing strategy, based on the current green performance of port. The establishment of performance measurement is important to help sustainable port to assess its current level of green port practice, in order to understand the lack of quality that needs to be solved. There is no current standard performance measurement to assess the green performance of ports in Asia. This research aim to help PT Terminal Teluk Lamong to assess the green performance, and therefore develop the best strategy to improve the lack of quality in order to better itself in gaining the international recognition.

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CHAPTER 3
METHODOLOGY

This chapter will explain about the methodology of the research that is done. There are 3 phases in the research, which are: problem identification and formulation, data processing, analysis and interpretation, recommendation and conclusion.

3.1 Research Flowchart

This subchapter will show the flowchart of the research

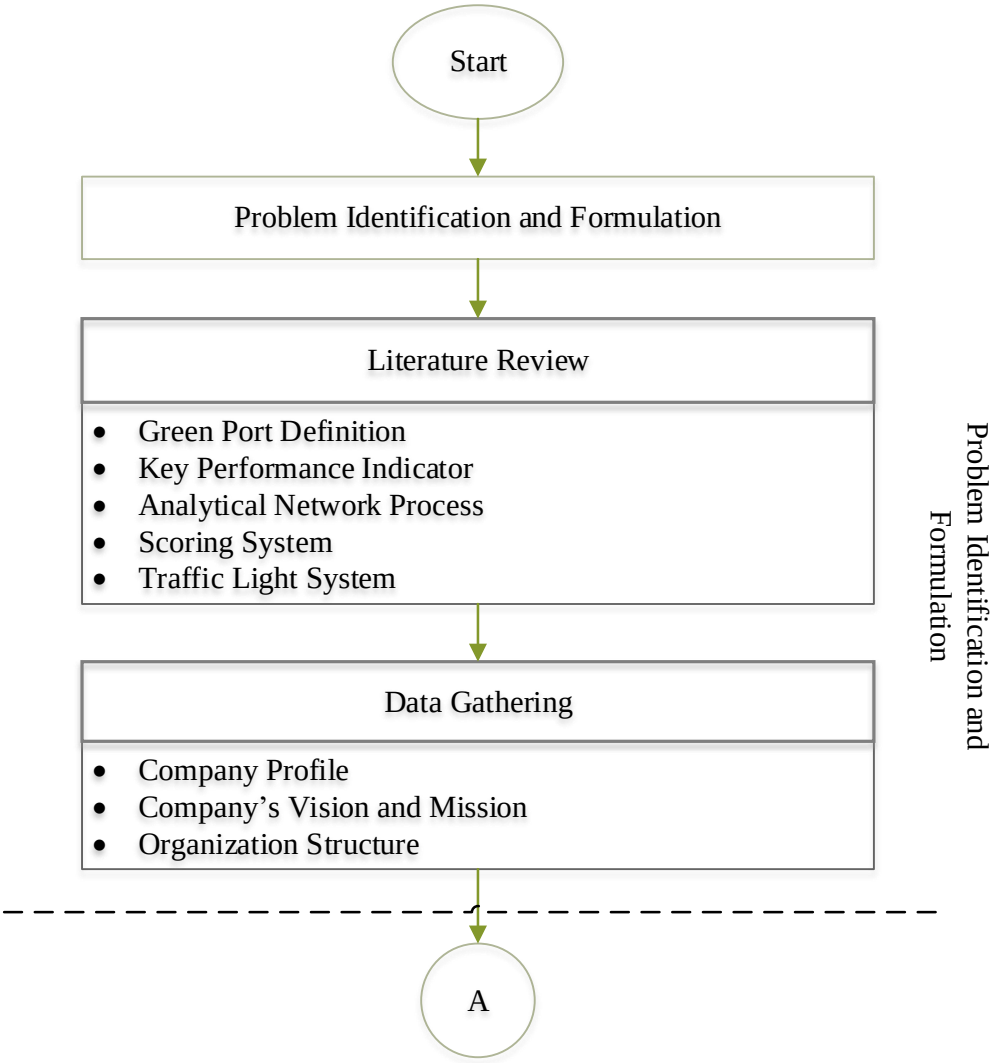

Figure 3.1 Flowchart of Research

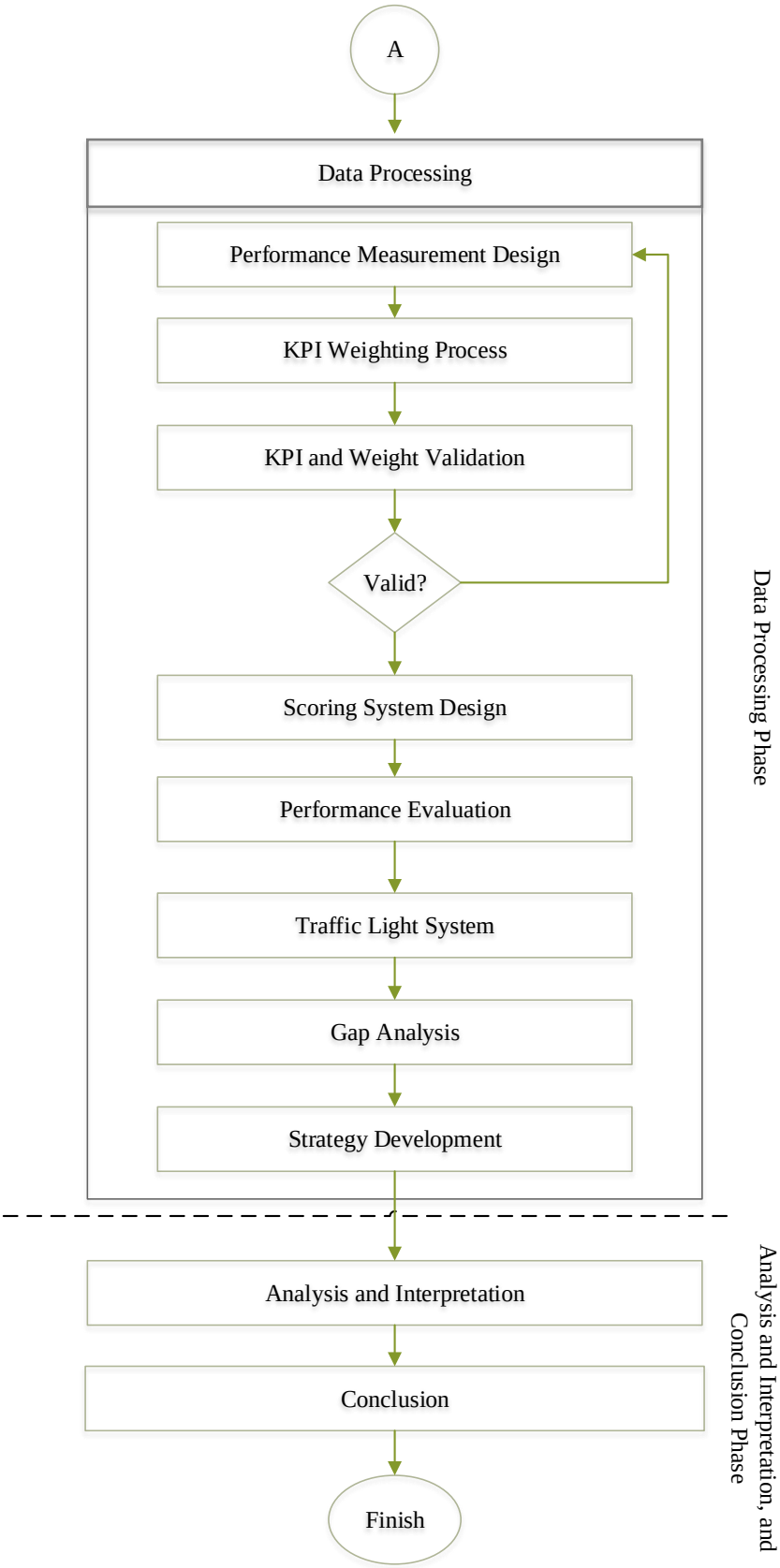

Figure 3.2 Flowchart of Research (cont'd)

3.2 Problem Identification and Formulation Phase

This subchapter will explain about the first phase of the research. The phase will include Problem Identification and Formulation, Literature Review, and Data Gathering.

3.2.1. Problem Identification and Formulation

This step will include the identification of the system, its purpose and problem. The problem identification is done by observation to the system. The observation is done by interview with the stakeholder of PT Terminal Teluk Lamong to gather information regarding the existing condition of Green Port system.

3.2.2. Literature Review

In this step, literature will be collected to cover the basis of the methods used in the research. Literature review is collected from various credible sources which are books and previous research that can help explain the methods and theory that are used in the research. The literature review will cover these topics: Green Port Definition, Key Performance Indicator, Analytical Network Process, Scoring System, Traffic Light System.

3.2.3. Data Gathering

In this step, the data that are needed will be gathered. The data that are needed includes company profile, company's vision and mission, and organization structure. These data will be gathered through interview with the company representatives.

3.3 Data Processing Phase

This subchapter will explain about the second phase of the research. The second phase of the research will include all data process phase to make the performance measurement system until the development of the strategy.

3.3.1. Performance Measurement Design

The next step is the Key Performance indicator for each of the strategy in the Green Performance Award System (GPAS). The key performance indicator is designed for each of the respective strategy. The key performance indicator will

help the company to measure the performance of each strategy, formalized with the respected properties.

3.3.2. KPI Weighting Process

The step of determining weight of the KPI is done by using the Analytical Network Process. The model network is made based on the interview and judgement is made by the Head of Department QHSEE. The result of the input will be processed with Super Decision software to determine the final weight.

3.3.3. KPI and Weight Validation

The next step is to validate the result of the KPI and weight determination. The validation is done through interview with the manager from PT Terminal Teluk Lamong. The data processing will be continued when the model is validated.

3.3.4. Scoring System Design

The scoring system is designed to structure the KPI calculation and help with the understanding of user through the KPI properties, The KPI properties will help understand through the attribute of KPI target, score type, realization, and final score.

3.3.5. Performance Evaluation

The evaluation of performance is done based on the framework that has been established in the earlier step. The performance evaluation by using the data that has been gathered, for each specific key performance indicators in the scoring system. The data gathered are based on the formula of each KPI.

3.3.6. Traffic Light System

The traffic light system is designed to give information about the key performance indicators level of performance. Each categories of performance are coded with color of red, yellow and green. The level of performance of key performance indicators is important to determine the next action needs to be taken.

3.3.7. Gap Analysis

The gap analysis is the management tools to analyze the gap between business strategies with its organization performance. The gap analysis will show the critical point of the difference from current performance with the desired condition.

3.3.8. Strategy Development

The strategy development is structured by using the result of the gap analysis. The strategies are developed with the goal to close the gap between the current condition and the desired condition.

3.4 Analysis, Interpretation and Conclusion phase

In this phase, the analysis and data interpretation will be done based on the data processing phase. Conclusion and suggestion will be made based on the result.

3.4.1. Analysis and Interpretation

Analysis of the performance measurement design, weight analysis, evaluation result, and traffic light system, gap analysis, and strategy development will be done. The analysis will cover the interpretation of the condition fulfilled, and the implication of it to the company's condition.

3.4.2. Conclusion and Suggestion

Conclusion will be made to answer the purpose of the research, according to the result of performance measurement system, Key Performance Indicator, Analytical Network Process, Scoring System, Traffic Light System, Gap Analysis, and Strategy Development. Suggestion will be made for future research and the result implementation in the company.

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CHAPTER 4
DATA GATHERING AND PROCESSING

4.1 Data Gathering

This subchapter will explain about the data that are gathered from the company. The General Description, Company's Vision and Mission, Organization Structure will be explained.

4.1.1 General Description

PT Terminal Teluk Lamong is the first semi-automatic terminal in Indonesia with green technology. PT Terminal Teluk Lamong is included in the *Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia* (MP2EI) including the Java island. The construction and operation of Terminal Teluk Lamongg, it is expected to decrease the waiting time in the Port of Tanjung Perak as the main gate for East Java and East Indonesia economy.

PT Terminal Teluk Lamong commit to be the Internationally recognized enterprise. The commitment is shown by giving the best service for the customer. The enterprise value operation performance by uphold safety and health. PT Terminal Teluk Lamong also use Solar Cell with LED to light the road. These solar cells are used to minimized the carbon footprint by using fossil generated electricity. The Automated Stacking Crane (ASC) is also used to support the operational performance in the container yard. The use of ASC is the first in Indonesian ports. The operation of ASC will support to increase effectiveness and efficiency in container yard operation.

4.1.2. Company's Vision and Mission

To guide the company in the everyday working activities and the strategic planning, the company has set the vision and mission. Vision is the long term goal that is set by the company, while missions are the intermediary goals to take the company to the its goal.

Vision: To be on the best five Eco-Friendly operator terminal in South East Asia (ASEAN) in 2020

Mission:

1. To provide integrated terminal services in the shipping industry based on the SLA, SLG, and international standard/regulations
2. To ensure profit growth/company development by using efficient and innovative terminal management with eco-friendly cutting edge technology.
3. To produce competent employees with high-quality performance through development and welfare.

