**Jurnal Sains dan Teknologi Lingkungan** Volume 12, Nomor 2, Juni 2020 Hal. 131-145

p-ISSN:2085-1227 dan e-ISSN:2502-6119

# A BRIEF REVIEW OF EMS IMPLEMENTATION IN UNIVERSITY

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***Abstract***

*Higher education institutions have a huge population that induces the large consumption of drinking water, the large consumption of electricity, the production of large quantities of garbage, the use of high transport and the rise in the building of facilities. Thus, the implementation of the Environmental Management System in University is crucial to achieving sustainable development. This study is a literature review of the ISO 14001 Environmental Management System implementation in University. The discussions are among the EMS implementation in Indonesia's university, as well as in other country universities. The implementation started from the environmental policy that was made by the university adjusting to the ISO 14001, the environmental management planning, implementation, and assessment for evaluation. Several universities have been implementing an environmental management system but still need improvement. Universities should start implementing environmental management practices that promote sustainable development and protection of the environment. These initiatives can focus on various environmental aspects, depending on the needs and culture of the university. However, some case studies have shown that solid waste management is a common aspect that many institutions are focused on.*

***Keywords:*** *University, Environmental Management System, Green Campus, Sustainability*

## 1. INTRODUCTION

Environmental Quality Management System (EQMS) is a collection of regulations, systems, and procedures that is necessary for the implementation and planning of production, development, and operation in the core business field of the organization or company. Environmental Quality Management System organizations are the way to measure its performance of the operation meets with the objective. EQMS is established based on the standard of action measurement that is needed to be done. EQMS can be certified, and it proves that the company has good environmental awareness and quality control. The purpose of EQMS itself should enable the company to provide good service and products and minimize environmental degradation (Simola, 2015).

The International Organization for Standardization (ISO) provides the standard that helps organizations to ensure both purposes of EQMS. First is ISO 9001 helps ensure that customers get consistent good-quality products and services. Another one is the ISO 14001 Environmental Management Systems (EMS) standard of an International Standardized Organization, which provides guidelines for an organization, in keeping with the philosophy of 'plan-do-check-actions,' to continuously improve its environmental efficiency. Because of ongoing questions

*Dikirim/submitted: 15 Mei 2020*

*Diterima/accepted: 28 Mei 2020*

regarding global environmental effects and climate change, the ISO 14001 specification reflects organizational sustainability commitments (Salim et al., 2018).

University, as a higher education institution has an interest in promoting sustainability. It is a key stakeholder that has a significant opportunity for changing behavior through environmental education and innovation (Sonetti et al., 2016). The United Nations also put great emphasis on the role of higher education institutions in promoting sustainable development (Aleixo et al., 2018). A sustainable university can be defined as ‘‘A higher education institution, as a whole or as a part of it, which discusses, involves and encourages, at a global or regional level, the minimization of the detrimental environmental, cultural, health and economic effects produced through the use of its resources to accomplish its teaching, science, outreach and collaboration functions, and stewardship in ways that enable society to migrate to sustainable lifestyles." (Alshuwaikhat, 2008).

Universities have the primary function of educating the next generation of leaders. Therefore, it plays an important role more than any other sectors in terms of implementing sustainable development and tacking sustainability issues. (Omrcen et al., 2018) Implementation of university sustainability serves as a role model for students and is also an important way of raising awareness about sustainability. Universities have four roles to play, which are education, research, outreach, and $CO_2$ reduction. (Omrcen et al., 2018).

According to a report by the International Sustainable Campus Network (ISCN), there are several common approaches to implement sustainability in universities. First is the Living Lab Approach, which is described as “providing opportunities for students to engage with hands-on experience both on campus and more broadly to learn and solve critical issues”. For example, in De La Salle University – Dasmarinas, they have student initiatives that educate the community of the importance of waste management. The second approach focuses on equality and wellbeing for all, which focuses on the social aspects of sustainable development. Third, the university implements sustainability by integrating sustainability in the infrastructure and operations of the university. For example, Chulalongkorn University has a five-year zero university action plan to cut usage and waste. Lastly, the university applies sustainability through the education approach by having courses and programs that teach sustainability (ISCN, 2018).

