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Development of Sustainability Assessment Tool for Malaysian hydropower industry: A case study

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Development of Sustainability Assessment Tool for Malaysian hydropower industry: A case study

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Abstract. This research deals with the development of sustainability assessment tools as a medium to assess the performance of a hydropower project compliances towards sustainability practice. Since the increasing needs of implementing sustainability practice, developed countries are utilizing sustainability tools to achieve sustainable development goals. Its inception within ASEAN countries including Malaysia is still low. The problem with most tools developed from other countries is that it is not very comprehensive as well as its implementation factors are not suitable for the local environment that is not quantified. Hence, there is a need to develop a suitable sustainable assessment tool for the Malaysian hydropower industry to comply with the sustainable development goals as a bridging gap between the governor and the practitioner. The steps of achieving this goal is separated into several parts. The first part is to identify sustainable parameters from established tools as a model for comparison to enhance new parameters. The second stage is to convert equivalent quantification value from the model to the new developed tools. The last stage is to develop software program as a mean of gaining energy company feedback with systematic sustainable reporting from the surveyor so as to be able to integrate sustainability assessment, monitoring and reporting for self-improved reporting.

1. Introduction

Sustainability can be stated as new implementation that can cater the needs of current situation without sacrificing future needs of next generation [1]. Sustainable development has become the main concern among energy industrial player [2]. During the past, quality of services has become the main interest in expending business venture. The last decade seen major changes in a company policy when producing business services [3]. The introduction of Sustainable Development Goals (SDGs) by the United Nations (UN) act as the main factor of improving the sustainability development [4-5]. The Bursa Malaysia as the authority that governs Malaysian-based public listed companies (PLCs) wants to emphasize the corporate transparency on environmental, society and corporate governance related issues. They introduced requirements listing for a new sustainability framework to the amended Sustainable Reporting Guide and Toolkit. Since its deception in 2015, PLCs are required to enhance corporate social responsibility (CSR) on sustainability reporting. The new implementation plays a major role towards more sustainable business practices and increasing competitiveness in the market [6-7].

The sustainability assessment (SA) tools can be recognized as a significant tool to assist towards a sustainability reporting production in addition to aid transformation towards sustainability [8-9]. It quantifies parameters that previously only qualifying the effects towards sustainability. SA tools assist

decision-makers to decide the very best option they have to create a more sustainable society. The SA have a definite target towards sustainable development through plan, system or activity. The SA thinking has been projected from several initially assessment method focusing on environmental. The Environmental Impact Assessment (EIA) as the first generation address the increasing pressure on human environment, following the economic and social transformation and resulted in public environmental concerns [1]. Strategic Environmental Assessment (SEA) as the later generation for assessment of Policies, Plans and Programs (PPPs). These assessments lead to extension of environmental assessment through SA. Therefore, SA is generally considered with same definition of EIA-driven that specify a model that is integrating social, economic and environmental impacts. Thus, SA is a crucial aspect to secure a long-term value creation for company and society. There are several green environment practices assessment tools which have matured remarkably since the introduction of the Green Project Management (GPM) P5 method [10].

The above examples indicate that there are many assessment tools focusing on triple bottom line: people, planet, profit, product sustainability perspective and process sustainability perspective. The focus of current practices is turned to developing assessment frameworks and tools for sustainability practices. This can be regarded as another step towards fulfilment Bursa Malaysia requirement of pursuing sustainable development at the local level.

There is a scant amount of research evaluating their sustainability performance and effectivity. The current sustainable assessment approach includes 3P (People, Planet, Profit) elements but they are individually assessed. It caused many individual reports to be produced. In terms of sustainability impact, it causes difficulty of criteria measurement, hard to control and thus become impossible to self-improve as the weak area is hard to be determined [11]. Most assessment focuses on Life-Cycle Assessment (LCA) method. The assessment are only concerns with environment, social and financial [12-13]. There is a need to unify the sustainability criterions for preparation of sustainability reporting. The most significant review regarding sustainability practices is that researches had been conducted thoroughly in western countries while it is more or less new among developing countries including Malaysia.

There are problems associated with the selection of criteria and transferability of SA tools to other contexts [14]. These studies are mainly focused on one of the existing tools, and are primarily aiming at providing a general introduction of the tools. They could also be mentioned with associated problems concerning weighting, criteria selection, and lack of a systems approach. However, there is still a lack of in-depth critical evaluation of the SA tools. Thus, the flaw in the reporting tool should be reassessed by the introduction Systematic Sustainability Assessment (SSA) providing guidelines to the industry to measure their level of sustainability compliance [15]. The resulting assessment tool will help the Malaysian hydropower industry to comply on sustainability reporting based reassessed weak criterions area.

