EasyChair Preprint

№ 6027

Analysis of the Implementation of an Environmental Management System ISO 14001: 2015 Based on the Level of Implementation and Obstacles Using Quantitative and QFD Methods

Dian Fitri Harmoko and Mokh Suef

July 6, 2021

ANALYSIS OF THE IMPLEMENTATION OF AN ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001: 2015 BASED ON THE LEVEL OF IMPLEMENTATION AND OBSTACLES USING QUANTITATIVE AND QFD METHODS

Case study: PT. PLN (Persero) UITJBTB

Dian Fitri Harmoko
Department of Management Technology, Sepuluh Nopember Institute of Technology,
Jl. HOS Cokroaminoto 12A, 60264, Surabaya, Indonesia, E-mail: dede.pln25@gmail.com

Mokh. Suef
Department of Management Technology, Sepuluh Nopember Institute of Technology,
Jl. HOS Cokroaminoto 12A, 60264, Surabaya, Indonesia, E-mail: mokhsuef@gmail.com

ABSTRACT

PT. PLN (Persero) Unit Induk Transmisi Jawa Bagian Timur dan Bali has implemented the ISO 14001: 2015 environmental management system since 2019 and has obtained ISO 14001 certificate in 2020. However, from the results of internal and external audits, there are still many discrepancies that occur. There must be an analysis related to the level of implementation and obstacles that can affect the consistency and continuous improvement in efforts to improve the quality of the environmental management system's implementation. Benchmarks for applying an environmental management system can be seen from the analysis of the level of implementation as measured by the standard elements of ISO 14001: 2015 and the obstacles that occur. This research uses quantitative methods and Quality Function Deployment (QFD). Quantitative methods are carried out by literature study, distributing questionnaires, and interviews with environmental experts. The output obtained from the quantitative analysis will be followed by the QFD method using House of Quality tools to obtain priority technical response which will be a quality improvement proposal in applying environmental management systems at PT. PLN (Persero) UITJBTB. After analyzing the data, there were seven indicators of implementation level that received the lowest scores and five indicators of the biggest obstacles. Based on these indicators, obtained it thirteen technical response priorities that PT PLN UITJBTB must implement to improve the quality of implementing the ISO 14001: 2015 environmental management system.

Keywords: Environmental Management System , QFD, *House Of Quality*

1. INTRODUCTION

In the modern era at this time PT PLN (Persero) Main Unit Transmission for East Java and Bali has realized that in the process of operational activities of substations, SUTT / SUTET, laboratories and offices need to pay attention to environmental balance so that the impact of operational activities does not become boomerang to employees and the community around the company. By-Law 32/2009 concerning Environmental Protection and Management Article 1 paragraph 2 (two) that *"Protection and management of the environment are systematic and integrated efforts undertaken to preserve environmental functions and prevent environmental pollution and / or damage life which includes planning, utilization, control, maintenance,*

supervision and law enforcement". To create a company that is environmentally friendly and cares about environmental protection and management, genuine efforts are needed to do this through an environmental management or management system that is reliable, effective, documented and encourages improvements such as the application of the Environmental Management System. SML) which refers to the ISO 14001: 2015 standard.

Management expects quality improvements on the implementation side of the Environmental Management System and also gaps that hinder the application of the ISO 14001 system can be overcome so that the creation of a company business process that is in line with the ISO 14001 System by prioritizing protection and management of the environment that is reliable, effective and documented as well as the financing of insurance premiums on company assets can be minimized. Environmental management system commitment between the top management to the lowest line in the organization PT.PLN (Persero) UITJBTB is needed to realize the environmental policies, goals and objectives that have been made to strengthen the environmental management system that has been implemented.

