Integration of UI Greenmetric performance measurement on ISO 14001 implementation in higher education

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Abstract. Increasing sustainability concern in the world, encouraging the growth of higher education participation. Many higher education institutions adopt Environmental Management System (EMS) ISO 14001 and UI GreenMetric performance measurement separately to achieve sustainability. The two systems have similar goal but different approach related to sustainability. The objective of this research is to integrate UI GreenMetric performance measurement on ISO 14001 implementation in higher education. The similarity goals of them, making the analysis of the using of UI GreenMetric performance measurement in the implementation of ISO 14001 EMS in higher education needs to be done. Based on that analysis, it is known the agreement level of relationship between EMS ISO 14001 and UI GreenMetric by using frequency analysis, as well as the level of their implementations in higher education through mixed method. The result is UI GreenMetric performance measurement can be used to implement ISO 14001 EMS, so that it can support the achievement of environmental performance in higher education.

1. Introduction

Higher education activities and operations to fulfill its function has impact on the environment. Green campus is an effort by higher education institution to participate and promote in reduction of the negative impact on the environment [1]. Higher education have commitment for continuous improvement to protect environment [1, 2, 3, 4]. Environmental Management System (EMS) ISO 14001 have been implemented by many higher education institutions around the world. EMS ISO 14001 objectives are improvement of environmental performance and reduction of negative impact on the environment [5]. Moreover, higher education make efforts towards continuous improvement of environmental performance through EMS [1]. It indicates the importance of EMS implementation as an effort to achieve sustainability in higher education.

Previous studies proposed evaluation for environmental performance in higher education. The UI GreenMetric World University Ranking is an initiative of Universitas Indonesia which is being launched in 2010 for green campus assessment. There are 6 criteria with 39 indicators to measure the environmental performance in UI GreenMetric

Alshuwaikhat and Abubakar (2008) stated that ISO 14001 EMS is an effective tool for controlling processes in a system regarding to the environment, because it is considered to contribute in achieving the goals as green campus [1]. Thus, it can be said that the concept of a green campus and ISO 14001 EMS related each other.

2. Literature Review
2.1. Sustainability Concept
According to Jorge, Madueño, Cejas, and Peña (2014), the concept of sustainability is part of the merger between the economic, social, and environment dimension, published in the Brundtland Report by World Commission on Environmental and Development (WCED) in 1987 [6]. The concept of sustainability is often represented as a combination of the three dimensions of social, economic, and environment, in which sustainability is an area where an organization can operate and maintain the harmony of these values [7].

The economic dimension describes a system of production, distribution, and consumption of wealth or well-being, which can be generally defined as a sense of someone's needs satisfaction. Furthermore, the social dimension is described as a system of group life that considers the interests in maintaining and improving the standard of human life. Meanwhile, the environment dimension describes a system that provides integrity and protection of the ecosystems as well as pays attention on productivity and sustainable functioning of these ecosystems [7].

One of the effort to implement sustainability is the adoption of international standard such as ISO 14001 and ISO 9001. The adoption of these standards significantly improving several aspects, not only creates sustainable economic but also company competitiveness and operational performances such as production volume, production efficiency, and time efficiency [8].

2.2. Green Campus
Alsuwaikhat and Abubakar (2008) stated that the beginning of the sustainability concept in higher education is the existence of the Stockholm Declaration in 1972. The declaration described the relationship of interdependence between humans and the environment and proposed several ways to achieve sustainability. Then, the higher education continues to find ways to engage and deploy their resources in order to respond the challenges of a balance between economic, technological developments, and environmental protection. Thus, the higher education compelled to incorporate the concept of sustainability into the system being operated by them, through the implementation of green campus [1].

According to Alsuwaikhat and Abubakar (2008), green campus is a form of management for the higher education environment by considering the construction of environmentally buildings and transportation facilities. Environmentally building (green building) can help to reduce energy usage and improve comfort for the university. Then, the green on the transportation system (green transportation) in higher education can be achieved through the using of bicycles in the campus as well as the providing of public transportation for all staffs, students, and visitors. Thus, it can reduce emissions and congestion [1].

2.3. UI GreenMetric
According to Lauder, Sari, Suwartha, and Tjahjono (2015), UI GreenMetric is a tool developed by Universitas Indonesia to help the higher education measure sustainability efforts within the university environment [9]. UI GreenMetric’s advantage is its rating system and it can be used as a framework and standards guidelines for realizing the green campus, so higher education can achieve better rankings in the next evaluation. UI GreenMetric can help higher education to better understand what are the things should be measured by them. There are six categories on UI GreenMetric, namely setting and infrastructure, energy and climate change, waste, water, transportation, and education.