4.1.3. Organization Structure

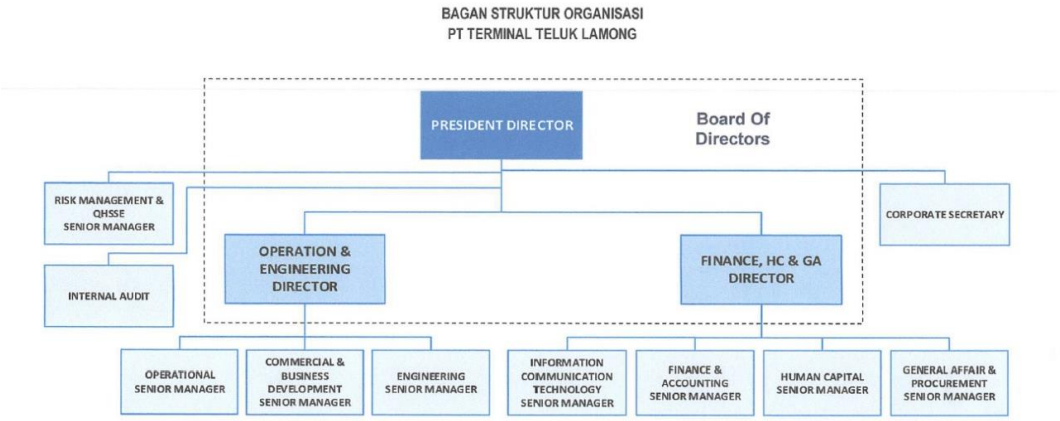

Figure 4.1 Organization Structure of PT Terminal Teluk Lamong
(Source:PT Terminal Teluk Lamong documentation)

The Figure 4.1 shows the organization structure of PT Terminal Teluk Lamong. Terminal Teluk Lamong has 9 Departments which operate under 2 major function. The Operation & Engineering Director is in charge of 3 departments, the Operational Department, The Commercial & Business Development Department, The Engineering Department. The Finance HC, and GA Director is in charge of the Information Communication Technology Department, The Finance & Accounting Department, The Human Capital Department, and General Affair & Procurement Department.

The Risk Management & Quality, Health, Safety, and Security on the other hand, has direct responsibility to the president director, also the Internal Audit Department. The green practices evaluation in TTL is the responsibility of the QHSSE department, with the support of other department.

4.2. Data Processing

In this subchapter, the data processing will be done based on the data that has been gathered in the previous subchapter. The data processing that will be done are the Performance Measurement Design, Weighting Process, Scoring System Design, Traffic Light System

4.2.1. Performance Measurement Design

Designing the Key Performance indicator is important to be able quantify the performance of each indicator. By using the KPI, the company can understand the performance of each indicator, that will enable the company to make improvement based on it. Below table 3.1 is the Primary indicator and its respective code for easier identification in the data processing. The primary indicators are earned from the Green Port Award System (GPAS).

Table 4. 1 Primary Indicator Code

Code	Explanation
A	Commitment and Willingness
B	Action and Implementation
C	Efficiency and Effectiveness

Below is the table that consist of the secondary indicators of GPAS and its respective code. The code identification is done to help in the process of data processing.

Table 4. 2 Secondary Indicator Code

Code	Explanation
A1	Green Port Awareness and Willingness
A2	Green Port Promotion
B1	Clean Energy
B2	Energy Saving
B3	Environmental Protection
B4	Green Management

Table 4. 3 Secondary Indicator Code

Code	Explanation
C1	Energy Saving Efficiency
C2	Environmental Protection effectiveness

The Key Performance Indicators are made by interviewing the managers and representatives of PT Terminal Teluk Lamong that are in charge of the green practices development. The KPI are made by identifying the best indicators to be measured by the company.

Table 4. 4 KPI Identification

Code	Secondary Indicator	Code	KPI
A1A	Green Strategy or Development Plans	A1A1	Innovation and updates on green practices on monthly meeting
		A1A2	Upgrade on Green Policies annually
A1B	Green Support Funding	A1B1	The realization of the funding on green practices
A1C	Green Annual Report	A1C1	Percentage of green annual report made
A2A	Green Training Program	A2A	The number of green training held in a year
A2B	Green Promotion Campaign	A2B	Updates on green practices on monthly meeting
B1A	Using renewable resources	B1A1	Upgrade on Green Policies annually
B1B	Using of CNG	B1B1	The realization of the funding on green practices
B1C	Using Cold Ironing	B1C1	Percentage of annual report made
B2A	Using Energy-Saving Devices & Technologies	B2A1	The number of green training held in a year
B2B	Optimizing Power Supply Systems	B2B1	The number of campaign event and tools in a year
B3A	Air Pollution Prevention	B3A1	The use of renewable resource in operation field
		B3A2	The use of CNG in the system
B3B	Noise Control	B3B1	The Percentage of ships that use cold iron
B3C	Waste Treatment	B3C1	The use of energy saving device
B3D	Biodiversity protection	B3D1	Power supply diversification
B4A	Green Environment Management System	B4A1	Percentage of clean energy truck / total truck
B4B	Green Performance Assessment	B4B1	Percentage of Conformity to standard

Table 4. 5 KPI Identification

Code	Secondary Indicator	Code	KPI
C1A	Energy Consumption Reduction	C1A1	Percentage of Conformity to standard
		C1A2	The establishment of Waste Treatment Facility
C1B	Renewable Energy Increment	C1B1	The establishment of biodiversity protection system
C2A	Air Quality Improvement	C2A1	Certification on ISO 140001
C2B	Noise Control Result	C2B1	The establishment of green performance assessment
C2C	Liquid & Solid Pollution Control	C2C1	Monthly energy consumption report

The next step of the process is to identify the unit and target of each KPI. The unit is chosen that best represent the dimension of measurement. The target of the measurement is set based on the need of current green port practice development and accommodate future challenges. Below is the table 3.4 that shows the result of the interview with company's manager.

Table 4. 6 Key Performance Indicator Target and Formula

Code	KPI	Unit	Target	Target Reasoning	Formula
A1A1	Updates on green practices on monthly meeting	Amount	12	Monthly updates necessary as information updates and necessary tools for improvement	Green innovation launch in monthly meeting/ total monthly meeting
A1A2	Upgrade on Green Policies annually	Amount	1	The green policies review necessary to accommodate needs of future green development	Annual renewal of Green Policy
A1B1	The realization of the funding on green practices	Percentage	100%	Maximizing fund spend as form of commitment in supporting green practices	(Total spending / budget) *100%
A1C1	Percentage of green annual report made	Percentage	100%	Green annual report as commitment in evaluating the green practices	Annual green report made/ total operating years
A2A	The number of green training held in a year	Amount	2	Green training as important part of Human Resource Development	Total green training held for employees
A2B	The number of campaign event and tools in a year	Amount	6	Bimonthly campaign considered as effective program implementation target	Total campaign event and tools generated
B1A1	The use of renewable resource in operation field	Amount	1	The commitment to use renewable resource as part of operation field to support continuous clean energy	The implementation of renewable resources as energy in the operation (STS, ASC)
B1B1	The use of CNG in the system	Amount	1	The action of implementing CNG as continuous clean energy resource	The implementation of Compressed Natural Gas
B1C1	The Percentage of ships that use cold iron	Percentage	10%	10% of berthing ship that use cold iron, are implemented in green port in Europe	Total ships that use cold iron/total ship berth
B2A1	The use of energy saving device	Amount	1	The implementation of technology that support energy saving	The implementation of energy saving device in the system
B2B1	Power supply diversification	Percentage	1	The optimization f power supply from diverse and renewable source	Energy supply by PLTMG / total Energy supplied
B3A1	Percentage of clean energy truck / total truck	Percentage	30%	The percentage of clean energy truck, that is aimed at 30% because the customer is not ready yet for total clean energy truck usage	Average of (Total clean energy truck / Total truck in in the vicinity per month * 100%)
B3A2	Percentage of Air Pollution conformity to standard	Percentage	100%	The percentage of conformity to the regulation has to be set 100%	Total sector that conform the standard/ total sector examined

Table 4. 7 Key Performance Indicator Target and Formula (con't)

Code	KPI	Unit	Target	Target Reasoning	Formula
B3B1	Percentage of Noise Pollution conformity to standard	Percentage	100 %	The percentage of conformity to the regulation has to be set 100%	Total sector that conform the standard/ total sector examined
B3C1	The establishment of Waste Treatment Facility	Amount	1	The first step of facility establishment as part of waste management	The completion of waste treatment Facility
B3D1	The establishment of biodiversity protection system	Amount	1	The first step of system biodiversity management	The establishment of biodiversity protection system
B4A1	Certification on ISO 140001	Amount	1	The proof of environmental management quality and commitment through certification	The accomplishment of ISO 140001
B4B1	The establishment of green performance assessment	Amount	1	Green performance assessment as the continuity of green performance control and improvement	The establishment of green performance assessment
C1A1	Monthly energy consumption report	Amount	12	The energy consumption has to be monitored every month to give room for improvement	The report made on monthly energy consumption
C1A2	Annual energy efficiency improvement	Amount	5%	Energy efficiency on container handling represent improvement in shop floor level	Energy to handle container for every 1 TEUs. 1 if 2018>2017
C1B1	Percentage of increase of renewable energy use from last year	Percentage	10%	The increase of renewable energy use represent the continuity of renewable energy use in PT Teluk Lamong, 10% increase is high enough to be achieved	((Total CNG used in 2017- Total CNG used in 2016)/ Total energy used in 2016)
C2A1	The percentage of reduction in air pollution level	Percentage	15%	The reduction of pollution level is aimed to be 15%, which is high level of goal because of increase in demand	(The average of pollution last year - Average noise pollution this year)/ Average pollution last year
C2B1	The percentage of reduction in noise pollution level	Percentage	15%	The reduction of pollution level is aimed to be 15%, which is high level of goal because of increase in demand	(The average of pollution last year - Average air pollution this year)/ Average pollution last year
C2C1	The percentage of reduction in liquid & solid pollution level	Percentage	15%	The reduction of pollution level is aimed to be 15%, which is high level of goal because of increase in demand	(The average of pollution last year - Average Liquid pollution this year)/ Average pollution last year

Table 4.5-4.7 describe the result of the KPI target and formula determination. This information is presented in the table to give clear understanding of the reason behind each and every target, and the formula to count ever key performance indicators. This information is presented to help in the process of transfer knowledge when the performance measurement is used and needed to be understood by other parties.

4.2.2. KPI Properties Design

The KPI properties design is the process of providing explanation in to the KPI, in regard to the details of information. The goal is to help the user understand the KPI clearly. The information that are provided, are the definition, unit, characteristic, formula of quantification. Table 4.8-4.10 that shows the result of the KPI Properties design.

Table 4. 8 KPI Properties Design

Primary Indicator	Code	Secondary Indicator	Code	Indicator	Code	KPI	Unit	Characteristic	Formula	Description	Target
Commitment and Willingness	A1	Green Port Awareness and Willingness	A1A	Green Strategy or Development Plans	A1A1	Updates on green practices on monthly meeting	Amount	Higher is better	Green innovation launch in monthly meeting	The total green innovation program launched in monthly meeting	12
					A1A2	Upgrade on Green Policies annually	Amount	Zero-one	Annual renewal of Green Policy	The updates on green policies annually	1
			A1B	Green Support Funding	A1B1	The realization of the funding on green practices	Percentage	Higher is better	(Total spending / budget) *100%	The percentage of funding used on green practice compared to its annual budget	100%
			A1C	Green Annual Report	A1C1	Percentage of annual report made	Percentage	Percentage	Annual green performance published	Report on Green Performance in a year	100%
	A2	Green Port Promotion	A2A	Green Training Program	A2A	The number of green training held in a year	Amount	Higher is better	Total green training held for employees	Total green training program executed	2
			A2B	Green Promotion Campaign	A2B	The number of campaign event and tools in a year	Amount	Higher is better	Total campaign event and tools generated	The tools made for green concept campaign	6
Action and Implementation	B1	Clean Energy	B1A	Using renewable resources	B1A1	The use of renewable resource in operation field	Amount	Zero-one	The implementation of renewable resources as energy in the operation (STS, ASC)	The implemented renewable resource in the operational field	1
			B1B	Using of CNG	B1B1	The use of CNG in the system	Amount	Zero-one	The implementation of Compressed Natural Gas	The implementation of CNG use in system	1

Table 4. 9 KPI Properties Design (cont'd)

Primary Indicator	Code	Secondary Indicator	Code	Indicator	Code	KPI	Unit	Characteristic	Formula	Description	Target
Action and Implementation	B1	Clean Energy	B1C	Using Cold Ironing	B1C1	The Percentage of ships that use cold iron	Percentage	Higher is better	Total ships that use cold iron/total ship berth	The percentage of ship that use cold iron facility in a year	5%
	B2	Energy Saving	B2A	Using Energy-Saving Devices & Technologies	B2A1	The use of energy saving device	Percentage	Higher is better	The implementation of energy saving device in the system	The implementation of energy saving device in the system	1
			B2B	Optimizing Power Supply Systems	B2B1	Power supply diversification	Amount	Zero-one	The implementation of power supply diversification	Percentage of renewable energy / total energy	1
	B3	Environmental Protection	B3A	Air Pollution Prevention	B3A1	Percentage of clean energy truck / total truck	Percentage	Higher is better	Average of (Total clean energy truck / Total truck in in the vicinity per month * 100%)	Percentage of clean truck compared to all trucks operating in the vicinity	30%
					B3A2	Percentage of Air Pollution conformity to standard	Percentage	Higher is better	Total sector that conform the standard/ total sector examined	The result of the air pollution assessment and how it conform the standard	100%
			B3B	Noise Control	B3B1	Percentage of Noise Pollution conformity to standard	Percentage	Higher is better	Total sector that conform the standard/ total sector examined	The result of the noise pollution assessment and how it conform the standard	100%
			B3C	Waste Treatment	B3C1	The establishment of Waste Treatment Facility	Amount	Zero-one	The completion of waste treatment Facility	The establishment of waste treatment facility	1
			B3D	Biodiversity protection	B3D1	The establishment of biodiversity protection system	Amount	Zero-one	The establishment of biodiversity protection system	The establishment of biodiversity protection system	1
	B4	Green Management	B4A	Green Environment Management System	B4A1	Certification on ISO 140001	Amount	Zero-one	The completion of ISO 140001 certification	The completion of ISO 140001 certification	1
			B4B	Green Performance Assessment	B4B1	The establishment of green performance assessment	Amount	Zero-one	The establishment of green performance assessment	The establishment of green performance assessment as permanent measurement system	1