Therefore, this research was conducted by measuring the level of implementation and barriers to the ISO 14001 system and listening to employees' needs and determining priority technical attributes for improving the quality of the Environmental Management System. Measurement of the level of implementation and obstacles of the Environmental Management System is carried out using quantitative methods. Attributes that have low scores will be collected, and needs and expectations are mapped. The needs and expectations will later be discussed with experts to obtain technical responses that will be processed using the Quality Function Deployment (QFD) model. The QFD model is used to translate customer requirements into technical responses. Understanding the Voice of Customer (VoC) is the foundation and starting point of QFD. Akao (1990) explains that QFD is a methodology for translating consumer needs and desires into a product design with specific technical requirements and quality characteristics.

This study will provide input to the management of PT PLN (Persero) UITJBTB regarding which elements of the ISO 14001 Environmental Management System need to be improved and what program priorities must be implemented based on the needs of management and employees.

2. LITERATURE REVIEW

2.1 Definition of Management

Management does not yet have an established and universally accepted definition. For example, Terry (1956) defines management as a typical process of several actions, such as planning, organizing, mobilizing, and monitoring. Meanwhile, Griffin (2002) defines management as a process of planning, organization, coordination, and control of resources to achieve goals effectively and efficiently. Effective here means that the goal is achieved according to plan, and efficient means that management is carried out carefully, organized, and timely. According to Appley (1957), management is expertise in arousing other people to be willing to do something. Organizations or groups can also possess management skills.

2.2 Definition of Organization

ISO 14001: 2015 states that an organization is personnel or group of people who have separate functions with responsibility, authority and relationships to achieve their goals. Hasibuan (2011) provides an understanding that an organization is a formal, structured, and coordinated union system of a group of people working together to achieve specific goals. In the environmental management system, the international standard organization (ISO) is a global association consisting

of national standardization bodies whose members are not less than 140 countries. ISO is an organization outside the government (Non-Government Organization / NGO) which was founded in 1947. The organization has the following characteristics, which are cited by Handayaningrat (1985):

1. There is a group of people who can be recognized for one purpose.
2. There are various activities but still interdependent parts which constitute a business entity.
3. Each member exerts all his efforts/energy.
4. There are authority, coordination and supervision.

2.3 Definition of Environment

Based on Law No. 32 of 2009, the environment is the unity of humans, objects, conditions and other living things in a place. Talking about the environment, of course, cannot be separated from the environment. Based on Article 1 point 1 of Law No. 32 of 2009, the environment is a spatial unit of all objects, power, conditions, living things, including humans and their behaviour, which affect nature itself, the continuity of life and the welfare of humans and other living creatures. According to S.J. McNaughton and Larry L Wolf (1973), the environment is all external factors that are physical and biological and have a significant impact on human life.

2.4 ISO 14001: 2015 Environmental Management System

The Environmental Management System is part of a management system used to manage environmental aspects in the form of elements of activities or products or services from organizations that interact or can interact with the environment which includes several aspects, namely water, air, land, natural resources, flora, fauna, humans and the relationship between them. The concept of the Plan - Do - Check - Action (PDCA) model underlies this approach to environmental management systems. This is because the PDCA concept provides an iterative process by which organizations achieve continuous improvement. It can be seen more clearly the relationship between the PDCA and the environmental management system framework in **Figure 1**.