This general objective of the project is to encourage sustainability perception in the Malaysian hydropower industry. It measures the current practices of sustainability compliances based on their feedback result.

    i.   To investigate the level of sustainability compliance using GPM P5 standard.
    ii.   To quantify sustainability parameters related to hydropower industry in Malaysia.
    iii. To develop software program that are able to compute the level of sustainability compliances.

This project begins with an introduction about the background of assessment practices, the significance of conducting assessment in the Malaysian hydropower industry, previous researches on SA tools, and aims of the study. An overview of proposed SSA tools, and selected tools for further analyses are briefly introduced. The criteria used for analyses and framework designed for this research will be presented. In addition, tools are analysed against the framework designed. Each sub-section of this part of the project deals with one of the five criteria identified in methodology. In each sub-section, first the justification for choosing the criterion, its importance, and its optimal state are described. At the

end of the project, the findings of this study are discussed and makes some suggestions for consideration in the future refinements.

2. Methodology

Generally, Table 1 shows the relationship of the research methodology that need to be carried out to fulfil all the objectives of this study. The selection of the method used for each objective as shown in Table 1 should meet the requirement of the study in order to gain as much as information to complete the project and also to avoid error occurs in the future. Each method is arranged systematically and in detail according to what should be done first and then followed by the next steps which require the information from the previous method. This means, each method is interrelated and interdependent with each other.

Table 1. Relation between objectives and methodology.

Objectives	Methodology

To investigate the level of sustainability compliance using GPM P5 standard.	1. Define phase
	  - Observation
	  - Problem statement
	  - Survey
	2. Measure phase
	  - Sample inspection
	  - Experimental study

To quantify sustainability parameters related to hydropower industry in Malaysia.	3. Analyse phase
	  - Statistical analysis
	4. Verification phase
	  - Sustainability performance evaluation

To develop software program that are able to compute the level of sustainability compliances	5. Develop desktop program
	  - Visual studio community2015
	6. Validation
	  - Evaluation of program model
	  - Sustainable measurement index

2.1. Data Collection

Data collection is of utmost important to test the developed program in the project to analyse its capability before making improvements from the problems that occurs in the Malaysian industry. The next step of data analysis is the quantification using "Weighing scale" and "Criteria based" [16]. Results from the calculated technique is to be interpreted from data tabulation on the line graph.

The data gathering process was conducted from several departments of the tested energy company. Data input using the developed program was distributed to the listed departments. Data was then being inserted in the scoring input window. The chosen correspondence came from several departments that is related to the Malaysian hydropower industry.

The "Weighting scale" is used during the distribution of the research questionnaire where the 6 value alluding to the highly positive impact meanwhile the 0 rating scale will show the highly negative impact of the sustainability compliance level in those companies. The departments involved in this field of study are:

 i.   Department of Compliance and Enforcement
 ii. Department of Project Construction
 iii. Department of Technical
 iv. Department of Environmental Quality
 v.   Department of Quality

The P5 concept integration matrix describes in the following paragraph:

 i.   Product impacts – objectives and efforts, lifespan and servicing

ii.   Process impacts – maturity and efficiency
iii. Society (People) – labour practices and decent work, society and customers, human rights, ethical behaviour
iv.   Environment (Planet) – transport, energy, water, waste
v.   Financial (Profit) – return on investment, business agility, economic simulation