Table 4. 10 KPI Properties Design (cont'd)

Primary Indicator	Code	Secondary Indicator	Code	Indicator	Code	KPI	Unit	Characteristic	Formula	Description	Target
Efficiency and Effectiveness	C1	Energy Saving Efficiency	C1A	Energy Consumption Reduction	C1A1	Monthly energy consumption report	Amount	Zero-one	The report made on monthly energy consumption	The report made on monthly energy consumption	12
					C1A2	Annual energy efficiency improvement	Percentage	Higher is better	Energy to handle container for every 1 TEUs. 1 if 2018>2017	Increase of energy efficiency percentage	5%
			C1B	Renewable Energy Increment	C1B1	Percentage of increase of renewable energy use from last year	Percentage	Higher is better	((Total CNG used in 2017-Total CNG used in 2016)/ Total energy used in 2016)	Percentage of increase of renewable energy use from last year	10%
	C2	Environmental Protection Effectiveness	C2A	Air Quality Improvement	C2A1	The percentage of reduction in air pollution level	Percentage	Higher is better	(The average of pollution last year - Average noise pollution this year)/ Average pollution last year	The percentage of pollution level reduction	15%
			C2B	Noise Control Result	C2B1	The percentage of reduction in noise pollution level	Percentage	Higher is better	(The average of pollution last year - Average air pollution this year)/ Average pollution last year	The percentage of pollution level reduction	15%
			C2C	Liquid & Solid Pollution Control	C2C1	The percentage of reduction in liquid & solid pollution level	Percentage	Higher is better	(The average of pollution last year - Average Liquid pollution this year)/ Average pollution last year	The percentage of pollution level reduction	15%

The KPI Properties are made to provide the necessary information in the system about the performance indicators. The KPI properties aimed to help the QHSSE Department in the transfer knowledge to other parties. The KPI Properties will make sure all those that read or use the KPI will have same perception about each and every one of it.

4.2.3. KPI Weighting Process

To determine each of the strategy that should be taken, the company has to determine the importance of each performance indicators that has been established by the GPAS. The weighting process is done by using the Analytical Network Process. The Analytical Network Process (ANP) is done by using software Super Decision. The weighting process by using ANP is only done on the Primary and the Secondary indicators only, for the weighting process of each performance indicator is done by using Expert Judgement method. The Expert Judgement is done by interviewing the management of the Terminal Teluk Lamong. The data processed in ANP are the dependence between the primary indicators, dependence between secondary indicators, and also dependence of each performance indicators.

There are several steps in the ANP. Below are the tests carried out in the ANP method: Network Modelling, Pairwise Comparison Matrix, Supermatrix Design, and the Final Weight Identification.

4.2.3.1. Network Model

The network model will be made by identifying the relations between each elements and clusters. The elements are the secondary indicators while the clusters are the primary indicators, both derived from the GPAS. Each of the elements and clusters are positioned as it is made by the GPAS.

After the identification of the cluster and the elements has been done, the next step is to determine the relations between each elements. Codes for each elements and cluster are made. Below are each of the code given to each cluster and elements.

Table 4. 11 Primary Indicator Code Identification

Code	Explanation
A	Commitment and Willingness
A1	Green Port Awareness and Willingness
A2	Green Port Promotion
B	Action and Implementation
B1	Clean Energy
B2	Energy Saving
B3	Environmental Protection

Table 4. 12 Primary Indicator Code Identification (cont'd)

Code	Explanation
B4	Green Management
C	Effectiveness and Efficiency
C1	Energy Saving Efficiency
C2	Environmental Protection Effectiveness

To help mapping the relations, the influence table is made. below is the influence table that will show the relations between elements:

Table 4. 13 Influence between Elements

		Elements that are getting influenced							
Elements that are giving influence		A1	A2	B1	B2	B3	B4	C1	C2
	A1		√	√	√	√	√		
	A2				√		√	√	
	B1								√
	B2							√	
	B3								√
	B4			√	√	√		√	√
	C1						√		
	C2						√		

The relations between elements are determined by interviewing the company management. There are 20 relations that has been identified. There are two types of relations, the inner dependence and outer dependence. The inner dependence is the relations between one elements with the other, within the same cluster. Meanwhile the outer dependence is the relation between one element with the other element of different cluster. The information regarding the reason of each relation are explained in the table below:

Table 4. 14 Influence Table Information (cont'd)

Code	Influenced by	Information
A2	A1	The score of Green Port Promotion (A2) is determined by how good the strategy developed and how much funding is given (A1)
B1	A1	The score of Clean Energy need lots of investment, therefore is determined by how good the strategy developed and how much funding is given (A1)
	B4	How clean energy is implemented will depend on the Green Management (B4)
B2	A1	The type of technology, and it's implementation depend on the strategy developed, and fund invested
	A2	The Energy saving system depend on the training program (A2) held by the TTL
	B4	The energy saving system will depend on the green performance management
B3	A1	The environmental protection needs technology that is supported by the funding (A1)
	B4	Environmental Protection needs to be controlled and sustained by green management (B4)
B4	A1	The Green performance assessment will be depend on the strategy developed for green action
	A2	Green performance result is affected by the green training program held (A2)
	C1	The Efficiency of the energy saving (C1), will affect the green performance
	C2	The effectiveness of the environmental protection, will determine the performance of the green assessment
C1	A1	The strategy and funding(A1) will determine what instrument of technology is used in implementing the energy saving, therefore the performance of the energy saving efficiency will be dependent of it
	A2	The training program developed in the green port promotion (A2)will give boost in energy saving efficiency, due to the increase of operational excellence
	B2	The efficiency of the energy saving (C1), is one of the indicator of the performance of the implementation of Energy saving
	B4	The periodical green assessment (B4) will help build stronger foundation and strategy for the future implementation of energy saving
C2	A1	The strategy and fund set on the Environmental Protection technology and implementation will affect the effectiveness
	B1	The implementation of the clean energy will help protect the environment, by reducing the pollution generated
	B3	The environmental protection effectiveness is the indicator of performance of the environmental protection program
	B4	The periodical green assessment (B4) will help build stronger foundation and strategy for the future implementation of environmental protection

From the table above, we can understand that there are inner dependence and outer dependence in the network model. The example for the inner dependence is how the Environmental Protection (B3) needs to be controlled and sustained by green management (B4). the example for the outer dependence is the how the training program developed in the green port promotion (A2) will give boost in energy saving efficiency (C1), due to the increase of operational excellence.

After the identification of each elements and the cluster has been done, the next step is to do the weighting of each strategy by using the Super Decision version 3.0. The network model will be made based on the elements and clusters that has been identified, and the relations that has been determined. Below is the result of the model by using the software:

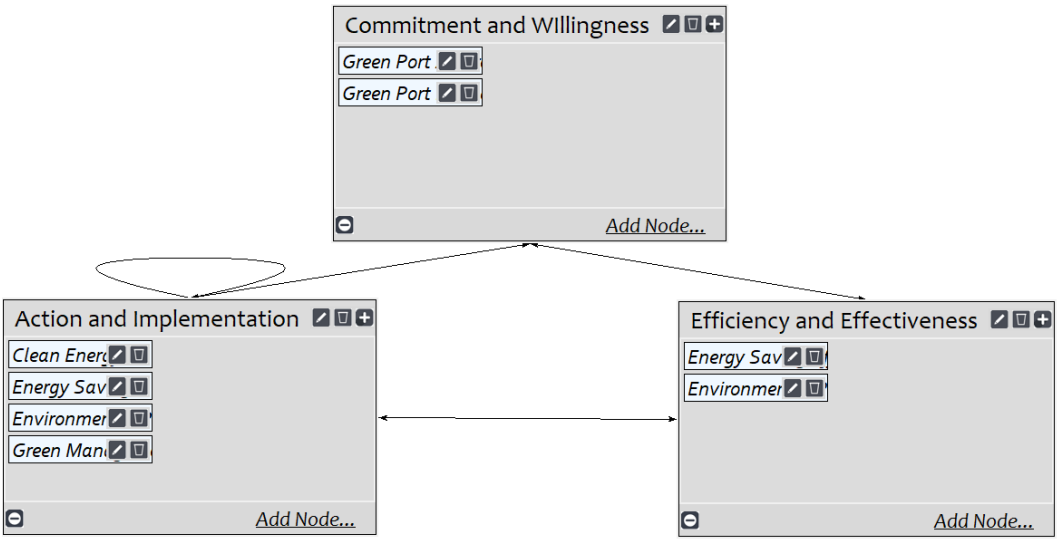

Figure 4.2 Network Model in Super Decision

Based on the model network that has been made, it can be seen that there are 3 clusters, with each elements associated with it. These clusters are defined based on the primary indicators that has been determined in the GPAS. The network model can show us that there are both inner dependence and outer dependence in it. The arrow that points out form one cluster to itself, shows that the cluster has inner dependence. while the arrow that points to the other cluster, show that it has outer dependence. The network model show that only one cluster has the inner

dependence, that is the Action and Implementation, while all three cluster has outer dependence.

4.2.3.2. Pairwise Comparison Matrix

In this phase, pairwise comparison will be done regarding to the relations between elements and also clusters. The pairwise comparison is done by interviewing the Head of Department of Quality, Health (QHSSE). The interview is done based on the questionnaire that has been made. The questionnaire is constructed from 12 comparisons.

The data is processed using the Super Decision software. The questionnaire result is processed in the software. below is the example of the judgement done:

Figure 4.3 Example of Judgment Process in Pairwise Comparison

The figure above show how the judgement of the comparison is done. The judgement is done based on the scale of 1-9. The software of Super Decision made further calculation of the inconsistency and the eigen vector of each element. Below is the example of the inconsistency that is calculated automatically by the Super Decision, on the comparison with regards to Environmental Protection Effectiveness in Action and Implementation cluster.

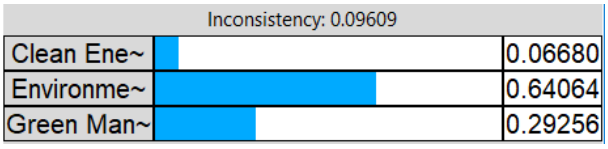

Figure 4.4 Inconsistency Calculation

Based on the figure above, it can be seen that the inconsistency is displayed on every calculation. The result of the comparison is considered valid when the consistency is below 0.1. The calculation which produce value of consistency above it, is recommended to be recalculated. After the relations between elements have been determined, the relations between clusters will be determined next. The

pairwise comparison for clusters is also done by inputting the value that have been received in the interview with the Head of Department in TPT Terminal Teluk Lamong. Below is the process of inputting the value of comparison into the Super Decision.

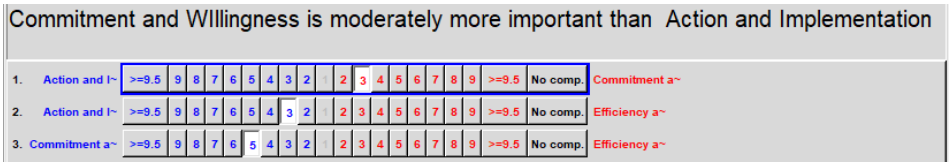

Figure 4.5 Pairwise Comparison for Clusters

Based on the figure above, it can be seen how important each of the cluster, with the other cluster. After it has been inputted, the Super Decision will calculate it automatically. Below is the result of the Cluster Matrix.

Clusters	Action and Implementation	Commitment and WIllingness	Efficiency and Effectiveness
Action and Implementation	0.258285	0.000000	0.250000
Commitment and WIllingness	0.636986	0.000000	0.750000
Efficiency and Effectiveness	0.104729	1.000000	0.000000

Figure 4.6 Cluster Matrix Value

It can be seen from the figure above, the eigen vector of each cluster that shows the relation between clusters. If there are values on the cluster, it means that there are dependency between one cluster and the other. The value of the dependency is reflected from the dependency set on the network model and the pairwise comparison done. Meanwhile, if the matrix shows the value of 0, then it means that there is no dependency between the clusters.

4.2.3.3. Supermatrix Design

The next step of the process is designing the supermatrix. There are 3 phase in designing supermatrix, which are the design of unweighted supermatrix, the design of weighted supermatrix, and also the design of limit supermatrix.

a. Unweighted Supermatrix Design

The unweighted supermatrix shows the relations between elements and the value of each relations. The unweighted supermatrix is obtained from the pairwise comparison that has been done. The unweighted supermatrix shows the entirety of

relations and its values, each from their respective cluster, without considering the total weight of the relation to the element. Below is the result of the unweighted supermatrix created using the Super Decision software.

Clusters	Nodes	Clean Energy	Energy Savi...	Environment...	Green Manage...	Green Port A...	Green Port Pro...	Energy Saving Ef...	Environmental Pro...
Action and Imple...	Clean Energy	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.066802
	Energy Saving	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.750000	0.000000
	Environmental Protection	0.833333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.640638
	Green Management	0.166667	1.000000	1.000000	0.000000	0.000000	0.000000	0.250000	0.292560
Commitment and ...	Green Port Awareness and ...	1.000000	1.000000	0.000000	0.750000	0.000000	0.000000	0.875000	1.000000
	Green Port Promotion	0.000000	0.000000	0.000000	0.250000	0.000000	0.000000	0.125000	0.000000
Efficiency and Eff...	Energy Saving Efficiency	0.000000	0.000000	0.000000	0.666667	0.000000	0.000000	0.000000	0.000000
	Environmental Protection Eff...	0.000000	0.000000	0.000000	0.333333	0.000000	1.000000	0.000000	0.000000

Figure 4.7 Unweighted Supermatrix

b. Weighted Supermatrix Design

The weighted supermatrix design, is designed by multiplying all the value in the unweighted supermatrix with the respective cluster matrix value so that the value for the weighted supermatrix is 1. The calculation is done automatically in the super decision software. Below is the result of the calculation.