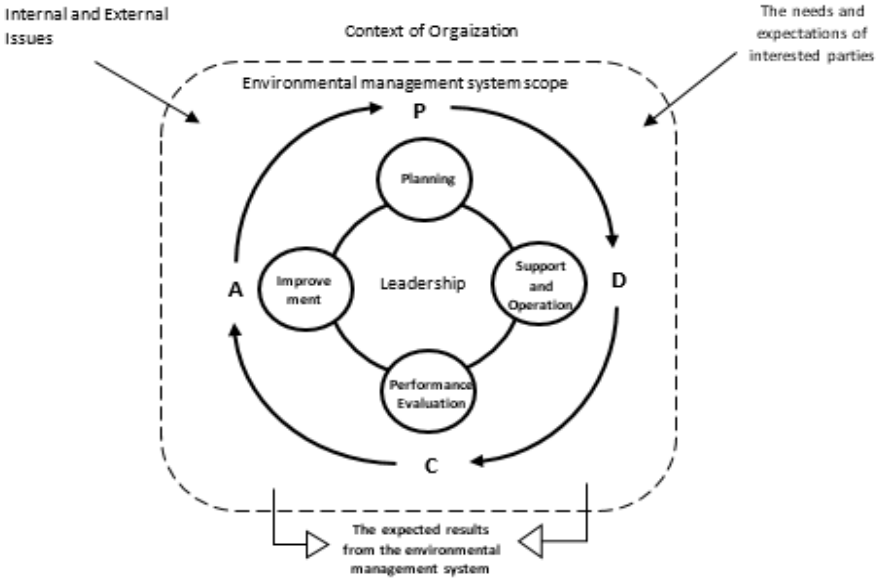

Figure 1. The relationship between the PDCA and the EMS framework (ISO 14001: 2015)

Every element or element in the environmental management system can apply this PDCA concept with the following explanation:

a. Plan: establish environmental goals and processes needed to achieve results consistent with the organization's environmental policy.
b. Do: apply the planned process.
c. Check monitor and measure processes against environmental policies, including commitments, environmental and operating criteria, and report results.
d. Action: take action for continuous improvement.

Picture. **Figure 1** shows how the framework introduced in this standard can be integrated into the PDCA model, which can help new and existing users understand the importance of a systems approach. With the PDCA approach, the ISO 14001: 2015 environmental management system can run well in a company because it continues to improve the process.

The ISO 14001: 2015 SML standard is a standard used for the registration process with requirements consisting of several elements that must be fulfilled as a specification requirement as follows:

1. Scope
2. Normative References
3. Terms and definitions
4. Organizational Context evaluation
5. Leadership
6. Planning
7. Support
8. Operations
9. Performance evaluation
10. Improvement

2.5 Quantitative Methods and QFD

In this research, the method used to analyze the quality of the environmental management system application is quantitative. Then, improve the quality of the environmental management system's implementation using the Quality Function Deployment (QFD) method.

According to Sugiyono (2017), the quantitative method is called a positivistic way because it is based on positivism. This method is called the scientific method because it has met concrete / empirical, objective, rational, measurable and systematic scientific principles. This method is also called quantitative approach because the research data is in the form of numbers, and the analysis is in the form of statistics. It can be concluded that the quantitative method according to Arikunto (2005) can be interpreted as a research method that uses numbers, starting from data collection, interpretation of the data, and the appearance of the results.

Yoji Akao developed quality Function Deployment (QFD) in Japan in 1960. Akao (1990) argues that QFD is a method for developing design quality that aims to satisfy consumers and then translate consumer demand into design targets and the main points of quality assurance used for all stages of the process. According to Heizer Render (2015), the quality function deployment (Quality Function Deployment) refers to determining what will satisfy the customer and translating customer desires into design targets. The idea is to capture a good understanding of what the customer wants and identify alternative process solutions.

According to Ariani (2002), there are three main benefits that companies get when using the QFD method, namely:

1. Reducing Costs

   If the products produced follow consumer needs and consumer expectations, there would be no work repetition, and raw materials are wasted due to mismatching specifications set by consumers. Cost reduction can be achieved by reducing the cost of purchasing raw materials, overhead costs, lowering wages, and simplifying the production process.

2. Increase Income
   With a reduction in costs, the results received will increase. With QFD, the resulting product or service will better meet customer needs and expectations.
3. Reducing Production Time
   QFD will create a product or service development team to focus on the development program for consumer needs and expectations.

