Development of hydropower sustainability assessment method in Malaysia context

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Development of hydropower sustainability assessment method in Malaysia context

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Abstract. Nowadays, sustainability is becoming one of the crucial requirement to business success today. This requirement is strongly supported by Bursa Malaysia. In their webpage, they stated that an entire way to business management, incorporating economic, environmental, social and governance considerations alongside financial ones, will serve as a sound business model that supports business continuity and long term value creation for stakeholders and society at large (Bursa Malaysia website, 21th April 2016). This proved that companies need to take sustainability as one of their aspect performance as well as an energy company. Apart from that, energy companies in Malaysia are facing problems as there is still no systematic assessment of sustainability. Before this, Malaysia energy companies assess their large projects based on Environmental Impact Assessments (EIAs) requirement. However, the EIAs mostly covers the environmental issues related to the projects. The EIAs give less attention to the social aspects and economical aspects. In addition, there are still not many companies comply all the three aspects together. So, this study is to help the energy companies to discover the systematic assessment of sustainability. In developing sustainable project, they need to include many criteria that cover the environmental, economic and social aspects at all stages. Thus, the new version of Systematic Sustainability Assessment (SSA) that apply the Hydropower Sustainability Assessment Protocol (HSAP) is used as a guideline to achieve sustainability in Malaysia energy companies. This tool will guide the energy company on how to assess the sustainability in their project and see the performance of the project.

1. Introduction

Sustainability refers to the long-term maintenance of systems according to environmental, economic and social consideration [1-4]. It can be divided into 3Ps which is planet, people and profit [5]. But, recently there is another two P's added which are process sustainability and product sustainability [6]. Both of these two aspects are important for achieving sustainability. Currently, the hydropower sustainability is developed in Malaysia. This is because hydropower is used as power generation. Besides, hydropower is a renewable energy source that has less negative impact to environment as it produces negligible amounts of greenhouse gases.

The development of hydropower will lead to the emergence of environmental issues and social issues [7]. As the hydropower sustainability is getting attention from governments and industry, it is vital for Malaysia to have sustainability assessment method that covers all stages and issues in the hydropower projects. However, the situation in Malaysia currently is there no systematic evaluation of hydropower

because the one that they use which is Environmental Impact Assessments (EIAs) only focused on environmental aspects and cover the early stage of the project [8].

In order to help them with these problems, this study introduces new Systematic Sustainability Assessment (SSA) [9] method. This new SSA will provides a guideline to the governments and hydropower industry on how to attain hydropower sustainability.

2. Methodology

The general framework of the approach is as portrayed in Figure 1.