Clusters	Nodes	Clean Energy	Energy Saving	Environment...	Green Mana...	Green Port Awar...	Green Port Pro...	Energy Savi...	Environmental...
Action and Impl...	Clean Energy	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.016700
	Energy Saving	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.187500	0.000000
	Environmental Protection	0.240416	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.160159
	Green Management	0.048083	0.288499	1.000000	0.000000	0.000000	0.000000	0.062500	0.073140
Commitment an...	Green Port Awareness and ...	0.711501	0.711501	0.000000	0.644101	0.000000	0.000000	0.656250	0.750000
	Green Port Promotion	0.000000	0.000000	0.000000	0.214700	0.000000	0.000000	0.093750	0.000000
Efficiency and Ef...	Energy Saving Efficiency	0.000000	0.000000	0.000000	0.094133	0.000000	0.000000	0.000000	0.000000
	Environmental Protection E...	0.000000	0.000000	0.000000	0.047066	0.000000	1.000000	0.000000	0.000000

Figure 4.8 Weighted Supermatrix

c. Limit Supermatrix

In this phase, the value of the weight limit is determined for every element. The calculation is done automatically by the super decision software. The result of the calculation will have resulted in which every value of the element in row will be the same.

Clusters	Nodes	Clean Energy	Energy Saving	Environmenta...	Green Manage...	Green Port Awar...	Green Port Pro...	Energy Saving Effici...	Environmental Protect...
Action and Implem...	Clean Energy	0.005568	0.005568	0.005568	0.005568	0.000000	0.005568	0.005568	0.005568
	Energy Saving	0.011207	0.011207	0.011207	0.011207	0.000000	0.011207	0.011207	0.011207
	Environmental Protecti...	0.056150	0.056150	0.056150	0.056150	0.000000	0.056150	0.056150	0.056150
	Green Management	0.150604	0.150604	0.150604	0.150604	0.000000	0.150604	0.150604	0.150604
Commitment and ...	Green Port Awareness ...	0.512980	0.512980	0.512980	0.512980	0.000000	0.512980	0.512980	0.512980
	Green Port Promotion	0.071996	0.071997	0.071997	0.071996	0.000000	0.071996	0.071996	0.071996
Efficiency and Effe...	Energy Saving Efficiency	0.029109	0.029109	0.029109	0.029109	0.000000	0.029109	0.029109	0.029109
	Environmental Protecti...	0.162385	0.162385	0.162385	0.162385	0.000000	0.162385	0.162385	0.162385

Figure 4.9 Limit Supermatrix

4.2.3.4. Final Weight Identification

The next phase is to get the final weight value of each element. To get the final weight of each element, calculation is done to normalize the weight, by multiplying the value of the limit matrix with the total value in the cluster. The

limit matrix is obtained from the calculation that has been done. The cluster matrix is obtained from accumulating all the value in the same cluster. The weight normalization is obtained from the result of the multiplication.

Table 4. 15 Result Normalization Process

Primary Indicator	Secondary Indicator	Limit Matrix	Cluster Matrix	Weight Normalization
Action and Implementation	Clean Energy	0.005568	0.223529	0.02490952
	Energy Saving	0.011207		0.050136671
	Environmental Protection	0.05615		0.251197831
	Green Management	0.150604		0.673755978
Commitment and Willingness	Green Port Awareness and Willingness	0.51298	0.584976	0.876924865
	Green Port Promotion	0.071996		0.123075135
Efficiency and Effectiveness	Energy Saving Efficiency	0.029109	0.191494	0.152009985
	Environmental Protection Effectiveness	0.162385		0.847990015
Total		1	1	3

After the weight normalization has been done, the next step is to set the primary indicator, and secondary indicator in its respective weight, without considering the limit matrix anymore. Below is the presentation of the weight of primary and secondary indicator.

Table 4. 16 Final Weight for Primary and Secondary Indicators

Primary Indicator	Weight	Secondary Indicator	Weight
Action and Implementation	0.223529	Clean Energy	0.02490952
		Energy Saving	0.050136671
		Environmental Protection	0.251197831
		Green Management	0.673755978

Table 4. 17 Final Weight for Primary and Secondary Indicators

Primary Indicator	Weight	Secondary Indicator	Weight
Commitment and Willingness	0.58497	Green Port Awareness and Willingness	0.876924865
		Green Port Promotion	0.123075135
Efficiency and Effectiveness	0.19149	Energy Saving Efficiency	0.152009985
		Environmental Protection Effectiveness	0.847990015

Based on the figure above, it can be seen that for the primary indicator, commitment and willingness with 58 percent. commitment and willingness has big percentage due to its significance in determining the result of the other are. The strategy and fund that are determined by Terminal Teluk Lamong, goes into account in this indicator. In action and implementation, the most important secondary indicator is the green management. the commitment and willingness indicator has the green port awareness and willingness as the most important indicator. The efficiency and effectiveness indicator, the environmental protection and effectiveness is the utmost important.

After the weight of the indicators have been determined, the weight for third indicators for each of the secondary indicator, need to be addressed. The weight of each third indicators will be determined with regard to its secondary indicator. The method Expert Judgement is used in this case. The expert that is chosen is the head of QHSSE department. Below is the result of the expert judgement that is done on the weighting process of third indicators.

Table 4. 18 Expert Judgment on Third Indicators Weight

Primary Indicator	Secondary Indicator	Third Indicator	Weight
Commitment and Willingness	Green Port Awareness and Willingness	Green Strategy or Development Plans	0.4
		Green Support Funding	0.4
		Green Annual Report	0.2
	Green Port Promotion	Green Training Program	0.5
		Green Promotion Campaign	0.5
Action and Implementation	Clean Energy	Using renewable resources	0.6
		Using of CNG	0.2
		Using Cold Ironing	0.2
	Energy Saving	Using Energy-Saving Devices & Technologies	0.6

Table 4. 19 Expert Judgment on Third Indicators Weight

Primary Indicator	Secondary Indicator	Third Indicator	Weight
		Optimizing Power Supply Systems	0.4
	Environmental Protection	Air Pollution Prevention	0.3
		Noise Control	0.15
		Waste Treatment	0.4
		Biodiversity protection	0.15
	Green Management	Green Environment Management System	0.6
		Green Performance Assessment	0.4

Table 4. 20 Expert Judgment on Third Indicators Weight

Primary Indicator	Secondary Indicator	Third Indicator	Weight
Efficiency and Effectiveness	Energy Saving Efficiency	Energy Consumption Reduction	0.7
		Renewable Energy Increment	0.3
	Environmental Protection Effectiveness	Air Quality Improvement	0.3
		Noise Control Result	0.25
		Liquid & Solid Pollution Control	0.45

After the weighting process has been done, the next step is to determine the weight for each of the key performance indicators. The weight of the key performance indicator is determined by expert judgement. The expert judgement is done by interviewing the management of the company. Below is the result of the expert judgement done

Table 4. 21 Expert Judgement on Key Performance Indicators Weight

Code	KPI	Weight
A1A1	Updates on green practices on monthly meeting	0.5
A1A2	Upgrade on Green Policies annually	0.5
A1B1	The realization of the funding on green practices	1
A1C1	Percentage of annual report made	1
A2A	The number of green training held in a year	1

Table 4. 22 Expert Judgement on Key Performance Indicators Weight

Code	KPI	Weight
A2B	The number of campaign event and tools in a year	1
B1A1	The use of renewable resource in operation field	1
B1B1	The use of CNG in the system	1
B1C1	The Percentage of ships that use cold iron	1
B2A1	The use of energy saving device	1
B2B1	Power supply diversification	1
B3A1	Percentage of clean energy truck / total truck	0.5
B3A2	Percentage of Air Pollution conformity to standard	0.5
B3B1	Percentage of Noise Pollution conformity to standard	1
B3C1	The establishment of Waste Treatment Facility	1
B3D1	The establishment of biodiversity protection system	1
B4A1	Certification on ISO 140001	1
B4B1	The establishment of green performance assessment	1
C1A1	Monthly energy consumption report	0.5
C1A2	Annual energy efficiency improvement	0.5
C1B1	Percentage of increase of renewable energy use from last year	1
C2A1	The percentage of reduction in air pollution level	1
C2B1	The percentage of reduction in noise pollution level	1
C2C1	The percentage of reduction in liquid & solid pollution level	1

After the weight process has been done, the next step is to determine the global weight of the key performance indicators. The global weight is obtained by multiplying the weight of each third indicators with its respective primary and secondary indicator weight. The result of the multiplication is the global weight. Below is the result of the calculation presented in the table.

Table 4. 23 The Global Weight Calculation

Primary Indicator	Weight	Secondary Indicator	Weight	Third Indicator	Weight	KPI	Weight	Global Weight
Commitment and Willingness	0.39	Green Port Awareness and Willingness	0.73	Green Strategy or Development Plans	0.4	Updates on green practices on monthly meeting	0.5	0.0570182
						Upgrade on Green Policies annually	0.5	0.0570182
				Green Support Funding	0.4	The realization of the funding on green practices	1	0.1140364
				Green Annual Report	0.2	Percentage of annual report made	1	0.0570182
		Green Port Promotion	0.27	Green Training Program	0.5	The number of green training held in a year	1	0.0533185
				Green Promotion Campaign	0.5	The number of campaign event and tools in a year	1	0.0533185
Action and Implementation	0.39	Clean Energy	0.04	Using renewable resources	0.6	The use of renewable resource in operation field	1	0.0101712
				Using of Compressed Natural Gas (CNG)	0.2	The use of CNG in the system	1	0.0033904
				Using Cold Ironing	0.2	The Percentage of ships that use cold iron	1	0.0033904
		Energy Saving	0.09	Using Energy-Saving Devices & Technologies	0.6	The use of energy saving device	1	0.0204954
				Optimizing Power Supply Systems	0.4	Power supply diversification	1	0.0136636
		Environmental Protection	0.28	Air Pollution Prevention	0.3	Percentage of clean energy truck / total truck	0.5	0.01641315

Table 4. 24 The Global Weight Calculation (con't)

Primary Indicator	Weight	Secondary Indicator	Weight	Third Indicator	Weight	KPI	Weight	Global Weight
						Percentage of Air Pollution conformity to standard	0.5	0.01641315
				Noise Control	0.15	Percentage of Noise Pollution conformity to standard	1	0.01641315
				Waste Treatment	0.4	The establishment of Waste Treatment Facility	1	0.0437684
				Biodiversity protection	0.15	The establishment of biodiversity protection system	1	0.01641315
		Green Management	0.58	Green Environment Management System	0.6	Certification on ISO 140001	1	0.1351896
				Green Performance Assessment	0.4	The establishment of green performance assessment	1	0.0901264
Efficiency and Effectiveness	0.22	Energy Saving Efficiency	0.22	Energy Consumption Reduction	0.7	Monthly energy consumption report	0.5	0.01709435
						Annual energy efficiency improvement	0.5	0.01709435
				Renewable Energy Increment	0.3	Percentage of increase of renewable energy use from last year	1	0.0146523
		Environmental Protection Effectiveness	0.78	Air Quality Improvement	0.3	The percentage of reduction in air pollution level	1	0.0520746
				Noise Control Result	0.25	The percentage of reduction in noise pollution level	1	0.0433955
				Liquid & Solid Pollution Control	0.45	The percentage of reduction in liquid & solid pollution level	1	0.0781119

Based on the table above, it can be determined how each of the indicators will place its importance to the overall performance of green award system. The weight process is important for the next step. the identification process result will be used in determining the performance of each strategy

4.2.4. Scoring System Design

The scoring system is the method of scoring done on the established Performance measurement, aiming to understand the value of performance from the data provided regarding each KPI. The scoring system will present the weight of each indicators that has been established from previous step in Analytical Network Process.