3. RESEARCH METHODOLOGY

The research methodology includes the following phases :

1. Based on the results of field studies, identification of problems in PT PLN (Persero) UITJTB and literature review, the researcher decided to use quantitative methods to measure the level of implementation and barriers to implementing the Environmental Management System at PT PLN (Persero) UITJBTB and to obtain dimensions or indicators that require improvement.
2. Determination of dimensions and indicators is formulated before the questionnaire/survey to determine what factors should be examined. Implementation level dimensions and indicators refer to the ISO 14001: 2015 standard and the Global Environment Management Initiative (GEMI).
3. After the dimensions and indicators are determined, the researchers compile and distribute questionnaires. In the questionnaire's preparation and distribution, several essential things are the population and research samples and data collection.
4. The target population includes all structural levels including General Manager, Senior Manager, Sub Division Manager, Unit Manager, Assistant Manager and Basic Supervisor. The target population of the functional ranks includes all PLN UITJBTB employees who are not structural.
5. The number of samples taken in this study uses the Slovin formula in Ryan (2013). The Slovin formula is expressed by:

   $$n = \frac{N}{1 + Ne^2}$$

   Where : n = Sample size or quantity
   N = Size or number of population
   e = The desired margin of error (5%)
6. The data collection required in this study is obtained through a survey containing a questionnaire. This research questionnaire was conducted with an online survey model using mobile device media to the sample unit.
7. Validity and reliability tests are carried out after the researcher has collected the questionnaire results that the user has filled in.
8. After that, data processing with quantitative methods is done by measuring the central tendency and dispersion. The measurement of central movement in this study is done by measuring the average or mean, which provides an overview of the data. The dispersion measurement is done by measuring the standard deviation of a sample. The analysis results from the quantitative method calculations are then classified into two types, namely the level of implementation and the obstacles to the performance of the ISO 14001: 2015 environmental management system. Implementation level variables and obstacles with low average scores and high standard deviation will be grouped and then considered the primary priority needs and expectations for improving the environmental management system.

9. Collection of technical responses is carried out with the Environmental Management Representative, namely the K3L (Safety, Health and Environment) Control Officer after the researcher has mapped the implementation level variables and barriers.
10. The results of the technical response will be measured based on the relationship or correlation of the level of importance and needs through QFD tools, namely the House of Quality (HOQ) so that repair needs will be obtained that must be addressed immediately and which corrective steps or technical responses are prioritized.
11. At the conclusion stage will explain the research results at PT PLN (Persero) Main Unit Transmission East Java and Bali that have been obtained. At the suggestion stage, suggestions will be conveyed regarding hopes or improvements for the management of PT PLN (Persero) UITJBTB and academics regarding future research progress.

It is more clearly seen in **Figure 2**, which contains the flow of this study's research steps.