2.4. ISO 14001 Environmental Management System
Environmental Management System (EMS) is part of the organization's management system that aims to control the environmental aspects associated with activities, products, and services produced by them. ISO (2004) defines EMS as a set of elements that are interrelated and a part of the organization's management system used to develop and implement environmental policies as well as to manage the environmental aspects [10, 11]. There is sustainability process in EMS, in which the sustainability concept is defined by the Environmental Protection Agencies (2007) as an ability to achieve economic prosperity continuously to protect nature and provide a high quality of life for the people [12, 13].
Sustainability processes in EMS referenced to ISO 14001. ISO 14001 is an international environmental standards related to EMS which allows an organization to plan policies and objectives based on information about environmental influences [14]. Meanwhile, ISO 14001 as defined as an international standard based on the concept that environmental performance will be achieved when the environmental aspects are identified, so it contributes in improving the continuous improvement. Then, they stated that ISO 14001 EMS is not only as a system of environmental performance, but also can be used to control the sustainable development and creating value in the process of quality improvement [15]. Furthermore, according to ISO (2004), ISO 14001 guidelines consist of four clauses, which in the forth clause consists of clause 4.2 environmental policy, 4.3 planning, 4.4 implementation and operation, 4.5 checking, and 4.6 management review [10].

2.5. Frequency Analysis
In a research, researcher needs to make the description of the data presentation in tables and graphs. In table, the data are arranged according to a rule or a specific category so that, an overview of the data can be read easily and systematically. Then in graph, the data are visualized in images. By using frequency tables, it can be seen a general description of the data. The table is made with data sets that have been grouped by category or specific rules. Frequency table can be presented in the some columns, for example column variable categories, frequency, cumulative frequency, and cumulative percent [16].

2.6. Mixed Method
Sugiyono (2013) stated that a comprehensive data are complete data which is a combination of quantitative and qualitative data. With the combination of these methods, the data would be more valid. Thus, the data accuracy that can not be validated with quantitative methods, can be validated using qualitative methods, or conversely. Moreover, with mixed method, the reliability of the data that can not be tested using quantitative data, can be tested using qualitative data, or conversely [17].

3. Methods
This study use quantitative and qualitative data. For collecting quantitative data, the study use a research instrument, questionnaire. There are two questionnaires that should be designed, the first questionnaire is aim to determine the level of the relationship agreement between the requirements of ISO 14001 EMS with UI GreenMetric categories, and the second questionnaire is aim to determine their implementation level in higher education. Every statement in the questionnaire regard to the requirements of ISO 14001 EMS, clauses 4.2 to clause 4.6, and also six categories of UI GreenMetric. Then, for collecting qualitative data, the study use secondary data related to the implementation of ISO 14001 EMS and UI GreenMetric in higher education.

In designing of the first questionnaire, researcher was brainstorming with experts of UI GreenMetric. Next, determining the target respondents, the respondents are experts on sustainability and participant of UI GreenMetric. After that, questionnaire can be given to the respondents. In the process of collecting data, the questionnaire also gets revised from expert on sustainability, so it needs to be improved in some parts of the questionnaire. And then, in designing of the second questionnaire, the researcher used indicators in the implementation of ISO 14001 EMS based on Environmental Management Guide for the University from Environmental Protection Agency. For the assessment associated with the UI GreenMetric categories, it uses indicators of UI GreenMetric as statements in the questionnaire. The target respondents in second questionnaire are experts on sustainability and higher education that have been certifed ISO 14001. After that, the questionnaire can be given to the respondents.

From both of questionnaires, quantitative data were obtained, and then processed using frequency analysis. In the second questionnaire, for supporting the result of quantitative data, qualitative data will be used through the case studies. That data is about information related to the implementation of ISO 14001 EMS requirements and UI GreenMetric categories in respondents’ higher education. Furthermore, quantitative and qualitative data will be conducted a comparative analysis using a mixed method to determine the compatibility between quantitative and qualitative data that were obtained.
4. Results and Discussion