Higher education aims to enhance environmental efficiency continuously by EMS. It demonstrates the value of EMS implementation as an attempt to achieve higher education sustainability (Nurcahyo et al., 2019). Higher education may implement ISO 14001 as an organizational guide to implement a system of environmental management that promotes sustainability (Pramono et al., 2017). Based on data that has been published or released by the Ministry of Technology and Higher Education Research (Kemenristekdikti) through the higher education database page, in 2018 the number of universities in Indonesia is 4,586. (DIKTI, n.d.) Meanwhile, with the heavy use of resources, high water use, high energy use, substantial waste, extensive transport and extensive construction of buildings and infrastructure, universities will have a considerable effect on the environment (Amrina and Suryani, 2019).

For instance, the university in Indonesia is regarded as an effective way of implementing and promoting the principle of sustainable development for civitas academia and the surrounding community through the environmental management system (EMS) (Nurcahyo et al., 2019; Pramono et al., 2017; Santoso et al., 2017). Global issues have arisen as a result of various agreements and promises concerning the need for sustainability in the university education and the role of higher learning and promoting sustainability. As a result, even more, university programs and initiatives are being implemented to incorporate sustainability into its processes. This literature review has the objective of analyzing various aspects of EMS application in the university including the role of sustainability measurement tools, the environmental problem in university, environmental planning and enforcement, implementation assessment, as well as the implementation in Indonesia's higher education and others country higher education. The last is to give a recommendation. The methods for identifying important parameters or criteria through observing several case studies.

## 2. MATERIALS AND METHODS

This paper is a literature review that analyzed various sources in a systematical way according to a fixed plan, thoroughly and efficiently to get result and discussion about sustainability measurement tools, the environmental problem in university, environmental planning and enforcement in university, environmental management system implementation and its assessment for university area. Besides, the implementation of environmental management systems in universities in Indonesia and other countries must also be analyzed. Then, the recommendations were explained inadequate way thorough case study analysis. Keywords

used in search engines are the university, environmental management system, green campus, sustainability campus.

## 3. RESULTS AND DISCUSSION

### 3.1. SUSTAINABILITY MEASUREMENT TOOLS

An important aspect is developing tools to measure, monitor, and evaluate the sustainability of an institution. Currently, there are several tools available such as the College Sustainability Report Card, STARS, GREENSHIP and UI Green Metric. First, the College Sustainability Report Card is a tool for evaluating the sustainability of university and colleges as an institution. This tool is intended to recognize the colleges and universities that lead sustainability by example.

There are nine categories of assessments, namely administration, climate change & energy, food & recycling, green building, student involvement, transportation, endowment transparency, investment priorities, shareholder engagement (*The College Sustainability Report Card*, n.d.). The Second tool, STARS stands for "Sustainability Tracking, Assessment & Rating System". This tool is an assessment program under The Association for the Advancement of Sustainability in Higher Education (AASHE). From the assessment, institutions will be given points that decide their ratings. The rating system in STARS includes bronze, silver, gold, platinum or reporter ratings. The categories assessed are operations, academics, planning & administration, engagement, and innovation & leadership (*About STARS - The Sustainability Tracking, Assessment & Rating System*, n.d.).