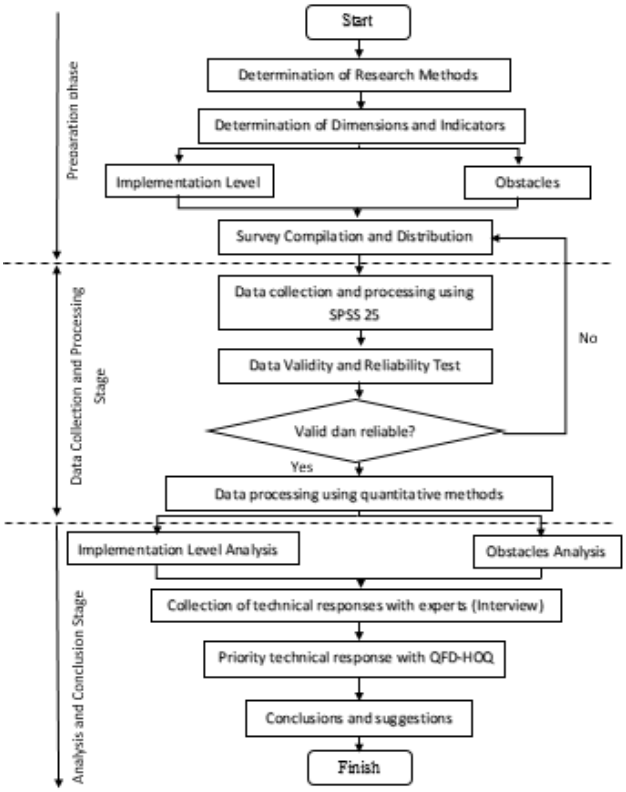

Figure 2. Research Steps

4. RESULTS AND DISCUSSION

4.1 Survey Results

The survey was carried out from 1 December - 20 December 2020 through an online survey method using the google form media. The survey was distributed through the WA media (WhatsApp), assisted by HR management in each implementing unit. In the survey, 46 questions consisted of 28 questions on implementing the ISO 14001 Environmental Management System and 18 questions regarding the obstacles experienced in implementing the ISO 14001 Management System. Of the expected 298 respondents, 406 respondents successfully filled out the survey through the link spread out. Of the 406 respondents, 26 extreme respondent data could not be used as research material because the results of filling out the questionnaire did not match the questions

given so that the number of respondents who met the criteria in filling out the survey was 380 respondents. This means that the percentage of the questionnaire survey performance (response rate) is 127.5% with details of 166% from the UPT Probolinggo sample (78 respondents), 97.9% from the UPT Madiun sample (47 respondents), 102.2% from the UITJBTB sample (46 respondents), 132.5% of the UPT Surabaya sample (57 respondents), 142.8% of the UPT Malang sample (70 respondents), 125% of the UPT Gresik sample (40 respondents), and 123.5% of the UPT Bali sample (42 respondents). Response rates in previous studies related to ISO 14001 environmental management systems include Chan (2008) at 25%, Rodriguez (2011) at 88.9%, and Harahap (2009) at 100%.

4.2 Respondent Profile

The respondents' profiles in this study include the location of the implementation unit, education and position levels shown in Figures 3 - 5. **Figure 3** shows the majority of respondents came from the Probolinggo Transmission Implementing Unit with 78 respondents (21%). **Figure 4** shows that most respondents' educational background is high school education, with 144 respondents (38%). In contrast, **Figure 5** shows most respondents are at functional levels with a total of 218 respondents (57%).

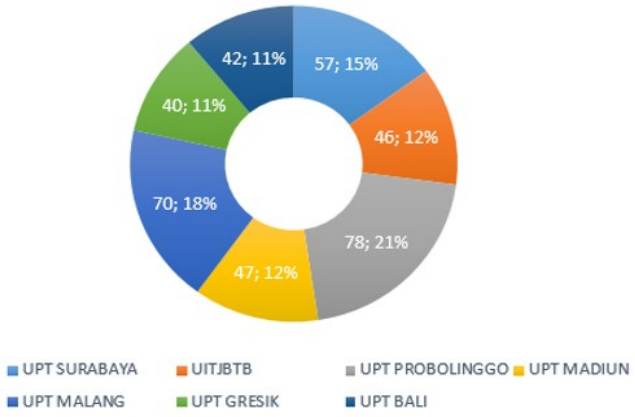

Figure 3. Composition of implementing units (Number of respondents,%)

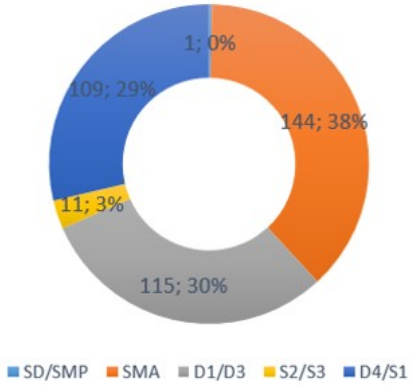

Figure 4. Composition based on education (Number of respondents,%)