Table 4. 25 Scoring System Design

Primary Indicator	Weight	Secondary Indicator	Weight	Indicator	Weight	KPI	Weight	Global Weight	Target	Realization	KPI Score	Weighted Score	Weighted Third indicator	Weighted Secondary	Weighted Primary Indicator	Final Score
Commitment and Willingness	0.39	Green Port Awareness and Willingness	0.73	Green Strategy or Development Plans	0.4	Updates on green practices on monthly meeting	0.5	0.0570182	12	12	1	0.057018	0.114036	0.254301172	0.28096042	0.55132774
						Upgrade on Green Policies annually	0.5	0.0570182	1	1	1	0.057018				
				Green Support Funding	0.4	The realization of the funding on green practices	1	0.1140364	100%	73%	0.73	0.083246	0.083246			
				Green Annual Report	0.2	Percentage of green annual report made	1	0.0570182	100%	100%	1	0.057018	0.057018			
		Green Port Promotion	0.27	Green Training Program	0.5	The number of green training held in a year	1	0.0533185	2	0	0	0	0	0.0266592		
				Green Promotion Campaign	0.5	The number of campaign event and tools in a year	1	0.0533185	6	3	0.5	0.026659	0.026659			
Action and Implementation	0.39	Clean Energy	0.04	Using renewable resources	0.6	The use of renewable resource in operation field	1	0.0101712	1	1	1	0.010171	0.010171	0.0135616	0.22202821	
				Using of Compressed Natural Gas (CNG)	0.2	The use of CNG in the system	1	0.0033904	1	1	1	0.0033904	0.0033904			
				Using Cold Ironing	0.2	The Percentage of ships that use cold iron	1	0.0033904	30%	0%	0	0	0			

Table 4. 26 Scoring System Design (cont'd)

Primary Indicator	Weight	Secondary Indicator	Weight	Indicator	Weight	KPI	Weight	Global Weight	Target	Realization	KPI Score	Weighted Score	Weighted Third indicator	Weighted Secondary	Weighted Primary Indicator	Final Score
		Energy Saving	0.09	Using Energy-Saving Devices & Technologies	0.6	The use of energy saving device	1	0.0204954	1	1	1	0.0204954	0.0204954	0.034159		
				Optimizing Power Supply Systems	0.4	Power supply diversification	1	0.0136636	1	1	1	0.0136636	0.0136636			
		Environmental Protection	0.28	Air Pollution Prevention	0.3	Percentage of clean energy truck / total truck	0.5	0.01641315	30%	25%	0.833333333	0.013677625	0.030090775	0.039118008		
						Percentage of Air Pollution conformity to standard	0.5	0.01641315	100 %	100%	1	0.01641315				
				Noise Control	0.15	Percentage of Noise Pollution conformity to standard	1	0.01641315	100 %	55%	0.55	0.009027233	0.009027233			
				Waste Treatment	0.4	The establishment of Waste Treatment Facility	1	0.0437684	1	0	0	0	0			
				Biodiversity protection	0.15	The establishment of biodiversity protection system	1	0.01641315	1	0	0	0	0			

Table 4. 27 Scoring System Design (cont'd)

Primary Indicator	Weight	Secondary Indicator	Weight	Indicator	Weight	KPI	Weight	Global Weight	Target	Realization	KPI Score	Weighted Score	Weighted Third indicator	Weighted Secondary	Weighted Primary Indicator	Final Score
		Green Management	0.58	Green Environment Management System	0.6	Certification on ISO 140001	1	0.1351896	1	1	1	0.1351896	0.1351896	0.1351896		
				Green Performance Assessment	0.4	The establishment of green performance assessment	1	0.0901264	1	0	0	0	0			
Efficiency and Effectiveness	0.22	Energy Saving Efficiency	0.22	Energy Consumption Reduction	0.7	Monthly energy consumption report	0.5	0.01709435	12	12	1	0.01709435	0.01709435	0.01709435	0.04833911	
						Annual energy efficiency improvement	0.5	0.01709435	5%	0%	0	0				
				Renewable Energy Increment	0.3	Percentage of increase of renewable energy use from last year	1	0.0146523	10%	0	0	0	0			
		Environmental Protection Effectiveness	0.78	Air Quality Improvement	0.3	The percentage of reduction in air pollution level	1	0.0520746	15%	9%	0.6	0.03124476	0.03124476	0.03124476		
				Noise Control Result	0.25	The percentage of reduction in noise pollution level	1	0.0433955	15%	1%	0.044981 06	0.00195 1976	0			
				Liquid & Solid Pollution Control	0.45	The percentage of reduction in liquid & solid pollution level	1	0.0781119	15%	0	0	0	0			

Table 4.24 - 4.26 showed how the scoring system for the performance is done. it can be seen that the Commitment and Willingness has the highest score contribution in the primary indicators level with 0.28 point out of 1. The second highest in the primary indicators level is the Action and Implementation with 0.22 point. The last score in the primary indicators level is the Environmental Protection and Effectiveness with 0.048 point.

The overall score for Terminal Teluk Lamong based on the scoring system designed is 0.55 point out of 1. This shows that TTL green practices still has not met lots of performance criteria that has been developed by Green Port Award System as the international standard.

4.2.5. Traffic Light System

The traffic light system is designed to give depiction on the KPI that need to be paid attention first. The traffic light system will give colors to different state of KPI score. The red will give warning for the KPI that lack in performance, yellow for the KPI that need to be monitored and give attention more, and green that has already close to fulfilling its KPI target. Below is the result of the Traffic Light System that are established from the data that has been gathered.

Table 4. 28 Traffic Light System

Code	KPI	KPI Score
A1A1	Updates on green practices on monthly meeting	1
A1A2	Upgrade on Green Policies annually	1
A1B1	The realization of the funding on green practices	0.73
A1C1	Percentage of annual report made	1
A2A	The number of green training held in a year	0
A2B	The number of campaign event and tools in a year	0.5
B1A1	The use of renewable resource in operation field	1
B1B1	The use of CNG in the system	1
B1C1	The Percentage of ships that use cold iron	0
B2A1	The use of energy saving device	1
B2B1	Power supply diversification	1
B3A1	Percentage of clean energy truck / total truck	0.833333333
B3A2	Percentage of Conformity to standard	1
B3B1	Percentage of Conformity to standard	0.55
B3C1	The establishment of Waste Treatment Facility	0
B3D1	The establishment of biodiversity protection system	0
B4A1	Certification on ISO 140001	1

Table 4. 29 Traffic Light System

Code	KPI	KPI Score
B4B1	The establishment of green performance assessment	0
C1A1	Monthly energy consumption report	1
C1A2	Annual energy efficiency improvement	0
C1B1	Percentage of increase of renewable energy use from last year	0
C2A1	The percentage of reduction in air pollution level	0.6
C2B1	The percentage of reduction in noise pollution level	0.044981061
C2C1	The percentage of reduction in liquid & solid pollution level	0

Table 4. 30 Traffic Light System Information

Code	Information
	Performance indicator show that gap between target and performance is still wide, so it will need corrective action and improvement
	Performance indicator show that the target is close to be achieved, so it need to be supervised intensively
	Performance indicator show that the target is achieved and or show good result, so there is no need for improvement but still need to be supervised

Based on the Table 4.27, there are 12 KPIs with green category, 9 KPIs with red category, and 3 KPIs with yellow category. The meaning of these colors as category can be found in the Table 4.28. Each of the colors represent the condition of fulfillment of the KPIs.

There is only one KPIs with red code, and one for the yellow code that belongs to the Commitment and Willingness primary indicators. There are 4 KPIs in the Action and Implementation group that fall in the red category, and one KPI that falls in the yellow category. The Efficiency and Effectiveness has 4 KPIs that fall for the red category and one KPI in the yellow category.

4.2.6. Gap Analysis

Gap Analysis is the process of identifying the gap between the organizational performance and its current business strategy. The gap analysis will be done for the green practice in the company. The business strategy that will be analyzed is the business strategies of the company that are being assessed in the Green Port Awarding System. The company's general expectation of the business strategies is to achieve the international recognition of Green Port Awarding System.

The organizational performance that will be analyzed are the green practices performances that has been measured in the previous chapter. The selected green practices performances are the performance that have been categorized medium and low performance according to the traffic light system. These performances are considered important to be analyzed because it need improvement strategies to fulfill the expectations or in this case, the target of the company.

Below are the green practices performances that will be analyzed in the Gap Analysis:

Table 4. 31 Selected Key Performance Indicators for Gap Analysis

No	Code	Key Performance Indicators	KPI Score	Traffic Light Code
1	A2A	The number of green training held in a year	0	
2	B1C1	The Percentage of ships that use cold iron	0	
3	B3C1	The establishment of Waste Treatment Facility	0	
4	B3D1	The establishment of biodiversity protection system	0	
5	B4B1	The establishment of green performance assessment	0	
6	C1A2	Annual energy efficiency improvement	0	
7	C1B1	Percentage of increase of renewable energy use from last year	0	
8	C2B1	The percentage of reduction in noise pollution level	0.044981	
9	C2C1	The percentage of reduction in liquid & solid pollution level	0	
10	A2B	The number of campaign event and tools in a year	0.5	
11	B3B1	Percentage of Noise Pollution conformity to standard	0.55	
12	C2A1	The percentage of reduction in air pollution level	0.6	

There are 12 key performance indicators that are analyzed. These performance indicators will be processed in the next step. The Gap analysis will be done by interviewing the management of the company. The next step of the Gap Analysis is the determining the expected condition of the business. After the expected condition have been determined. The existing condition can be determined by interpreting the current condition of each key performance indicator. The next step is to determine the gap between the expected condition and the current condition of the business. Below is the result of the gap analysis:

Table 4. 32 Gap Analysis Result

No	Code	Desired Condition	Existing Condition	Gap Analysis
1	A2A	The green training program as comprehensive training program and give impact in green awareness and implementation to company's workers	The current training program in the Human Capital Development department has not accommodate the green training program	There is absence of comprehensive green training system to accommodate the needs of the company human capital competence
2	B1C1	The cold iron system that has been invested on can be implemented to promote the use of clean energy, prevent air pollution and give benefit in cost reduction to the customer	Cold Iron facility is under installation in the system. The customers are still not aware of the cold iron facility benefit	The facility is still not ready to be used, and the customers are not informed about the benefit of using the cold iron facility
3	B3C1	The Waste Treatment facility can be used in managing liquid and solid waste to reduce the pollution rate and improve monitoring system	Waste Treatment Facility is written on Masterplan, but there is no action that is taken on the development of the waste treatment facility.	The facility planning process of waste treatment is still ongoing and no research has been done on the development of waste treatment installation
4	B3D1	Biodiversity as important environment aspect, and the company ensure the protection of such biodiversity	The biodiversity protection has not been paid attention at, and there is no formal program that improve and design biodiversity protection.	Research has not been done on the biodiversity protection system, and current certification doesn't give important updates on ISO 140001
5	B4B1	The green performance measurement is used as the continuous green performance monitor and control by the whole organization	The green performance assessment has not been established by the company, and green performance measurement responsibility is focused on QHSEE Department	The lack of comprehensive research on international standard on green performances and its monitoring steps

Table 4. 33 Gap Analysis Result (cont'd)

No	Code	Desired Condition	Existing Condition	Gap Analysis
6	C1A2	Continuous improvement in energy efficiency of the process by improving the process in container handling	The container handling energy efficiency has reduction of quality rather than improvement	The process improvement in the operational field is not effective to increase the energy efficiency
7	C1B1	The increase of renewable energy use in the system as commitment to establish clean energy	The current implementation of renewable source is through the use of CNG only, and there is no increase from last year	There are little increase due to limitation use of renewable resource in gas truck
8	C2B1	Continuous improvement in the noise pollution reduction to protect the environment	There is little to none improvement in noise pollution reduction, with no general known cause of bad performances	The lack of comprehensive assessment of pollution cause has caused the improvement program to a bad performance
9	C2C1	Continuous improvement in the liquid and solid pollution reduction to protect the environment	There is no specific measurement and control for liquid pollution, and there is no waste treatment facility for solid and liquid waste	There is absence of waste treatment facility for liquid and solid pollution, and no proper measures and control
10	A2B	Green campaign program as the effective way to increase awareness to all the stakeholder of the company	Green campaign program held on certain event only, without clear plan on the issues relevant to be campaigned	The lack of planning process and intensity of the implementation has caused green campaign not to perform accordingly
11	B3B1	Continuous improvement in the noise pollution reduction to protect the environment	There is little to none improvement in noise pollution reduction, with no general known cause of bad performances	The lack of comprehensive assessment of pollution cause has caused the improvement program to a bad performance
12	C2A1	Continuous improvement in the air pollution reduction to protect the environment	The air pollution reduction has hit 9% out of its reduction target of 15%. The air pollution is controlled through clean emission truck policy.	The truck emission policy can be enforced and there are still several air pollution policy that can be implemented such as the cold iron usage and emission control from ships

Table 4.32- 4.33 shows the result of the gap analysis done. All of the gap analysis has been validated with the management of PT Terminal Teluk Lamong. Each of these gap is the lack of performance that is needed to be solved. The gap of each performance varies for each of the key performance indicators. The gap analysis will be used as the basis for strategy development.

4.2.7. Strategy Development

Strategies need to be developed based on the result of the performance measurement that has been done. The strategies have been made based on the result of the gap analysis for each of the key performance indicators that are categorized in the red and yellow code. The strategies are made to close the gap between the desired condition and the existing condition. There is also information about the department that will be responsible in executing the strategies. The department in charge is determine to give instructions and responsibility to the respective department. This is done because the green practice development will involve several departments in PT Terminal Teluk Lamong. Below are the strategies generated based on the green practice performances:

1. Strategies that are made for key performance indicators that are categorized as red. These key performance indicators have the KPI score below 4 in the traffic light system. The strategy may act as corrective measures to close the gap between the desired condition and the existing condition of the performance. The strategy is also accompanied by the department responsible and also the timeframe to finish the strategy.