Next, GREENSHIP is an assessment method for determining building scores on the accomplishment of the eco-sustainable construction framework. GREENSHIP is prepared and collected by the Indonesian Green Building Board, taking into account the circumstances, natural character, laws, and requirements applicable in Indonesia. The six categories of Greenship assessments are Land Use, Energy Efficiency and Energy Conservation, Water Source & Cycle Materials, Air Quality & Indoor Air Comfort, Building Environmental Management (*GREEN BUILDING COUNCIL INDONESIA - GREENSHIP*, n.d.). UI-Green Metric has the function of “helping the higher education measure sustainability efforts within the university environment.”(Marrone et al., 2018) This tool provides guidelines and frameworks for helping higher education institutions to implement sustainable behaviors. In

UI-Green Metric, there are six categories, setting and infrastructure, energy and climate change, waste, water, transportation, and education. (Nurcahyo et al., 2019)

In addition to the assessment tools mentioned above, Implementation of EMS is another option that could provide the institution with the tools to control and monitor operational aspects and sustainable practices. (Torregrosa-López et al., 2016) EMS is assumed to be able to increase participation and sustainable practices by providing a platform and means for staff and students to implement sustainable practices. (Omrcen et al., 2018) Although there is continuing discussion about the utility of the ISO 14001 standard and model for higher education programs in the university environmental management framework. Some scholars have concluded that the EMS model such as ISO 14001 is suitable for any organization, including institutions of higher education. Some found that universities need a unique EMS framework. (Clarke & Kouri, 2009)

### 3.2. ENVIRONMENTAL PROBLEM OF UNIVERSITY

As a center for education, universities have several environmental issues that need to be given attention. The university area has a huge population that induces the use of large quantities of drinking water, the large use of electricity, the production of large quantities of garbage, the use of high transport and the rise in the building of facilities. According to reports by ASEAN-USAID, the standard consumption of education institutions are 240 kWh/$m^2$/year (Adhiaksa et al., 2019). This causes negative impacts that include raising the temperature in the university area due to increased emissions caused by motorized vehicles when the use of motorized vehicles is not limited, drought and lack of clean water supplies if the use of clean water is not controlled, and environmental degradation due to the absence of waste management created by university activities (Amrina and Suryani, 2019). A study that survey student's perception toward environmental issues in university found that a majority of students answered that scattered litter is the most frequent environmental issue (Maffia et al., 2011). As mentioned before universities consume a huge amount of electricity to support the learning activities.

A study in one of the universities in Indonesia found that the highest energy user in university buildings is the air conditioning system with 50-70%, then 10-25% of which comes from artificial lighting (Nur et al., 2019). Energy use in university buildings is influenced primarily by different factors such as the size of the structure, construction age, usage, working hours, amount of equipment installed, and climate (Amber et al., 2017). Besides, from academic

activities, one of the reasons for the importance of environmental management at the university is where some of the university's laboratories produce hazardous and toxic waste (Sari & Kamalia, 2019). Such as the case of the calculation of hazardous and toxic waste from one of the laboratories of a reputable university in Indonesia, shows that the acid waste produced is 34.85 kg/week, bases 43.91 kg/week, solvents 83.91 kg/week, infectious waste 0.152 kg/week, heavy metals 27.47 kg/week, and chemical mixture 267.23 kg/week. Seeing the amount and types of hazardous and toxic waste produced are different, the management effort must also be different for every type of waste (Sidik and Damanhuri, 2016)

### 3.3. ENVIRONMENTAL PLANNING AND ENFORCEMENT

Universities need to formulate environmental policies as a fundamental component driving all the other environmental management systems requirements, which include planning, application, and enforcement. Most universities in Indonesia refer to UI green metrics as an indicator, and ISO 14001 as a reference in setting the standard and application of the policies. ISO 14001: establishes requirements for environmental management systems that organizations can use to improve their environmental performance. This international standard helps the organization achieve the desired results from its environmental management system, which provides value to the environment, the organization itself, and the parties concerned (Sari and Kamalia, 2019). A variety of elements of ISO 14001, amongst other items, are envisaged by the reporting framework and environmental management system requirements such as (Sari and Kamalia, 2019).

1. Master Plan of Waste Management Program
2. Plan of the WWTP.
3. Planning of water catchment building and laying.

This standard is based on the **Plan-Do-Check-Action** (PDCA) model for improving the environmental management system (EMS) requirements. The PDCA loop, which offers greater confidence in its application, underpins the current environmental management systems model(Torregrosa-López et al., 2016). Samples of critical elements of ISO 14001 aligned with the PDCA systems of enhancement are shown in the figure 1.