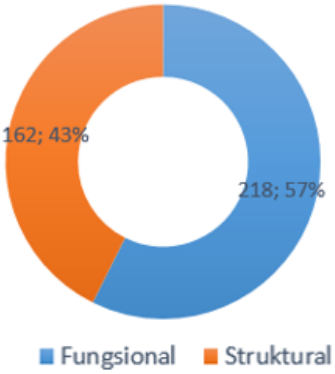

Figure 5. Composition based on position level (Number of respondents,%)

4.3 Analysis of Implementation Level, Obstacles and technical responses

After conducting a quantitative analysis of the survey results as well as discussions with experts from PLN UITJBTB and considering the required resources, it was decided that seven indicators of implementation level got the lowest mean value and the five biggest obstacles in implementing ISO 14001 as the voice of the customer (What) and determining the technical response (How) for each indicator. The results can be shown in **Table 1**.

Tabel 1. Types of Implementation level indicators, Obstacles and Technical responses

Indicator (*what*)	***Mean***	**Technical Response (*How*)**
The organization provides the personnel, technology, infrastructure and budget to function effectively and improve the EMS.	3,96	- Forming an environmental management team - Prepare infrastructure and budget in an annual RKAU
The organization regularly updates EMS documents and performs document control.	3,98	- Making a schedule for regular annual document updates. - Creation of an online document storage server
The organization provides education, training and experience to employees in the environmental field to improve competence.	3,99	Propose EMS training for all Environmental employees
The organization has ensured that all employees have an awareness of the importance of EMS.	4,00	Conduct an awareness survey related to awareness of the importance of EMS
Top management provides the necessary resources including employee training to contribute effectively	4,01	Provide a knowledge sharing forum regarding the implementation of ISO 14001 EMS
The organization has been evaluating the effectiveness of its Environmental Management System on a regular basis	4,02	Prepare Monthly Management Review Meetings.
The organization has controlled planned changes and is reviewing the consequences of unwanted changes	4,03	Conduct monthly inspections in each Implementing Unit
Lack of understanding of the ISO 14001 environmental management system	3,09	Socializing Environmental Management Systems through Web Binar.
Lack of training or knowledge sharing regarding the ISO 14001 standard for employees	3,01	Provide a knowledge sharing forum regarding the implementation of ISO 14001 EMS

Tabel 1. Types of Implementation level indicators, Obstacles and Technical responses (continue)

Indicator (*what*)	*Mean*	Technical Response (*How*)
Lack of employee awareness of the importance of ISO 14001	2,95	Creating visual management of the environmental management system.
Difficulty in meeting the requirements of the ISO14001 clause	2,89	Creating an ISO 14001 pocket book and interpretation of its requirements
The involvement and commitment of all employees in implementing ISO 14001	2,88	Give awards to employees who are involved in implementing ISO 14001

Furthermore, the researcher carried out the planning matrix calculation to determine the level of importance of each indicator according to the respondent, the level of respondent satisfaction with the current implementation of the ISO 14001 environmental management system, how much effort PT PLN UITJBTB had to do to achieve the goal and the last was how much each indicator contributed improving the quality of the environmental management system at PT PLN UITJBTB. Information from the planning matrix is then used as the basis for PT PLN UITJBTB to find solutions to existing problems. After formulating the technical response, the following calculation is to determine the ranking of the technical responses. More details are in **Figure 6** below.