3. Case Study Results

3.1. Overall Sustainability Score

The main point of results at this part is where the research feedback at the energy company is being mapped on the scoring board which has been injected by the GPM P5 Standard as the guideline. It can be seen on the scoring board in Figure 1 where it comprises of the five sustainability elements which are correlated to each other. Apart from that, the relation of the environmental, social and financial elements with the product and process part in the waste management system are being illustrated in the pie chart at each of the departments.
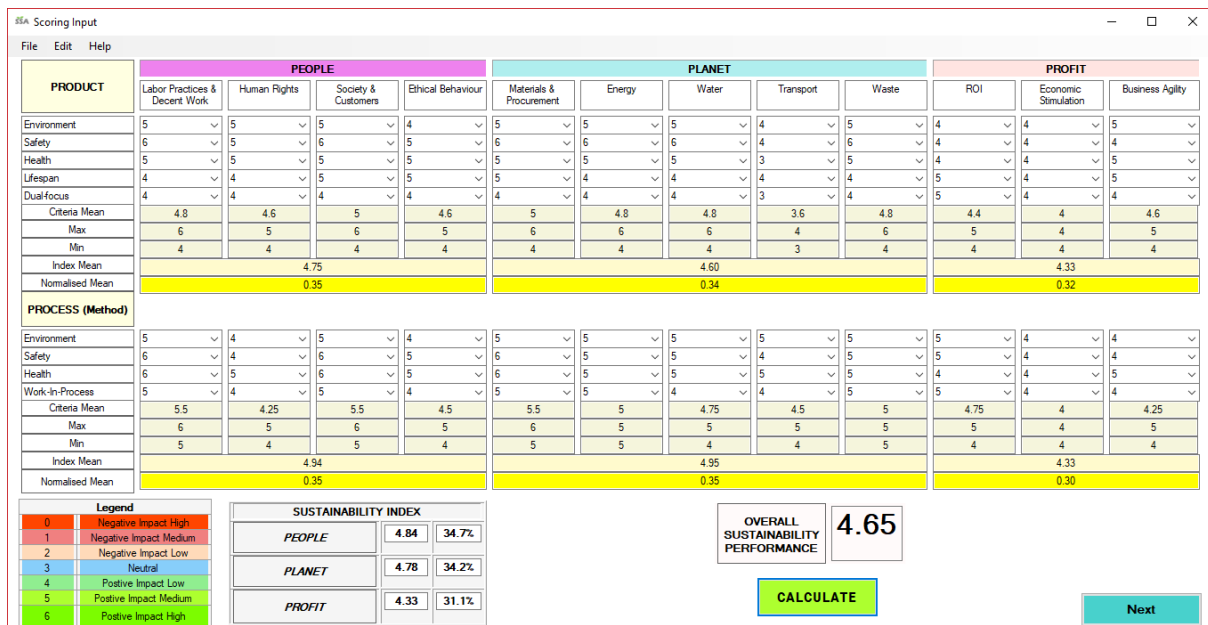

Figure 1. SSA Tools Scoring Input Worksheet window.

Compliance and Enforcement department and the department of quality shows the result of the sustainability assessment where it is still at the partially complied level. Here, the overall percentage result of the research survey of the both departments marks on the 53.67% only which are not quite a good compliance level of sustainability appraisal. In addition, the example of division percentage of the three elements that parallel to the other two parts of Product and Process for Compliance and Enforcement department are also being illustrated in the pie chart as Figure 2 and Figure 3.

Eventually, for the department of Quality, the percentage outcomes from the pie chart (refer Appendix) of the 3P's factor (People, Planet and Profit) when interconnected to Process aspect are 32%, 35%, and 33% subsequently. Aside from that, the relation of the 3P's factor (People, Planet and Profit) with the Product itself comprises of 34%, 33% and 33% respectively.
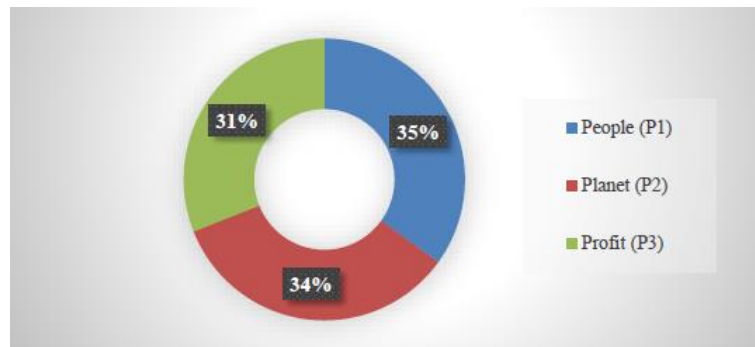
Figure 2. Percentage division of 3P's element according to Process element (Compliance and Enforcement department).
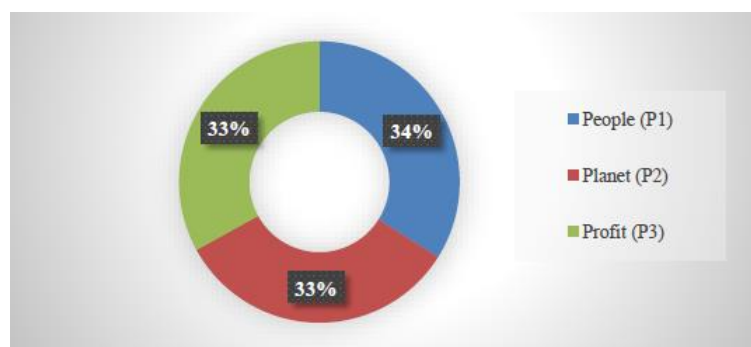
Figure 3. Percentage division of 3P's element according to Product element (Compliance and Enforcement department).