The use of external university correspondence includes relevant departments and contact with the academic community. The university receives, registers, and responds to relevant complaints or grievances from external parties by introducing these two forms of contact. The

correspondence on the world applies to protocols for internal and external contact. The method consists of Interior coordination between various roles and levels of the organization and Acceptance, documentation, and answers to relevant external communications (ISO 14001) (Sari and Kamalia, 2019). Each institution may have a strategy for implementing environmental planning that varies according to their needs, so it is essential to conduct a thorough evaluation before making a strategy (Choi et al., 2017).


**Figure 1.** Samples of critical elements of ISO 14001 aligned with the PDCA system of enhancement

Another research from one of the universities in Korea and official organizations are running Green Campus Plans and sponsored by the university in twelve multilateral categories as shown in the table 1 governance, electricity, water, climate change, greenhouses, green purchases, waste disposal and recycling, food and dining, tourism, land usage, education, and student life. Distinctive sustainability strategies or characteristics include the following: District heat and cooling loops; Stormwater strategies; an Environmental environment and development plan; Waste audit reports; public transit on university; Electric Lane, which supplies several electric cars charging stations; a "Park Block" which represents the "Sustainability Campus." (Leal, 2020).

**Table 1**. Green Campus Plans

| Categories | Plans |
|---|---|
| Administration | -Official organizations for sustainability campus.<br>-Funding<br>-Research for long term plans |
| Energy | -Green revolving fund<br>-Energy conservation guideline<br>-District heating and cooling loop<br>-Efficient class scheduling for saving energy<br>-Interactive energy dashboards for student's understanding about building energy generation and consumption<br>-Solar photovoltaic (PV) arrays on campus |
| Water | -Stormwater plan<br>-Sustainable drinking water<br>-Landscaping practices to help reduce pollutants in stormwater |
| Climate action | -Climate action plan<br>-Climate action progress<br>-Climate champions guidance document<br>-Climate champions checklist |
| Green Building | -Achieving leadership in Energy and Environmental Design (LEED) Certifications is necessary for newly constructed or renovated facilities since 2003.<br>-Technical design standards for green building |
| Waste reduction and recycling | -Waste audit reports<br>-Course catalogs, schedules, and directories are no longer printed, and free PDFs are available online.<br>-Recycle<br>-Outdoor compost bin |
| Food and Dining Services | -Reusable to-go container program<br>-All cooking oil recycled into bio-diesel<br>-Excess pre-consumer food donated to charity<br>-Increasing local and organic food purchases<br>-Bike hub offers bicycle services, classes, and merchandise. |
| Transportation | -Bicycle transportation plans<br>-Making cycle track<br>-Zipcar for free lower rates |
| Land Use | -Green pedestrian corridor<br>-Clean air corridor<br>-Making and maintaining a community garden and park block |
| Actions | Online guide for information about commuting to campus, eating on or around campus, working in an office traveling for university purpose, living on campus, learning or teaching in a classroom, researching in a lab, and purchasing university supplies |
| Education and Student Activity | -Sustainability Volunteer Program<br>-Student Sustainability Leadership Council<br>-Green Student Groups<br>-Graduation Sustainability Pledge<br>-Campus gardens<br>-Sustainability-related and focused courses<br>-Graduate Certificate in Sustainability<br>-Sustainability scholar group |

### 3.4. EMS IMPLEMENTATION ASSESSMENT

ISO 14001 EMS are designed to achieve sustainable development for the organization's environmental aspects, namely higher education. Assessment tools can compliment the EMS by providing a performance indicator that can improve the EMS implementation.