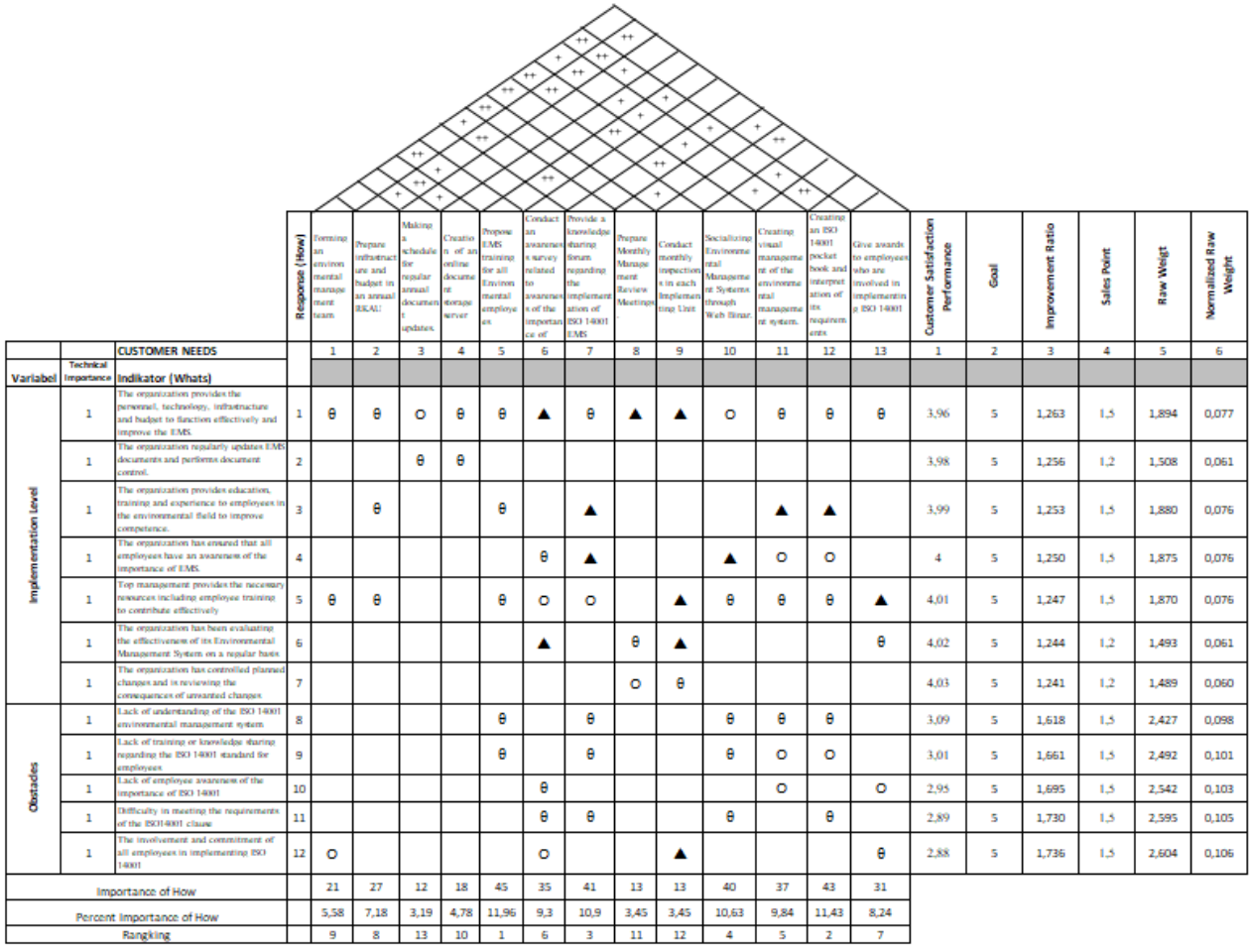

Figure 6. House of Quality

The result of the House of Quality in **Figure 6** is quality improvement. In this study, thirteen technical response priorities were produced as follows:

1. Propose EMS training for all environmental employees.
2. Creating an ISO 14001 SML pocketbook and interpreting the requirements.
3. Providing a Knowledge Sharing Forum regarding the implementation of ISO 14001.
4. Socializing the Environmental Management System through Webinar.
5. Creating Visual Management of Environmental Management Systems.
6. Conduct an awareness survey related to awareness of the importance of EMS
7. Give awards to employees who are involved in implementing ISO 14001.
8. Prepare infrastructure and budget in the annual RKAU.
9. Forming an Environmental Management Team.
10. Creating an online document storage server.
11. Prepare Monthly Management Review Meetings.
12. Conduct monthly inspections in each Implementing Unit
13. Creating an annual routine document update schedule.