4.1. The Agreement Level Identification of Relationship between ISO 14001 EMS and UI GreenMetric

| Category                  | Setting and infrastructure | Energy and climate change | Waste | Water | Transportation | Education |
|---------------------------|-----------------------------|---------------------------|-------|-------|----------------|-----------|
| 4.2                       | 73                          | 81                        | 82    | 79    | 81             | 73        |
| 4.3.1                     | 71                          | 84                        | 84    | 82    | 80             | 68        |
| 4.3.2                     | 66                          | 70                        | 73    | 66    | 64             | 60        |
| 4.3.3                     | 70                          | 75                        | 78    | 78    | 74             | 74        |
| 4.4.1                     | 68                          | 70                        | 70    | 70    | 71             | 71        |
| 4.4.2                     | 64                          | 69                        | 68    | 62    | 70             | 76        |
| 4.4.3                     | 60                          | 72                        | 71    | 69    | 70             | 72        |
| 4.4.4                     | 64                          | 72                        | 68    | 61    | 61             | 62        |
| 4.4.5                     | 59                          | 64                        | 66    | 59    | 61             | 61        |
| 4.4.6                     | 65                          | 67                        | 71    | 71    | 69             | 64        |
| 4.4.7                     | 56                          | 66                        | 65    | 58    | 85             | 51        |
| 4.5.1                     | 78                          | 78                        | 77    | 77    | 67             | 64        |
| 4.5.2                     | 64                          | 72                        | 70    | 68    | 63             | 55        |
| 4.5.3                     | 57                          | 65                        | 63    | 64    | 62             | 57        |
| 4.5.4                     | 65                          | 64                        | 66    | 61    | 64             | 64        |
| 4.5.5                     | 66                          | 66                        | 64    | 64    | 69             | 60        |
| 4.6                       | 68                          | 66                        | 65    | 66    | 81             | 64        |

Based on the first questionnaire, the agreement level of relationship between ISO 14001 EMS and UI GreenMetric is obtained by using frequency analysis. The result is presented in Table 1.

4.2. The Implementation Level Identification of ISO 14001 EMS and UI GreenMetric in Higher Education

In this stage, quantitative and qualitative data is used to identify the implementation level of ISO 14001 EMS and UI GreenMetric in higher education. Based on the second questionnaire, quantitative data is obtained by frequency analysis, as presented in Table 2. Furthermore, qualitative data is obtained by case studies in respondents’ higher education.

| Category                  | Setting and Infrastructure | UI GreenMetric Categories |
|---------------------------|-----------------------------|---------------------------|
| ISO 14001 EMS Requirements |                             |                           |
| Environmental Policy      | 05,00                       | 04,00                     |
| Planning                  | 04,00                       | 02,52                     |
| Implementation and Operation | 04,53                      | 04,37                     |
| Checking                  | 04,23                       | 02,83                     |
| Management Review         | 05,00                       | 03,42                     |
| Total                     | 22,76                       | 15,21                     |
| UI GreenMetric Categories |                             |                           |
| Setting and Infrastructure | 04,00                       | 03,31                     |

Table 1. Survey result.

Table 2. Calculation result of the implementation ratings of ISO 14001 ems and UI Greenmetric in higher education.
4.3. Case Study in Higher Education: University of Cadiz

The explanation related to the implementation of ISO 14001 EMS and UI GreenMetric can be outlined as follows:

A. ISO 14001 EMS Implementation

- Environmental policy: The higher education ensures that its policy includes a commitment to comply with the rules related to environment.
- Planning: The higher education implements the law and the current environmental regulation as well as ensures its compliance with the rule in future to manage the environment.
- Implementation and operation: The higher education implements the updating principle which aims to ensure the formation of human resources continuously to address environmental challenges in higher education and also implements external communication with suppliers.
- Checking: The higher education ensures the compliance of legal rules and procedures that have been designed and implemented for environmental management.
- Management review: The higher education evaluates its commitment to ensure the compliance with environmental problems in the future.

B. UI GreenMetric Implementation

- Setting and infrastructure: The higher education has done infrastructure planning effort that pay attention between the design and the using of open spaces and buildings with environmental impact.
- Energy and climate change: The higher education tries to pay attention in resource management by the using of renewable energy to reduce environmental impact.
- Waste: The higher education tries to do residue management effort to optimize the management of residues or waste materials generated from various activities, as well as improves reuse and recycling activities.
- Water: The higher education makes efforts to pay attention in resource management through water usage.
- Transportation: The higher education have paid attention for the suitability of infrastructure planning between the designing and using of the road with environmental criteria in their area.
- Education: The higher education provides environmental education to promote environmental practices and raise awareness contributing to solve environmental problems. [17].