The use of the UI green metric as an indicator of performance results provides input for policymakers at Andalas University to continue to improve sustainable university performance in detail, so that it can be an evaluation to improve the implementation of EMS on the university (Amrina and Suryani, 2019)

Another research found that there is two green university implementation assessment currently used by universities worldwide, namely AASHE, which creates the Sustainability and Ranking System (STARS) and the University of Indonesia, which issues GreenMetric UI. GreenMetric UI provides a more general appreciation and is easy to use. STARS assessment will be easy to view in the official website, but the GreenMetric UI does not clarify how to assess in full (Santoso et al., 2017).

GreenMetric's STARS and UI have separate evaluation types and methods. STARS consists of 65 sub-indicators and 19 indicators in 5 academic, engagement, operational, planning, management and innovation categories (STARS, 2017) while GreenMetric UI has 38 signs in 6 criteria: infrastructure and environment, energy and climate change, waste, water, education and transport (Santoso et al., 2017).

***Analytical Hierarchy Process (AHP) and Importance Performance Analysis (IPA)***

The analytical hierarchy process and importance-performance analysis are used to determine the factors that have importance in the implementation of ISO 14001 in universities. The analytical hierarchy method (AHP) is an important decision-making technique for multi-criteria applications in various fields, including economics, politics, and engineering (Nugroho et al., 2014). The AHP will give scores to criteria according to its importance. The AHP then produces weights for each evaluation parameter based on a set of standards comparisons between the decision-makers. The higher the weight, the more the corresponding criteria, is al relevant (Pramono et al., 2017). AHP flowchart is shown in Figure 2.

According to Philip Kotler, the purpose of the importance-performance review is to rate various elements of a service set and classify the activities that are required (Lo-Iacono-Ferreira et al., 2018). In an IPA diagram there are four quadrants, Quadrant 1: Concentrate These, Quadrant

2: Keep up the good work, Quadrant 3: Low priority and Quadrant 4: Possible Overkill (Figure 3).

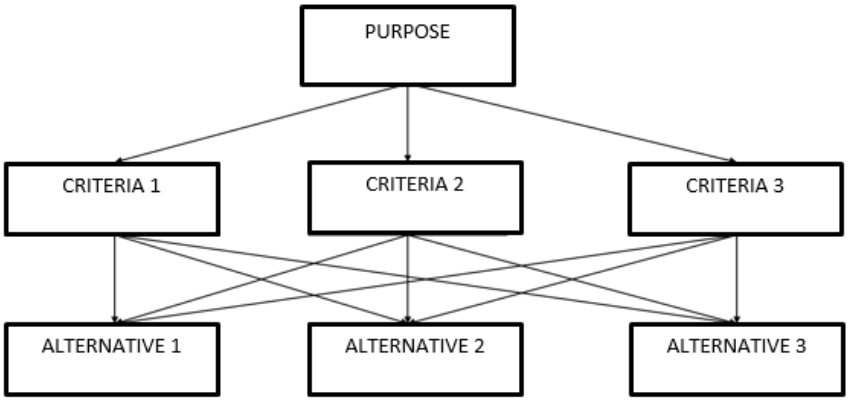


**Figure 2**. AHP Flow chart

Usually, the big challenge in implementing ISO 14001 in institutions is cost. In addition, the things that are crucial in its application are the awareness of all stakeholders (Gunawan et al., 2020). In terms of ISO 14001 implementation in university, AHP and IPA analysis are used to determine which factors are relevant to the implementation of ISO and needs to be improved. Conducting this analysis will help in the successful implementation process of ISO 14001 in university.


**Figure 3.** Importance Performance Analysis Diagram

### 3.5. EMS FOR UNIVERSITY IMPLEMENTATION IN INDONESIA

The first case study is a research (Pramono et al., 2017) that was done analyzing the university sustainability of Diponegoro University by using AHP and IPA (Pramono*et al.*, 2017). The study was analyzed 5 main criteria, which are: (1) Commitment and policy, (2) Planning, (3)

Implementation and Operation, (4) Management Review, and (5) Checking and Corrective action. Generally, the university has an overall good result in terms of compliance. From the AHP analysis, it is found that the most important criteria are the implementation and operation. This criterion relates to the allocation of resources and ensuring that operating procedures are were developed, recorded and widely communicated. The most important sub-criteria in for implementation and operation is that "Procedures periodically tested and reviewed." From the IPA diagram, it was found that quadrant 1 contain checking and corrective action criterion, the second quadrant contain implementation and operation as well as management review. In the fourth quadrant, it contains commitment and policies and planning. Criterion located in the first quadrant means that the institution needs to concentrate and improve on this criterion.