Table 4. 34 The Strategy Development Result

No	Attribute to KPI	Desired Condition	Existing Condition	Gap Analysis	Strategy	Department in Charge	Timeframe					
							Quarter of 2018		Quarter of 2019			
							3rd	4th	1st	2nd	3rd	4th
1	A2A	The green training program as comprehensive training program and give impact in green awareness and implementation to company's workers	The current training program in the Human Capital Development department has not accommodate the green training program	There is absence of comprehensive green training system to accommodate the needs of the company human capital competence	Develop comprehensive green training program according the needs of company's worker competence in green practice and integrate it with the Human Capital Development program	Human Capital Department						
2	B1C1	The cold iron system that has been invested on can be implemented to promote the use of clean energy, prevent air pollution and give benefit in cost reduction to the customer	Cold Iron facility is under installation in the system. The customers are still not aware of the cold iron facility benefit	The facility is still not ready to be used, and the customers are not informed about the benefit of using the cold iron facility	Cold iron facility implementation and promotion to customer about the benefit of using the facility	Operational Department						
						Commercial and Business Development Department						
3	B3C1	The Waste Treatment facility can be used in managing liquid and solid waste to reduce the pollution rate and improve monitoring system	Waste Treatment Facility is written on Masterplan, but there is no action that is taken on the development of the waste treatment facility.	The facility planning process of waste treatment is still ongoing and no research has been done on the development of waste treatment installation	Develop feasibility study for Waste Treatment Facility	QHSSE Department						
4	B3D1	Biodiversity as important environment aspect, and the company ensure the protection of such biodiversity	The biodiversity protection has not been paid attention at, and there is no formal program that improve and design biodiversity protection.	Research has not been done on the biodiversity protection system, and current certification doesn't give important updates on ISO 14.0001	Research and develop standard of biodiversity protection to be implemented in near future, with Eco Management Audit Scheme (EMAS) in Europe as one of the reference standard	QHSSE Department						

Table 4. 35 The Strategy Development Result (con't)

No	Attribute to KPI	Desired Condition	Existing Condition	Gap Analysis	Strategy	Department in Charge	Timeframe					
							Quarter of 2018		Quarter of 2019			
							3rd	4th	1st	2nd	3rd	4th
5	B4B1	The green performance measurement is used as the continuous green performance monitor and control by the whole organization	The green performance assessment has not been established by the company, and green performance measurement responsibility is focused on QHSEE Department	The lack of comprehensive research on international standard on green performances and its monitoring steps	Research on the international standard green performance indicators and develop green performance assessment according to the regional condition with clear responsibilities to each department	QHSSE Department						
6	C1A2	Continuous improvement in energy efficiency of the process by improving the process in container handling	The container handling energy efficiency has reduction of quality rather than improvement	The process improvement in the operational field is not effective to increase the energy efficiency	Improvement on operational field by encouraging innovation on the system	Operational Department						
7	C1B1	The increase of renewable energy use in the system as commitment to establish clean energy	The current implementation of renewable source is through the use of CNG only, and there is no increase from last year	There are little increase due to limitation use of renewable resource in gas truck	The implementation of PLTMG can be introduced to the system, and also reinforce the use of gas truck compared to diesel based truck	QHSSE Department, Operational Department						
8	C2B1	Continuous improvement in the noise pollution reduction to protect the environment	There is little to none improvement in noise pollution reduction, with no general known cause of bad performances	The lack of comprehensive assessment of pollution cause has caused the improvement program to a bad performance	Comprehensive research on the causes of noise pollution in order to give proper corrective action to the problem	QHSSE Department						
9	C2C1	Continuous improvement in the liquid and solid pollution reduction to protect the environment	There is no specific measurement and control for liquid pollution, and there is no waste treatment facility for solid and liquid waste	There is absence of waste treatment facility for liquid and solid pollution, and no proper measures and control	The establishment of Waste treatment facility to manage and control liquid pollution	QHSSE Department, Engineering Department						
10	C2C1	Continuous improvement in the liquid and solid pollution reduction to protect the environment	There is no specific measurement and control for liquid pollution, and there is no waste treatment facility for solid and liquid waste	There is absence of waste treatment facility for liquid and solid pollution, and no proper measures and control	Research and develop standard of liquid pollution measurement	QHSSE Department						

2. The strategies that are made for the that falls on the yellow category. These strategies are made to close the gap between the desired condition and the existing condition. The strategies and made for improving the performances, with the responsibility of the department in charge.

Table 4. 36 Strategy Development Result for Yellow Category

No	Attribute to KPI	Desired Condition	Existing Condition	Gap Analysis	Strategy	Department in Charge	Timeframe					
							Quarter of 2018		Quarter of 2019			
							3rd	4th	1st	2nd	3rd	4th
1	A2B	Green campaign program as the effective way to increase awareness to all the stakeholder of the company	Green campaign program held on certain event only, without clear plan on the issues relevant to be campaigned	The lack of planning process and intensity of the implementation has caused green campaign not to perform accordingly	Design structured green campaign program annually	QHSSE Department						
2	B3B1	Continuous improvement in the noise pollution reduction to protect the environment	There is little to none improvement in noise pollution reduction, with no general known cause of bad performances	The lack of comprehensive assessment of pollution cause has caused the improvement program to a bad performance	Research on the causes of noise pollution	QHSSE Department						
3	C2A1	Continuous improvement in the air pollution reduction to protect the environment	The air pollution reduction has hit 60% of its reduction target of 15% reduction. The air pollution is controlled through clean emission truck policy	The truck emission policy can be enforced and there are still several air pollution policy that can be implemented such as the cold iron usage and emission control from ships	The enforcement of truck registration and cold iron implementation	QHSSE Department						

4.2.8. Cost Effectiveness Analysis

The cost Effectiveness Analysis is done to compare the effectiveness of each strategies to fulfill its objective of overall performance, to costs that is attributed to each of it. To do the cost effectiveness analysis, the cost that is attributed to each of the strategies

will be presented. Due to the fact that some strategies have common action and cost, the strategies are being categorized into strategy packages. These strategies can be fulfilled by the same expenses.

The cost effectiveness is calculated by determining the benefit for each of the strategy. The benefit is calculated from the performance gap between the full global weight of each KPI, to the current KPI weighted score. The performance gap is determined as the benefit that can be fulfilled by implementing the strategy. The cost effectiveness is defined as the cost needed for each strategy to increase the overall green performance by 0,1%. Below is the example of the calculation

$$Cost\ Effectiveness\ = \frac{Total\ cost\ of\ implementing\ program}{Total\ impact\ of\ program\ on\ specific\ outcome}$$

Example of calculation for the 1st strategy

$$Cost\ Effectiveness = \frac{200.000.000}{53.3}$$

$$Cost\ Effectiveness = 3.751.043$$

Below is the table of the calculation

Table 4.37 The Cost Effectiveness for Each Strategy

Strategy Package	Attribute to KPI	Strategy	Department in Charge	Timeframe						Cost	Performance Gap	Cost Effectiveness (Cost /0,1% increase in performance)
				Quarter of 2018		Quarter of 2019						
				3rd	4th	1st	2nd	3rd	4th			
1	A2A	Develop comprehensive green training program according the needs of company's worker competence in green practice and integrate it with the Human Capital Development program	Human Capital Department							Rp200,000,000	5.33%	Rp3,751,043
2	B1C1	Cold iron facility implementation and promotion to customer about the benefit of using the facility	Operational Department							Rp4,000,000,000	2.42%	Rp165,151,130
			Marketing Department									
	C2A1	The enforcement of truck registration and cold iron implementation	QHSSE Department									

Table 4.38 The Cost Effectiveness for Each Strategy (cont'd)

Strategy Package	Attribute to KPI	Strategy	Department in Charge	Timeframe						Cost	Performance Gap	Cost Effectiveness (Cost /0,1% increase in performance)
				Quarter of 2018		Quarter of 2019						
				3rd	4th	1st	2nd	3rd	4th			
3	B3C1	Develop feasibility study for Waste Treatment Facility	QHSSE Department							Rp5,000,000,000	8.28%	Rp60,368,720
	C2C1	The establishment of Waste treatment facility to manage and control liquid pollution	QHSSE Department, Engineering Department									
4	B3D1	Research and develop standard of biodiversity protection to be implemented in near future, with Eco Management Audit Scheme (EMAS) in Europe as one of the reference standard	QHSSE Department							Rp200,000,000	1.64%	Rp12,185,351
5	B4B1	Research on the international standard green performance indicators and develop green performance assessment according to the regional condition with clear responsibilities to each department	QHSSE Department							Rp16,000,000	9.01%	Rp177,528
6	C1A2	Improvement on operational field by encouraging innovation on the system	Operational Department							Rp2,000,000,000	1.71%	Rp116,997,721

Table 4.39 The Cost Effectiveness for Each Strategy (cont'd)

Strategy Package	Attribute to KPI	Strategy	Department in Charge	Timeframe						Cost	Performance Gap	Cost Effectiveness (Cost /0,1% increase in performance)
				Quarter of 2018		Quarter of 2019						
				3rd	4th	1st	2nd	3rd	4th			
7	C1B1	The implementation of PLTMG can be introduced to the system, and also reinforce the use of gas truck compared to diesel based truck	QHSSE Department, Operational Department							Rp2,000,000,000	1.47%	Rp136,497,342
8	C2B1	Comprehensive research on the causes of noise pollution in order to give proper corrective action to the problem	QHSSE Department							Rp50,000,000	4.88%	Rp1,023,972
	B3B1	Research on the causes of noise pollution	QHSSE Department									
9	C2C1	Research and develop standard of liquid pollution measurement	QHSSE Department							Rp160,000,000	3.91%	Rp4,096,687
10	A2B	Design structured green campaign program annually	QHSSE Department							Rp20,000,000	2.67%	Rp750,209

The result of the calculation, is then being ranked according to its cost effectiveness. Below is the result of the ranked strategies based on the calculation

Table 4.40 The Ranked Strategy

Strategy Rank	Strategy Package	Attribute to KPI	Strategy	Department in Charge	Cost	Performance Gap	Cost Effectiveness (Cost /0,1% increase in performance)
1st	5	B4B1	Research on the international standard green performance indicators and develop green performance assessment according to the regional condition with clear responsibilities to each department	QHSSE Department	Rp16,000,000	9.01%	Rp177,528
2nd	10	A2B	Design structured green campaign program annually	QHSSE Department	Rp20,000,000	2.67%	Rp750,209
3rd	8	C2B1	Comprehensive research on the causes of noise pollution in order to give proper corrective action to the problem	QHSSE Department	Rp50,000,000	4.88%	Rp1,023,972
		B3B1	Research on the causes of noise pollution	QHSSE Department			
4th	1	A2A	Develop comprehensive green training program according the needs of company's worker competence in green practice and integrate it with the Human Capital Development program	Human Capital Department	Rp200,000,000	5.33%	Rp3,751,043

Table 4.41 The Ranked Strategy (cont'd)

Strategy Rank	Strategy Package	Attribute to KPI	Strategy	Department in Charge	Cost	Performance Gap	Cost Effectiveness (Cost /0,1% increase in performance)
5th	9	C2C1	Research and develop standard of liquid pollution measurement	QHSSE Department	Rp160,000,000	3.91%	Rp4,096,687
6th	4	B3D1	Research and develop standard of biodiversity protection to be implemented in near future, with Eco Management Audit Scheme (EMAS) in Europe as one of the reference standard	QHSSE Department	Rp200,000,000	1.64%	Rp12,185,351
7th	3	B3C1	Develop feasibility study for Waste Treatment Facility	QHSSE Department	Rp5,000,000,000	8.28%	Rp60,368,720
		C2C1	The establishment of Waste treatment facility to manage and control liquid pollution	QHSSE Department , Engineering Department			

Table 4.42 The Ranked Strategy (cont'd)

Strategy Rank	Strategy Package	Attribute to KPI	Strategy	Department in Charge	Cost	Performance Gap	Cost Effectiveness (Cost /0,1% increase in performance)
8th	2	B1C1	Cold iron facility implementation and promotion to customer about the benefit of using the facility	Operational Department Marketing Department	Rp2,000,000,000	2.42%	Rp82,575,565
		C2A1	The enforcement of truck registration and cold iron implementation	QHSSE Department			
9th	6	C1A2	Improvement on operational field by encouraging innovation on the system	Operational Department	Rp2,000,000,000	1.71%	Rp116,997,721
10th	7	C1B1	The implementation of PLTMG can be introduced to the system, and also reinforce the use of gas truck compared to diesel based truck	QHSSE Department , Operational Department	Rp2,000,000,000	1.47%	Rp136,497,342

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CHAPTER 5
ANALYSIS AND INTERPRETATION

5.1. Key Performance Indicator Analysis

In this subchapter, the Key Performance Indicator design and result will be analyzed. The performance measurement design will include the key performance indicator for the primary indicators of Commitment and Willingness, Action and Implementation, and Efficiency and Effectiveness

5.1.1. Key Performance Indicator for Commitment and Willingness

Commitment and Willingness is the primary indicator in the Green Port Award System (GPAS). There are two secondary indicators which are the Green Port Awareness and Willingness and Green Port Promotion. Green Port Awareness and Willingness has 3 Third Indicators which are the green strategy or development plan, green support funding and the green annual report.

The green strategy and development plan has two key performance indicators which are updates on green practices on monthly meeting and upgrade on green policies annually. The updates on green practices on monthly meeting is chosen because it resembles the awareness build in the company by controlling the performance of green practices in monthly meeting. The updates on green practices in monthly meeting is done to increase the internal awareness on the green practices while the upgrade on green policies annually is to resemble the concern of the company for future development on green practices, and its implementation in the green policies.

The green support funding has the performance indicator of the realization of funding on green practices. The realization of funding can show how committed is the company to the implementation of its own green practices. The green practices implementation needs lots of investment, and therefore need to be supported through proper funding.

The green annual report has the key performance indicator of percentage of green annual report made. The percentage of green annual report made per total

operating years can show the commitment of the company to report its green practices performance annually for all the operating years.

The Green Promotion indicators has two Third Indicators which are the green training program and the green promotion campaign. The green training program has the key performance indicator of the number of green training held in a year. The green training program success can be measured at how intensive the training is held by the company. The green promotion campaign is measured by the number of campaign event and tools in a year. The green promotion campaign is measured by how much planned campaign event is done by the company to promote the green practices.

5.1.2. Key Performance Indicator for Action and Implementation

The Action and Implementation primary indicators has four secondary indicators which are clean energy, energy saving, environmental protection, and green management. The clean energy has three third level indicators which are using renewable resource, using of Compressed Natural Gas (CNG), Using of Cold Ironing. The use of renewable resource has the KPI of the use of renewable resource in the operational field. it is already an achievement for company that has already installed the use of renewable resource for the operational system. The use of CNG in the system is the second KPI. The implementation of CNG use is also considered as achievement in the use of renewable resource. The third KPI is the percentage of ships that use cold iron, which is chosen because although the system of Cold Iron has already been installed, the measurement of success can only be depicted by counting how many of the ships that actually use the cold iron facility compared to the total customers.