4.4. Case Study in Higher Education: Vytautas Magnus University

The explanation related to the implementation of ISO 14001 EMS and UI GreenMetric can be outlined as follows:

A. ISO 14001 EMS Implementation

- Environmental policy: The higher education needs to develop environmental policy consistently and implements them efficiently.
- Planning: The higher education has arranged their environmental goals. However, between short-term and long-term goals have not been indicated properly.
- Implementation and operation: The higher education cooperates with stakeholders from the outside. In other words, they have established an external communication well.
- Checking: The higher education has implemented the measurement and reporting properly.
- Management review: The higher education makes the changes to environmental policy, but it still needs attention to keep it running consistently.

| Category                  | University of Cadiz | Vytautas Magnus University |
|---------------------------|---------------------|---------------------------|
| Energy and Climate Change | 04,76               | 04,00                     |
| Waste                     | 04,82               | 05,00                     |
| Water                     | 05,00               | 05,00                     |
| Transportation            | 04,00               | 02,83                     |
| Education                 | 05,00               | 04,31                     |
| Total                     | 27,58               | 21,36                     |
B. UI GreenMetric Implementation

- Setting and infrastructure: The higher education allocates financial resources for infrastructure development and renovation as the sustainability efforts.
- Energy and climate change: The higher education tries to do energy saving and reduction of greenhouse gas emissions.
- Waste: The higher education has Go Green program that invites to reduce the using of paper and promotes recycling. However, this program has not been implemented in all areas.
- Water: The higher education pays attention in water usage and saving water.
- Transportation: The higher education executes Go Green program promoting the using of public transportation. But, it has not been implemented in all areas.
- Education: The higher education has provided several courses for their students that related to environmental and sustainability topics.

5. Discussion

5.1. The Agreement Level Analysis of Relationship between ISO 14001 EMS and UI GreenMetric

Referring to Table 1, it can be seen that the respondents agreed if each ISO 14001 EMS requirements associated with each UI GreenMetric category. The explanation as follows:

1. Setting and Infrastructure Category

   Based on Table 1, it can be seen that all requirements of ISO 14001 EMS are assessed agree related to setting and infrastructure category. It shows that the implementation of them need to be considered in this category. However, the implementation of monitoring and measurement requirements obtain the highest relationship rating with setting and infrastructure category. Higher education concentrate on infrastructure development activities that pay attention in the green area to protect the environment for achieving sustainability through this category. Thus, it is important for higher education to monitor and measure the infrastructure development activities in order to keep attention to environmental impact. Therefore, the implementation of these requirements should be considered to support the achievement of the performance in this category.

2. Energy and Climate Change Category

   Based on Table 1, it can be seen that all requirements of ISO 14001 EMS are assessed agree related to the category of energy and climate change. This shows that the implementation of them is also worth noting in this category. But, the implementation of environmental aspects requirement obtain the highest relationship rating with energy and climate change category. Higher education concentrate to achieve sustainability in this category through the using of energy efficient and environmental friendly. Thus, it is important for higher education to know the negative impact of energy sources used. Therefore, the implementation of this requirement should be considered to support the achievement of the performance in energy and climate change category.

3. Waste Category

   Based on Table 1, it can be seen that all requirements of ISO 14001 EMS get agree assessment related to the category of waste. It shows that the implementation of all requirements of ISO 14001 EMS need to be considered in this category. However, implementation of the environmental aspects requirement is given the highest relationship rating with waste category. To achieve sustainability in the category of waste, higher education concentrate on management and recycling of waste. Thus, it is important for higher education to know the negative impact caused by the waste management that is not good. So that, the implementation of the requirement should be considered to support the achievement of the performance in this category.

4. Water Category

   Based on Table 1, it can be seen that all requirements of ISO 14001 EMS are assessed agree related to the category of water. This shows that the implementation of all requirements of ISO 14001 EMS need to be considered in water category. But, implementation of environmental
aspects requirement get the highest relationship rating with water category. Higher education concentrate to achieve sustainability in this category through water management activities in order to use more efficient. Thus, it is important for higher education know the negative effects caused by the uncontrolled using of water. Therefore, the implementation of that requirement should be considered to support the achievement of the performance in water category.