The second case study is a research that was conducted at Brawijaya University. For the AHP assessment, the researches spread questionnaires to five expert respondents. The scores to identify the importance of each criterion ranges from 1-9. The AHP assessment found that the most important criterion is the institution's environmental policy. From the AHP and IPA analysis, it was found that both the control of documents and institution environmental policy is the top priority in running ISO 14001.

From the case study, it can be observed that the studies have a slightly different method in running the AHP and IPA analysis. The first case study uses an IPA diagram, while the second case study multiplies the AHP values with the IPA values to find the highest value. It can also be observed that each university or higher education institution will have different criteria, depending on the environment and culture of the university itself. Although both methods might work, it might be beneficial to develop a standardized method of analysis that can be used and aid in the improvement of EMS implementation in higher education institutions in Indonesia.

Universities that are considering implementing EMS (or already implemented it) should look into AHP and IPA assessment as a possible tool to assess the success and find weak points in the implementation of ISO 14001 or other EMS options in Universities. It is observed that the institution that has implemented environmental management systems has a defined environmental agenda that assists in identifying goals, the institution's program parameters are simple to identify because it specifically defines the mechanism and the activities and the environmental factors that have already been established as being of significance.

### 3.6. EMS FOR HIGHER EDUCATION IMPLEMENTATION IN OTHER COUNTRY

Research in a European university (Lo-Iacono-Ferreira et al., 2018) tried to create a procedure for defining key performance indicators for EMS implementation in higher education institutions. The procedure includes defining the reporting organization, identifying environmental factors that are significant, defining goals, and key performance indicators. From the procedure, the researchers identified seven key performance indicators for the Universitat Politècnicade València (UPV). These include the Ratio of the consumption of clean energy to the gross electricity consumption, Ratio of recycled waste to the total generated waste, GHG emissions from machines and facilities equipped by combustion engines, boilers, and own vehicle use, Ratio of sustainable purchases over the total of purchases, Ratio of sustainable tenders over total tenders, the amount of GHG pollution from FTE students commuting and the amount of GHG pollution from FTE staff commuting. By identifying these key performance indicators, the organization can plan the necessary actions to improve the susainability of the university.

In India, there are several case studies of environmental management practices such as in Shiva Ji University in Maharashtra. The university carried out a green audit to track the usage of various environmental aspects on its university, such as water use, energy use and waste management. Then the university applied environmental efforts such as using composting in the university canteen, use of street light in an effective manner, no vehicle day, and many more initiatives (Bhandari & Raj, 2019).

From the case studies in other countries, it is found that developing key performance indicators or a method of green auditing for higher education institutions in Indonesia can help the institutions to develop plans and initiatives that are critical for each institution's needs.

## 4. CONCLUSION

The implementation of the environmental management system in higher education institutions has to be done starting from an environmental policy made by university adjusting to the ISO 14001, the environmental management planning, implementation, and assessment for evaluation. As an institution that creates future leaders, universities should start implementing environmental management practices that promote sustainable development and protection of the environment. These initiatives can focus on various environmental aspects, depending on the needs and culture of the university. Although, some case studies have shown that solid waste management is a common aspect that many institutions focus on several universities

which have been implementing an environmental management system but still need improvement. Identifying the important criteria and the key performance indicators of the university is an important step to ensure a successful implementation of environmental management systems, either ISO 14001 or other assessments. This can be done in several ways, such as AHP and IPA analysis or other unique assessment procedures. Further studies can be done on the application of criteria importance analysis integration with ISO 14001 in other types of institutions.

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