5. CONCLUSION

This study aims to provide an overview of the level of implementation and obstacles in applying the ISO 14001: 2015 environmental management system. Based on the analysis results, the implementation level of ISO 14001 PT PLN UITJBTB is 3.96 - 4.69, where the consistency level of implementation is at a reasonably good story and reasonable adoption rate. In an organisational context, the principles of environmental management, leadership, planning, operation, continuous evaluation, and improvement have an excellent implementation level. Simultaneously, the principles of support have an implementation level that is close to good which is also an aspect of environmental management system principles with the lowest level of application consistency. Based on the results of the technical response analysis obtained from the seven lowest levels of implementation and the five biggest obstacles experienced in the application of an environmental management system using the Quality function Deployment method and House of Quality tools, the priority of technical response can be carried out by top management of PT PLN UITJBTB to improve the implementation of the implementation. ISO 14001 on principle aspects of environmental management systems.

ISO 14001 environmental management system certification is not the end, but the beginning of an environmental management system process. The PDCA (Plan-Do-Check-Action) process or Continuous Improvement is a continuous improvement process. Top management needs to show accountability in implementing ISO 14001 by regularly monitoring its implementation effectiveness and identifying any obstacles experienced and taking evaluation actions to overcome them.

6. REFERENCES

Akao, Y., ed. (1990). *"Quality Function Deployment, Integrating Customer Requirements into Product Design."* (1st Edition). Cambridge Mass : Productivity Press.

Appley, A. L. (1957). *"Management in Action:The Art of Getting Things Done Through People"* (American Management Assoc (ed.)). University of California.

Ariani, D. (2002). *"Manajemen Kualitas: Pendekatan Sisi Kualitas."* Departemen Pendidikan Nasional.

Arikunto, S. (2002). *"Metodologi Penelitian Suatu Pendekatan Proposal."* PT. Rineka Cipta.

Chan, E. S. W. (2008). "Barriers to EMS in the hotel industry." *International Journal of Hospitality Management*, *27*(2), 187–196. https://doi.org/10.1016/j.ijhm.2007.07.011

Cohen, L. (1995). *"Quality Function Deployment : How To Make QFD Work For You* (Addison Wesley Publishing Company (ed.)).

Gemi. (2017). *"ISO 14001 Environmental Management System Self-Assessment Checklist."* GEMI, Inc. http://gemi.org/solutions/solutions-interactive/iso- 14001-2015-checklist/.

Griffin, W. R. (2002). *"Manajemen Jilid I"* (I). Airlangga.

Heizer, J. and R. B. (2015). *"Manajemen Operasi : Manajemen Keberlangsungan dan Rantai Pasokan"* (11th ed.). Salemba Empat.

Rodríguez, G., Alegre, F. J., & Martínez, G. (2011). Evaluation of environmental management resources (ISO 14001) at civil engineering construction worksites: A case study of the community of Madrid. *Journal of Environmental Management*, *92*(7), 1858–1866. https://doi.org/10.1016/j.jenvman.2011.03.008

Ryan, T. P. (2013). *"Sample Size Determination and Power."* John Sons, Wiley and.

S, J, McNaughton dan Larry L, W. (1973). *"General Ecology Second Edition"* (Second Edition). Saunders College Publishing.

Sugiyono. (2017). *"Metode Penelitian Kuantitatif, Kualitatif, dan R&D."* Alfabeta CV.

Terry, R. G. (1956). *"Principles of Management."* R.D.Irwin.

Yazeril R.Harahap. (2009). *"Evaluasi Pelaksanaan Sistem Manajemen Lingkungan ISO 14001 Pada PT.Bina Guna Kimia Semarang."* Universitas Diponegoro.