Moving on to the next point is the departments of the Project Construction and the department of Technical which have shown the moderate level of the sustainability compliance in their assembly line of the production. Their implementation degree of the "green" assessment that covers those five elements is only at 53.33%. This situation displayed us that the assessment performance is does not thoroughly practiced.

For the Technical department, the results exhibit the society, nature and economical aspect to be 34%, 35% and 31% correspondingly when connected to the Process component. In addition, the yielding results of those elements when being mapped into the pie chart diagram shows the percentage of the society to be 37%, nature to be 30% and economy to be 30% when interconnected to the Product factor. The outcome from the pie chart that embraces the relation of all sustainability constituents shows that the relation of Process part to the 3P's components which are People, Planet and Profit lies on the 35%, 34% and 31% respectively. Meanwhile, the calculated percentage that associated to the Product part along with the People, Planet and Profit are 35%, 34% and 31% respectively.

Consequently, the highest level of the overall project sustainability score is only 53.8% which also resembles the moderate level of the sustainability assessment only. The outcome from the figure of the percentage division for human, earth and the financial earning related with the Process constituent's marks on 35%, 35% and 30% correspondingly while the three elements when being interconnected with the Product will show the reading of 35% for human, 33% for our earth nature and 32% for the financial side.

3.2. Criteria Based Analysis. Here, at this section the data discussion will continue to be emphasized on the criterion based towards the sustainability compliance in the environmental management system for Malaysian context industry. By referring back to the formulated data that has been normalised earlier, the gap difference of the human's perception can be integrated to the sustainability assessment level of compliance by finding the value of the standard deviation from the raw data collected.

The data result has been sorted according to the each of the criteria that will interconnected to the Product and Process elements. It will demonstrate on how the data being normalised to get the spreading tendency of the data. This outcome is the utmost important peak point that will help to understand more about the relation of the sustainability assessment in the environmental management system.

3.2.1. Process. The value of the data that covers from the five departments that have been mentioned earlier are being sorted according to the twelve criterions. The maximum and minimum value of the data can be determined directly from the categorised element while the average number at each of the criteria are being computed. These calculated values indicate that the lower the value of the difference between the maximum and minimum value, the better the result is and vice versa.
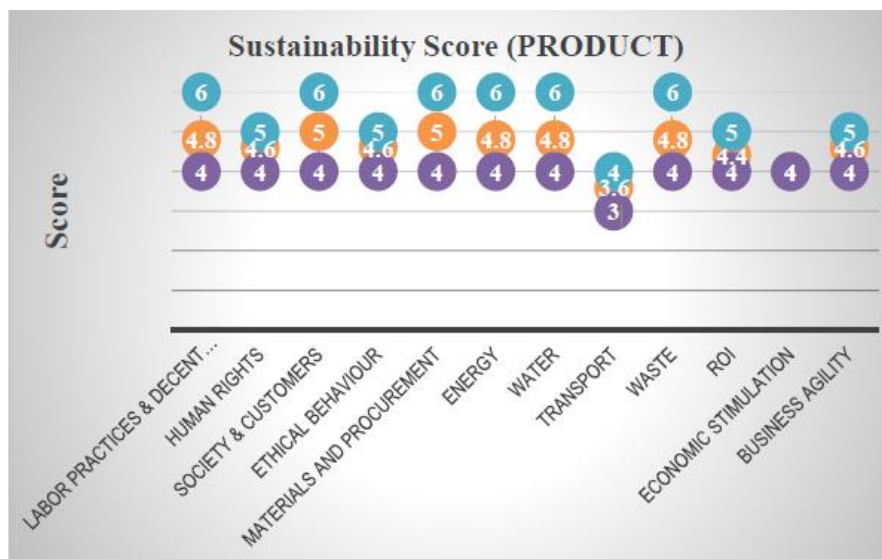

Figure 4. Process line graph.