The energy saving has two secondary indicators which are using energy-saving device and technologies, and optimizing power supply system. The first KPI is the use of energy saving device. It is considered important to installed energy saving devices in the Green Port system. The second KPI is the power supply diversification. The power supply diversification is chosen because it is important to have more than one power supply system that use different power source.

The environmental protection has four third level indicators which are the air pollution prevention, noise control, waste treatment, biodiversity protection. The air pollution prevention has two KPI which are the percentage of clean energy truck/total truck and the percentage of air pollution conformity to standard. The percentage of clean truck compared to total truck in a month is important to show the implementation on the green policy that the company has on the air pollution prevention, which is to switch the customer's truck that has not been registered to the clean energy truck. The percentage of air pollution conformity to standard is important because the company has the responsibility to keep the air pollution level on the standard given by the government. The noise control is measured by the percentage of noise pollution conformity to the standard. It is important for the company to also measure how the pollution management has conformed to the standard.

The waste treatment is measured by the establishment of waste treatment facility. The liquid and solid waste in port need to be attended properly, and the terminal should have its own waste treatment facility. this is important because without waste treatment facility, the liquid pollution cannot be controlled properly.

Biodiversity near terminal needs to be protected. The right measurement is the establishment of biodiversity protection system. The right protection system and control has to be established based on research of environment biodiversity characteristic and need.

The Green Management has two indicators which are the green environment management system and the green performance assessment. The green environment management system can be measured on how the green management has conform to the ISO 140001 and 50001. These two certification can be proof of the green environment and green energy management system in the port. The green performance assessment is measured by the establishment of green performance assessment system. it is important to be established because the performance assessment will be the system that evaluate and control the continuity of green performance.

5.1.3. Key Performance Indicator for Efficiency and Effectiveness

The efficiency and effectiveness has two secondary indicators which are the energy saving efficiency and environmental protection effectiveness. The energy saving efficiency has two third-level indicators which are the energy consumption reduction and the renewable energy increment. The energy consumption reduction has two key performance indicators which are the monthly energy consumption report and the annual energy efficiency improvement. The monthly energy consumption report is important because the energy consumption report can act as control and evaluation system to see how the energy saving program can actually reduce the consumption of energy. The annual energy efficiency improvement is important to see how energy efficient is the operational work.

The renewable energy increment is measured by the percentage of increase of renewable energy use from last year. The increase of renewable energy usage is both hard and important. It is hard because there is trade off that has to be made in term of renewable energy use that compromise the wants of the customers. firm green policy and implementation is needed to stay on track in the increase of renewable energy use over the years.

5.2. KPI Properties Design Analysis

The KPI properties is the information embedded to the key performance indicators that are structured to help stakeholders in understanding the key performance indicators. The KPI properties are structured with the primary, secondary and third-level indicators column, the unit column, target column, formula column, characteristic column.

The code column is given to structure each of the KPIs to its respective indicators. The unit column is set to give information on the unit of count for every KPI. The characteristic column is set to give information about the achievement level of each KPI, whether higher is better, lower is better, or zero-one characteristic. The target of the KPI is set based on the expectation and achievement target of the company. The reasoning of the target is already provided

in the previous chapter. The formulation column is set to give information about the mechanism of quantification for each KPI

5.3. KPI Weight Analysis

The weight of the KPI is set based on the interview with the manager of the company. The result is then processed in the Analytical Network Process that are made. it can be seen form the result that the commitment and willingness has the weight of 0.39, compared to the Action and Implementation that also has 0.39 and Efficiency and Effectiveness that has 0.22. The result shows that commitment and willingness has the same importance with the action and implementation., while efficiency and effectiveness has the least importance of weight.

In the commitment and willingness primary indicators, the green port awareness and willingness is the most important part with the 0.73 compared to the green port promotion with 0.27. The action and implementation primary indicators, green management has the highest importance with 0.58. In the Efficiency and Effectiveness, the Environmental Protection Effectiveness has 0.78 weight.

For the global weight of each KPI, the highest priority is the B4A1, certification on ISO 140001 with 0.135 weight. The second on the rank is the realization of the funding on green practices with 0.114 weight. These will prove to be important in understanding each KPI contribution to the overall performance.

5.4. Scoring System Design Analysis

The scoring system is made based on the KPI measurement design, the weighting process of the ANP, and the data of each KPI realization. The realization of each KPI will then combined with the weight of each KPI and then result with the performance level of each primary indicators, secondary and third indicators. The overall performance level can also be computed using the value of all primary indicators.

The total performance of commitment and willingness 0.28, while the action and implementation in 0.22, and 0.04 for the efficiency and effectiveness. The overall performance is 0.55. This shows that the company still lack

performance in its green practices according to the GPAS standard. There are still lots of opportunity for the company to improve the performance.

5.5. Traffic Light System Analysis

The traffic light system is made based on the overall KPI score of each KPI. The KPI are then categorized based on the score into three categories. The code red, yellow and green is embedded to the KPI. The red code is for the KPI with performance level below 0.4, yellow for the performance between 0.4-0.7, and green for the KPI with score above 0.7

There are 9 KPIs that are coded red, 3 KPIs with code yellow and 12 KPIs with green code. The corrective action will be done on the KPI with code red, while improvement strategies will be made for the KPIs that are coded yellow. The KPIs that are coded green are considered in good performance.

5.6. Gap Analysis

The Gap analysis will be done for each of the KPI that has been identified in from the scoring system. The gap analysis is the result form the desired condition and existing condition.

The desired condition in A2A KPI is that the green training program is targeted to be the comprehensive green training that is established and integrated with the Human Capital Development training program. There is an absence in this condition, whereas there is no green training that has been structured in the Human Capital Development program.

The desired condition in the B1C1 KPI is that the cold iron system is targeted to promote the use of clean energy to the customer, to prevent air pollution from the berthing ship, and to give the customer benefit in the cost reduction for energy spending along the berthing time. The gap is that the facility has been established but it is currently not operational because there is still lack of infrastructure needed to operate it. The customers in TTL also has not been informed about the advantage of using cold iron facility in the port. This condition will further escalate the problem, because not only the facility that needs to be prepared, but also the customers.

The desired condition of KPI B3C1 is the establishment of Waste Treatment facility as the part of the integrated waste management. The waste treatment facility is part of the requirement in the GPAS award, that is still not fulfilled by Terminal Teluk Lamong. TTL only treat the solid pollution by using the service of third party provider, treat the water pollution on the building, while neglecting the impact of the water pollution on the ocean.

The desired condition of KPI B3D1 is that biodiversity protection has to be structured in the system. The biodiversity protection system has not been structured, and the protection that has been done are based on the first strategy on the building phase. The assessment of the biodiversity protection has not been established.

The desired condition of KPI B4B1 is the establishment of the green performance measurement system. The performance measurement system will be used to continuously control the green performance and improve it further. The green performance system has not been developed, and so there is no system that can control and improve the green practice performance.

The desired condition of C1A2 is the continuous improvement in energy efficiency of the process, in this case in the container handling sector. The current container energy efficiency, cannot be improve into a significant level. The improvement in operational level has not given significant impact in the increase of energy efficiency.

The desired condition of C1B1 is the annual increase in renewable energy use in the system. The increase of renewal energy use, will create cleaner environment. The condition in Terminal Teluk Lamong is that the CNG usage is still not stable. The CNG usage still declines from last year, due to the unstable exchange rate in the gate. The PLTMG that has been installed, currently has little support to the power supply.

The desired condition of C2B1, is the reduction of noise pollution over the years. The current condition is the Terminal Teluk Lamong cannot distinguish the noise pollution cause because the noise level assessment is done outside the region of Terminal Teluk Lamong. Therefore, no improvement program can be carried out to reduce the pollution.

The C2C1 KPI desired condition is the reduction of liquid and solid pollution to protect the environment. The current condition is the liquid pollution management does not include the ocean pollution management, while the solid pollution management responsibility is being transferred to third party provider. There is no

The A2B desired condition is to make effective green campaign to promote green internally for the company. The green promotion campaign is already held but not sufficient as the target of the company. The green promotion is still not effectively planned based on the annual green theme or structured program on what knowledge that needs to be promoted.

The B3B1 desired condition is to manage the noise pollution in according to the standard given by Indonesian government. The condition is that there are still areas that do not conform to the standard over the years. There needs to be improvement program to solve the problem.

The C2A1 is the reduction of air pollution to protect the environment. The current condition is that there is already reduction in the system, but not sufficient enough. The reduction of the pollution needs to be further developed through programs.

5.7. Strategy Development Analysis

The strategy will be developed based on the result of the current performance level of the company in the green practices. Corrective actions will be made based on the KPI that has poor performance and are coded red, improvement action are made for the KPI that has medium performance and are coded yellow.

The A2A KPI has the problem, whereas the absence of comprehensive green training program system, that has not been included in the current human capital competence development. to close the gap, the strategy that will be implemented is to build the comprehensive training program to be integrated in the Human Capital Development program, to be carried out 2 times in a year as the target that has been determined by the company. The timeframe for the development of green training program is on the 3rd quarter of 2018. This

timeframe is the ideal time to allocate resources from the Human Capital Department to finish the strategy.

The B1C1 KPI has the problem can be improved by implementing the shore power facility and promote it to the customer. The promotion to the customer will help customer to understand the benefit of using the shore power facility. The action can also help the improvement for the C2B1 KPI. The percentage of ship that use shore power will help decrease the noise pollution. The ship noise is one of the identified noise pollution.

The B3C1 KPI can be improved by implementing the action of developing the feasibility study for waste treatment facility. the waste treatment facility will play key role in managing the liquid and solid pollution. Unfortunately, the current condition is that the waste treatment still has not been planned.

B3D1 KPI can be improved by research and develop standard of biodiversity protection, and establish the biodiversity protection system. The B4B1 KPI can be improved by research on the international standard green performance indicators and develop the green performance assessment. C1A2 The improvement on operational field using the PDCA. The C1B1 can be improved by establishing upgrade on green policies.

The B4B1 KPI has the problem in the lack of comprehensive research on international standard and regional conformity on developing the green performance measurement assessment. The strategy is to do the research on the international standard, and also develop regional need of green practices. This research aims to give foundation to the green performance assessment.

The C1A2 KPI has the problem in the process improvement in the operational field, that does not have significant impact in the efficiency improvement. The strategy is to make improvement program internally by encouraging the departments involved to give innovations.

The C1B1 KPI has the problem of little increase in renewable resource usage due to the limitation use of gas truck and PLTMG allowance to operate. The strategy is to implement and increase usage of PLTMG and reinforce the use of gas truck exchange compared to diesel based truck.

The C2B1 KPI has the problem in the lack of comprehensive assessment of pollution cause, that made it hard to identify the cause of pollution. The strategy is to do comprehensive research on the cause of noise pollution and give do the assessment of pollution not only outside TTL but also inside. \

The C2C1 KPI has the problem in liquid and solid waste management, whereas there is no integrated form of liquid and solid waste management. The strategy is to establish the Waste Treatment facility, and the system to measure the performance of liquid and solid pollution management. The program is expected to be done on the 4th quarter of 2019.

The A2B KPI has the problem in the lack of planning process and the intensity of implementation in green campaign. The strategy is to designed structured green campaign program in annual time, according to the knowledge that needs to be campaigned to the whole company. The green campaign will cover the needs of the company.

The B3B1 KPI has the problem in the lack of comprehensive assessment of pollution cause in the noise pollution. The strategy is to held research on the cause of the pollution and do the improvement implementation. The program is expected to be done in the 3rd quarter of 2018.

The C2A1 KPI has the problem in the lack of enforcement in truck exchanges and air pollution control. The strategy is to reinforce the policy on truck exchange in the gate and also implement the cold iron system. The program is expected to be done in the 1st quarter of 2019.

CHAPTER 6
CONCLUSION AND SUGGESTION

6.1. Conclusion

Below are the conclusions made based on the data processing, and analysis that has been done:

1. Design green performance measurement system according to international standard reference. Green performance measurement system is made based on the GPAS indicators that has been established. Key performance indicators are made based on the interview with the company. The results are then processed using the Analytical Network Process to set the weight of each performance. KPI properties are designed based on the future development plan by the company. Scoring system is made based on the realization the KPIs, and traffic light system is used to control the performance of the KPIs.
2. Design Key Performance Indicators for green performance measurement. Key performance indicators are made based on the interview that has been done. The KPI properties are also established based on the information embedded to the KPI to help the company stakeholder understand the structures.
3. Evaluate current green performance. Evaluation has been done based on the scoring system using the established green practice performance measurement.
4. The strategies are made to close the gap between the desired condition and the existing condition. The strategies serve as corrective actions to the KPIs that has low performance, and as improvement strategies for the middle level performance.

Based on the result of the research, the green practice performance measurement that has been made, has given advantage to the company in evaluating and determining the current condition of the green practice performances. The

result of the current condition has given the company understanding on the low performance, middle performance, and high performance green practices.

The gap analysis is also done to determine the desired condition of the strategies, the current condition from the performance measurement result, and the gap between these two conditions. The result of the gap analysis has helped the company to understand to what extend the company has to improve the condition to achieve the desired result.

The strategy development that has been done, has given advantage for the company in determining the right corrective actions for the key performance indicators in the red category and the improvement action for the key performance indicators in the yellow category. The strategies developed has also determine the departments that are responsible to each respective strategy, and each of its respective timeframe set to be ideal to finish the strategy. This information is aimed to help the company to plan and execute the strategy in the best possible way.

6.2. Suggestion

Below are the suggestions made based on the research that has been done

1. Annual green practice performance measurement based on GPAS has to be done to check the performance and strategize improvement to support the goal to achieve the award in 2020.
2. Further research need to be done in establishing green performance measurement based on international standard and best practice, not only to conform to specific awarding system.
3. The green performance measurement and control has to be made as one of the responsibilities to one of the function of organization structure, to ensure continuity in green practice measurement and control.