5. Transportation Category

Based on Table 1, note that all requirements of ISO 14001 EMS are assessed related to the category of transportation. It shows that the implementation of all requirements of ISO 14001 EMS need to be considered in this category. However, the implementation of environmental requirements objective and management review obtain the highest relationship rating with transportation category. Higher education is focus to achieve sustainability in this category through the transportation system management. Thus, it is important for higher education to arrange the environmental policy and management review related to the activities of transportation in their areas. It aims to reduce the negative impact on the environment due to air pollution generated by vehicles in it. Thus, the implementation of the requirements should be considered to support the achievement of the performance in the category of transportation.

6. Education Category

Based on Table 1, it can be seen that all requirements of ISO 14001 EMS are assessed agree relate to the category of education. This shows that the implementation of all requirements need to be considered in this category. But, the implementation of goals, objectives, and program requirement is scored the most related to education category. Higher education is focus to achieve sustainability in this category by providing educational activities related to the environment. Thus, it is important for higher education to determine the goals and objectives of the activities. Through the appropriate program, the higher education can achieve the goals and objectives that have been determined previously. So that, the implementation of that requirement should be considered to support the achievement of the performance on education category.

5.2. The Implementation Level Analysis of ISO 14001 EMS and UI GreenMetric in Higher Education

Analysis of the implementation level from ISO 14001 EMS and UI GreenMetric can be done by comparing the quantitative data, based on the assessment of respondents on the second questionnaire that is presented in Table 2, as well as qualitative data, based on information about the real implementation of ISO 14001 EMS and UI GreenMetric in higher education.

Based on Table 2, it can be seen that the average assessments of the implementation of ISO 14001 EMS requirements and UI GreenMetric categories at University of Cadiz are respectively 22.76 and 27.58. Meanwhile, Vytautas Magnus University get average assessments of implementation of ISO 14001 EMS requirements and UI GreenMetric categories respectively are 15.21 and 21.36. The ideal total scoring for the entire statements in ISO 14001 EMS if all respondents answered strongly agree is 25. Then, for the entire statement on the UI GreenMetric if all respondents is strongly agreed, it will obtain 30 an ideal total scoring of 30.

Based on the above explanation, University of Cadiz is considered to have implemented ISO 14001 EMS and UI GreenMetric better than Vytautas Magnus University. Meanwhile, from the case studies, overall University of Cadiz have implemented ISO 14001 EMS and UI GreenMetric well. Then, at Vytautas Magnus University, although the implementation of ISO 14001 EMS requirements and UI GreenMetric categories are good, but there are still lack that must be improved in order to increase their achievement. This indicates that there is no difference between quantitative and qualitative data generated from both higher education. Thus, qualitative data can support quantitative data.

Overall, it can be said that the implementation of ISO 14001 EMS and UI GreenMetric interrelated. If higher education implements the ISO 14001 EMS very well, then the result of environmental performance, which is measured by using of UI GreenMetric, is also very good. However, if the implementation of ISO 14001 EMS in higher education is not good, then the result of environmental performance is also not good. So that, environmental performance in higher education can be achieved as expected by implementing both concepts properly.
6. Conclusion
Both of UI GreenMetric and ISO 14001 EMS are aim to achieve sustainability regard to the environmental aspects of the organization, in this case the higher education. Thus, it is important to analyse the using of UI Green Metric performance measure in the implementation of ISO 14001 EMS in higher education. By doing this analysis, it will be knew the requirements of ISO 14001 EMS are considered related to the UI GreenMetric categories and the implementation of the ISO 14001 EMS requirements for environmental performance in higher education that measured by UI GreenMetric categories. Therefore, it is expected to improve environmental performance at the higher education.
Based on the analysis of the relationship agreement level between the requirements of EMS ISO 14001 and category UI GreenMetric, it obtains the conclusion that each ISO 14001 EMS requirement have relationship with one of the categories in UI GreenMetric. So that, the implementation of these requirements is considered supporting the achievement of environmental performance based on categories of UI GreenMetric. Furthermore, from the analysis of their implementation level, it can be concluded that the implementation of ISO 14001 EMS can support the achievement of environmental performance measured by UI GreenMetric. Through the implementation of ISO 14001 EMS, the environmental management process can be controlled, so that the environmental performance can be improved. Therefore, in the implementation of ISO 14001 EMS in higher education, UI GreenMetric performance measure can be used to improve the environmental performance achievement.
Time limitations of the study cause the data that are collected has not met expectations. It is because the lack of the number of respondents who give feedback on the study. Thus, this study still needs to be further investigated with more number of respondents in order to obtain a more valid research results. For further research, it can integrate ISO 14001 EMS and UI GreenMetric as an environmental performance measurement method in higher education that more comprehensive.

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