Referring to the graph in Figure 4, it shows that the gap difference of the maximum rating value of the Society and Customers that is from the People group is on the uppermost rank amongst all of the criterion which marks on 1.0 value. It shows that, this part of element is essentially needed the enhancement of improving the understanding of the sustainability concept in the environmental management system. Meanwhile, the zero value of the disparity between the maximum and minimum number of the rating values are from the Planet element which are (Water) and (Waste). It demonstrates that these parts are having no gap difference of understanding among the twelve criterion listed.

3.2.2. Product. Graphically, the result in Figure 5 shows that there are several criteria having the same value of the gap difference of the understanding about the sustainability assessment in their company scope of the environmental management system. The value of the Ethical & Behaviour from the People portion, Energy from the Planet division and Return of Investment (ROI) along with the Economic Stimulation from the Profit part is 0.8 which is similar to each other.

In contrast from the Product line graph in Figure 5, the gap distinction of understanding in the terms of Product is the superlative one which is zero value by means there is no variance of ideas in the sustainability concept in the Malaysian hydropower industry. Thus, this situation will make the process of reaching the main goals of this research study to be easier where the lower the gap difference of understanding variation, the better the results of the project study will be achieved.
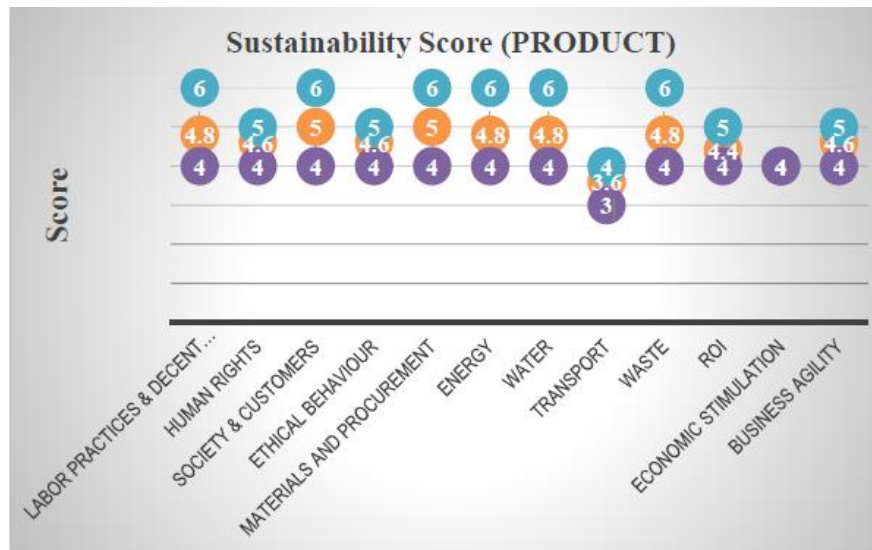
Figure 5. Product line graph.

3.2.3. Statistical Analysis. Moving on to the next part of this topic is the significant value of the standard deviation. The standard deviation can be defined as a numerical value in the units of the observed values that measures the spreading tendency of the data. Hence, the greater the value of the standard deviation at each of the criterion, it will indicate the challenging task in aligning them to the targeted objectives of this study will become harder and vice versa.

Concerning to Process bar graph in the Figure 6, it represents the standard deviation value according to each criteria from those elements in the sustainability assessment in the declining order. The highest value of the spreading tendency goes to the Society and Customer from the People group by 0.41 which is the highest rate among others. In addition, there are two types of the criteria from the Planet element which are Water and Waste that are having similar value of the dispersion of the data which indicates zero value. This situation shows that the outcomes from this part are showing such a good quality of sustainability measurement.