ATTACHMENT

Attachment 1:

Kuesioner Pembobotan KPI dengan Metode Analytical Network Process

Nama Responden :

……

Jabatan :

……

Perkenalkan, nama saya Dionisius Andre Kusuma Dewa, mahasiswa semester 8 Departemen Teknik Industri, Institut Teknologi Sepuluh Nopember yang sedang melakukan penelitian Tugas Akhir dengan judul "Strategy Development towards International Recognition on Green Port Practices in PT Terminal Teluk Lamong".

Penelitian ini bertujuan untuk menyusun system pengukuran performansi *green practices* di PT Terminal Teluk Lamong, sesuai dengan indicator yang di tetapkan organisasi Asia Pacific Economic Community (APEC) yakni Green Port Award System (GPAS). Hasil dari pengukuran performansi tersebut akan digunakan untuk menetapkan strategi PT Terminal Teluk Lamong untuk mendapatkan penghargaan internasional dari APEC.

Kuesioner ini bertujuan untuk dapat menentukan bobot tiap indikator yag terdapat pada Green Port Award System dengan menggunakan metode Analytical Network Process (ANP). Pembobotan dilakukan dengan membandingkan tingkat kepentingan dari tiap indicator di tingkat kedua, kepada indicator utama. Terdapat empat perbandingan perbandingan berpasangan pada tingkat elemen dan dua perbandingan berpasangan pada tingkat klaster yang harus dilaksanakan.

Kerahasiaan identitas dari Bapak/Ibu sekalian akan dirahasiakan. Sebelum melakukan pengisian kuesioner, Bapak/Ibu harap membaca petunjuk pengisian kuesioner terlebih dahulu. Atas perhatiannya saya ucapkan terima kasih.

Petunjuk Pengisian Kuesioner

Beri tanda silang (X) pada nilai perbandingan yang sesuai berdasarkan keterangan tiap nilai yang tertera dibawah ini. Terdapat istilah klaster dan elemen yang digunakan dalam perhitungan nilai perbandingan. Klaster merupakan

indikator utama dalam GPAS, sedangkan elemen merupakan indikator tingkat kedua. Berikut merupakan keterangan dari nilai perbandingan berpasangan ANP.

Nilai	Definisi	Keterangan
1	Sama (Equal)	Kedua elemen memiliki kepentingan yang sama
2	Nilai antara sama dan sedang (Equal-Moderate)	Nilai antara dua penilaian yang berdekatan
3	Sedang (Moderate)	Satu elemen sedikit lebih penting dibandingkan dengan elemen pasangannya
4	Nilai antara sedang dan kuat (Moderate-Strong)	Nilai antara dua penilaian yang berdekatan
5	Kuat (Strong)	Satu elemen lebih penting dibandingkan dengan elemen pasangannya
6	Nilai antara kuat dan sangat kuat (Strong-Very Strong)	Nilai antara dua penilaian yang berdekatan
7	Sangat kuat (Very Strong)	Satu elemen sangat penting dibandingkan dengan elemen pasangannya
8	Nilai antara sangat kuat dan ekstrim (Very Strong-Extreme)	Nilai antara dua penilaian yang berdekatan
9	Ekstrim (Extreme)	Satu elemen memiliki sifat mutlak sangat penting dari elemen pasangannya

Kuesioner Perbandingan antar Elemen

Clean Energy																		
Environmental Protection	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Management

Green Management																		
Green Port Awareness and Willingness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Port Promotion
Energy Saving Efficiency	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental Protection Effectiveness

Energy Saving Efficiency																		
Energy Saving	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Management
Green Port Awareness and Willingness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Port Promotion

Environmental Protection Effectiveness																		
Clean Energy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental Protection
Clean Energy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Management
Environmental Protection	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Management
Green Port Awareness and Willingness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Green Port Promotion

Kuesioner Perbandingan antar Klaster

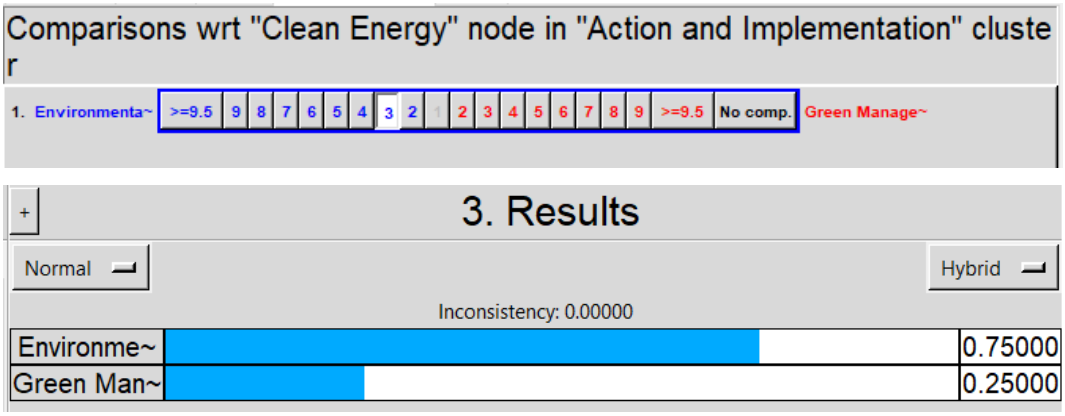
Action And Implementation																		
Action And Implementation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Commitment and Willingness
Action And Implementation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Efficiency and Effectiveness
Commitment and Willingness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Efficiency and Effectiveness

Efficiency and Effectiveness																		
Action And Implementation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Commitment and Willingness

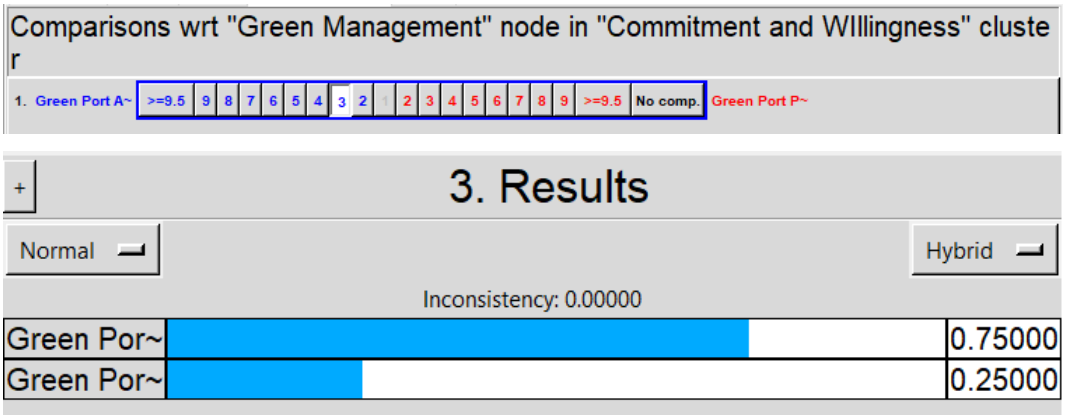
Selesai

Attachment 2:

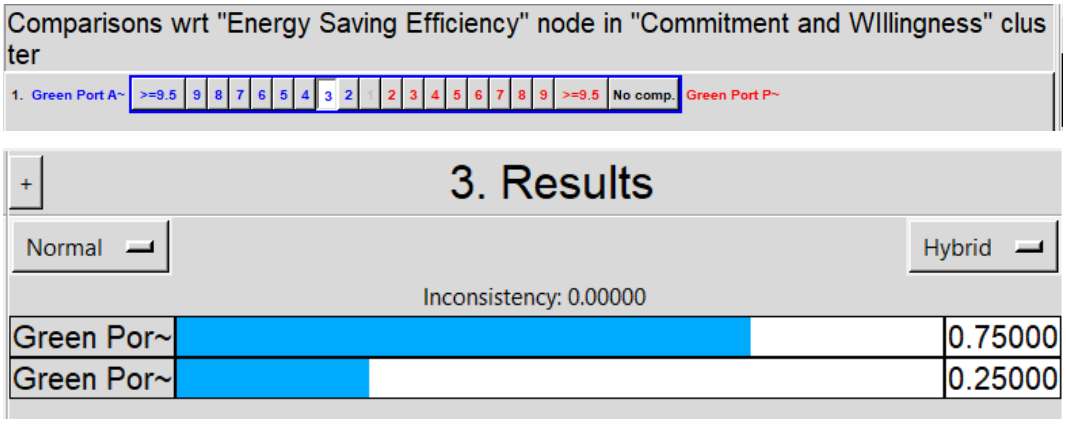
A. Pairwise comparison for Node Clean Energy



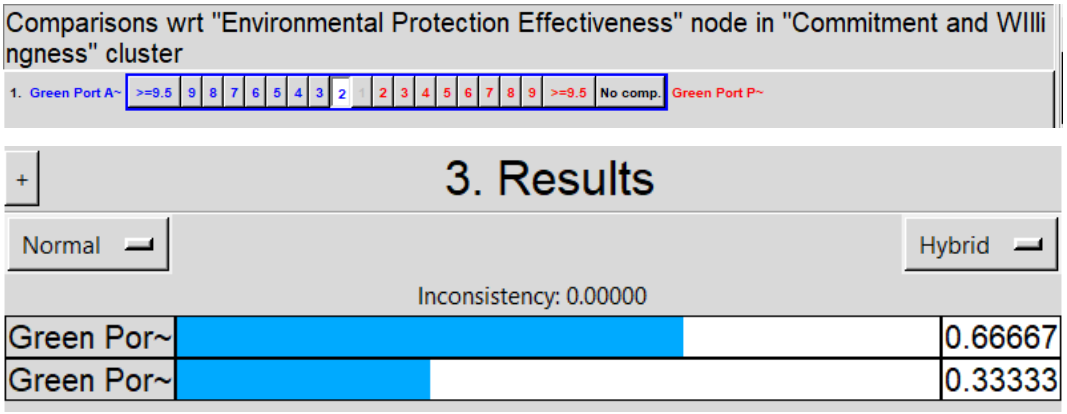
B. Pairwise Comparison for Node Green Management



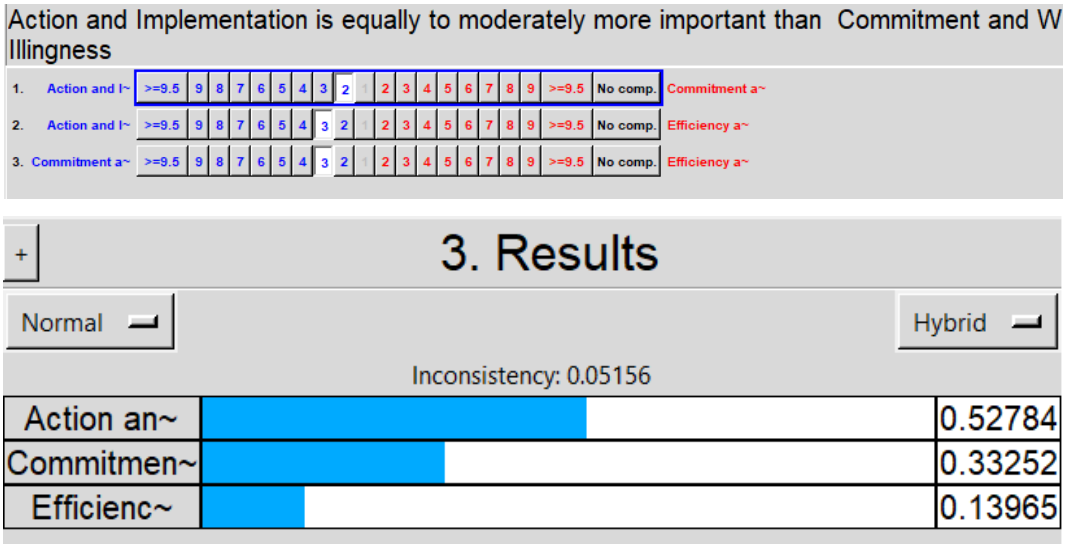
C. Pairwise Comparison for Node Energy Saving



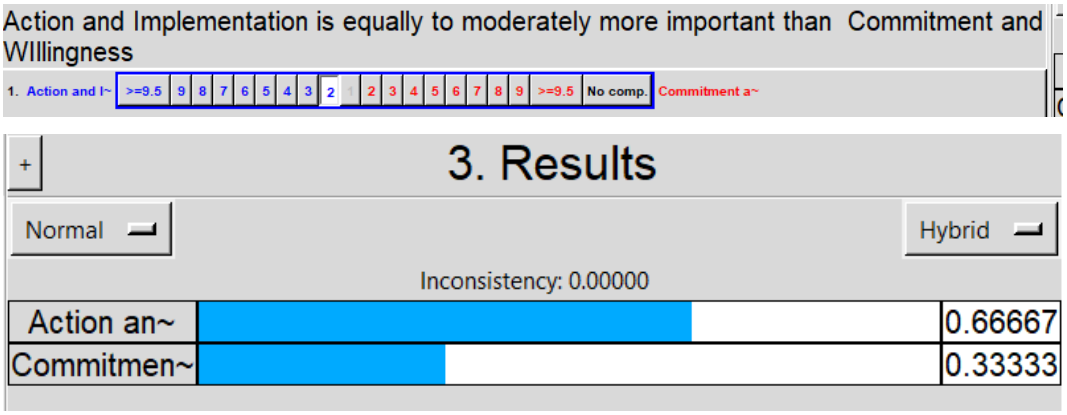
D. Pairwise Comparison for node Environmental Protection



E. Pairwise Comparison for Action and Implementation Cluster



F. Pairwise Comparison for Efficiency and Effectiveness Cluster



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