In contrast, the overall dispersion of the cumulative data is showing quite an enormous divergence in their understanding level of the sustainability compliance. It can be clearly seen when the disparity between the first highest value of the criteria which are Society and Customer along with the Transport part in the Planet group with the last two criterion which are previously stated is quite a huge difference value. 0.41 value marks that this restraint is compulsory to be reduced or even removed in the future.
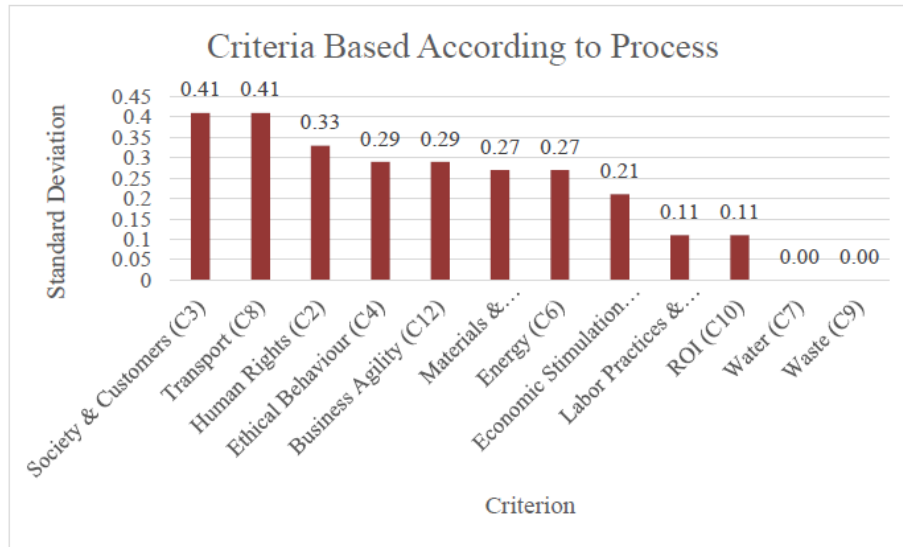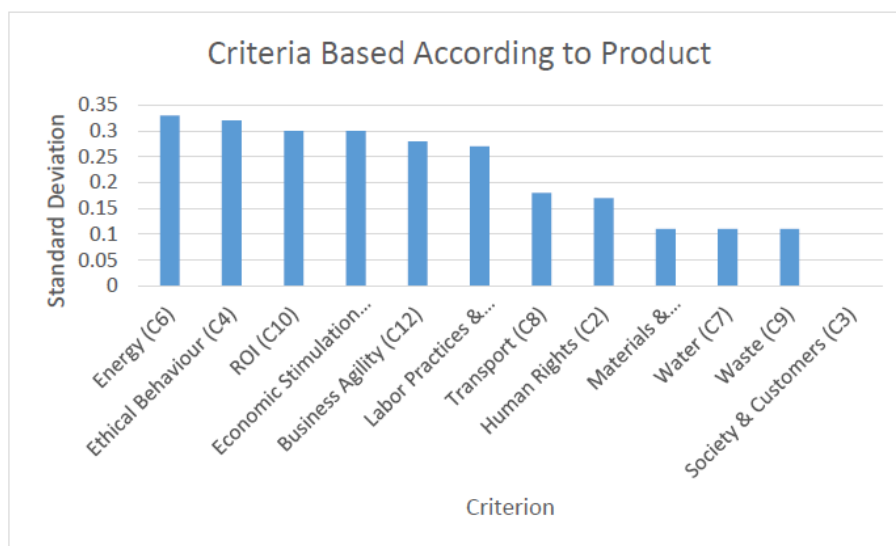
Figure 6. Process bar graph illustrating the rank value of the standard deviation.

Continuing to the Product bar graph in Figure 7, the Energy part which comes from the Planet criteria is laying on the topmost of the ranking. The value of the spreading tendency from this criteria is 0.33 only. Consequently, the overall overview of the criteria based graph in terms of the Product is portraying a slightly minimal value of the standard deviation obtained from the formulated data.

In contrast, there is only one criteria in this data that is having zero value of the dispersion data which is Society and Customers that comes from the group of People. It indicates that most of the interpretation from the respondents seems unbalance even though its having lower value of the spreading. Hence, the overall observation portraying that there is quite a challenging mission of this research study in order to succeed the goals.

Figure 7. Product bar graph illustrating the rank value of the standard deviation.

The example of SSA tool dashboard from the program is shown in Figure 8.

Figure 8. SSA Tools Dashboard Results window.

4. Conclusions

Conclusively, this research work is focusing on the sustainability assessment in the environmental management system for Malaysian hydropower of industry. By means, it represents on how to integrate the current assessment for the sustainability concept for the environmental management system especially in hydropower industry. The existed approaching systems are not still in the deficiency level; hence it acquires a new solution to overcome this recent problem.

Most of the respondents that involve in this project research are having diverge of understanding about the sustainability compliance. The ideas towards this assessment are only restricted on the existed sustainability tool of measure which does not comprises of the product and the process elements. Since the new integrated sustainability system approach is introducing the five components into the assessment, the outcomes will surely across-the-board of the current assessment in the sustainability practices.

In addition, it will help to fill the knowledge gap towards the sustainability compliance concept and provides new opportunities for further studies. Hopefully, the findings of this study will become a benchmarking purposes and as a point of references for the identifications in Malaysian hydropower industry.

Acknowledgments

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