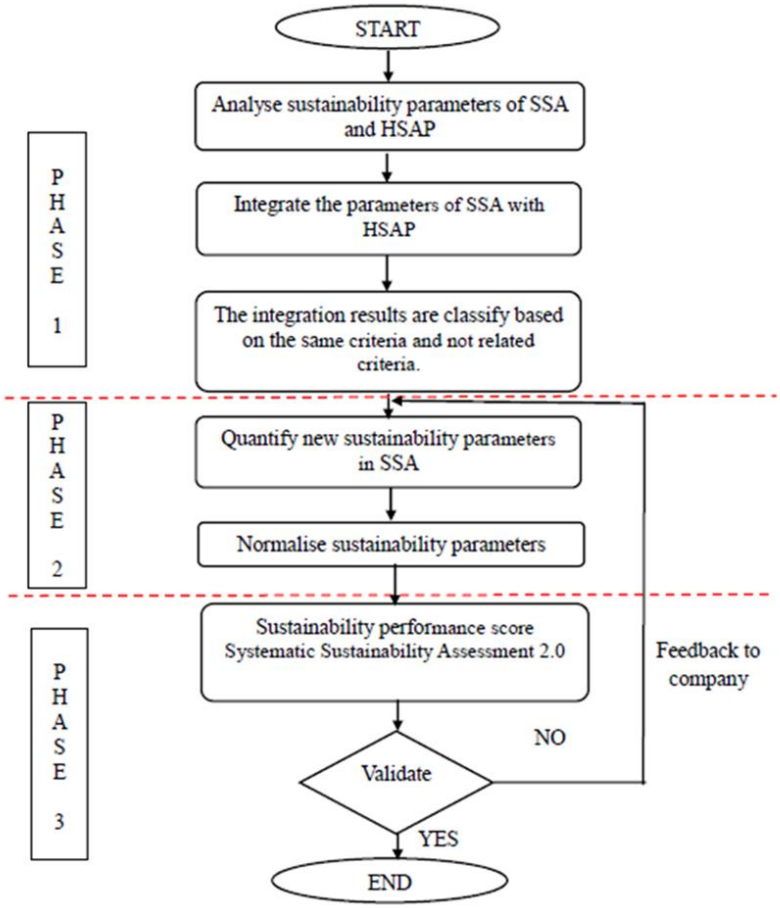

Figure 1. Flow chart of the research

2.1. Phase 1

In this phase, twenty-three criterions of HSAP [7] are classified based on P5 concept integration matrix. The results of this phase are classification of these criterions based on the same criteria and not related criteria between GPM P5 with HSAP. Subsequently, the result of both the same criteria and not related criteria will be used as parameter in SSA version 2.0.

2.2. Phase 2

The scale between 0 to 6 was developed to ease the respondents' group for rating the evaluation criteria. For this phase, an energy company in Pahang is visited to collect some data. There are five departments that are being chosen to do the data collection process. The departments involved are Department of Compliance and Enforcement, Department of Project Construction, Department of Technical, Department of Environmental Quality and Department of Quality. Table 1 describes the scale of "Weighting criteria" in more detail.

Table 1. Scale of "Weighting Criteria" from 0 to 6

Numerical Rating	0	1	2	3	4	5	6
Description	Negative high impact	Negative medium impact	Negative low impact	Neutral	Positive low impact	Positive medium impact	Positive high impact

As the data is gathered from the company, this phase is proceeds with quantifying and normalizing the data gathered according to with "Functional Based" and "Criteria Based". For the "Functional Based", the data is being summarized based on the "Same Criteria" and "Not Related Criteria" that is equated to the Product and Process factors. Meanwhile, the "Criteria Based" is being illustrated according to each of the criterions. For each criterion, the minimum, average and maximum values is computed. The standard deviation of each criterion is determined to identify the sustainability compliance level in the company.

2.3. Phase 3

Result of sustainability compliance ratio of each sustainability parameters are proposed to be ranked as shown in Table 2 below. All the departments of the company sustainability score will be compared to proposed sustainability ranking to recognize they are at which level of sustainability.

Table 2. Proposed ranking of sustainability compliance

Sustainability Score	**Sustainability Impact**
0-2	Negative impact
3	Neutral
4-6	Positive impact

3. Results

3.1. Criteria integration matrix

There are twelve criterions of GPM P5 and twenty- three criterions of HSAP. These twenty- three criterions of HSAP are integrated with the twelve criterions of GPM P5 according to the P5 concept integration matrix. The results of the integration process are shown in Table 3 and Table 4 below. Based on Table 3, there are ten criterions of HSAP that are related with GPM P5. Meanwhile, the not related criteria of HSAP with GPM P5 consists of thirteen criterions.

Table 3. Same characteristics between GPM P5 with HSAP

GPM P5	**HSAP**
1. Labour practices & decent work	1. Labour & working conditions (C1)
2. Human rights	2. Affected Communities (C2) 3. Resettlement (C3) 4. Indigenous People (C4)
3. Society & customers	5. Public health (C5)
4. Materials & procurement	6. Procurement (C6)
5. Water	7. Water quality (C7)
6. Return on investment	8. Economic viability (C8)
7. Economic stimulation	9. Project benefits (C9)
8. Business Agility	10. Financial viability (C10)

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Table 4. Not related characteristics between GPM P5 with HSAP

GPM P5	HSAP
1. Ethical behaviour 2. Energy 3. Transport 4. Waste	1. Communication & consultation (C11) 2. Governance (C14) 3. Demonstrated need & strategic fit (C12) 4. Siting & design (C13) 5. Environmental & social management (C15) 6. Integrated project management (C16) 7. Hydrological resource (C17) 8. Infrastructure safety (C18) 9. Cultural heritage (C19) 10. Biodiversity & invasive species (C20) 11. Erosion & sedimentation (C21) 12. Reservoir planning (C22) 13. Downstream flow regimes (C23)

3.2. Sustainability rating score for each criteria

In order to achieve a sustainable hydropower project, this assessment need to cover all these twenty-three criterions which including environmental, economic, social and technical elements. The criterion is scored from zero to six by the respondents. The mean score of product with process is determined to evaluate the overall performance of sustainability for each criterion. The result is illustrated in Figure 2 below.

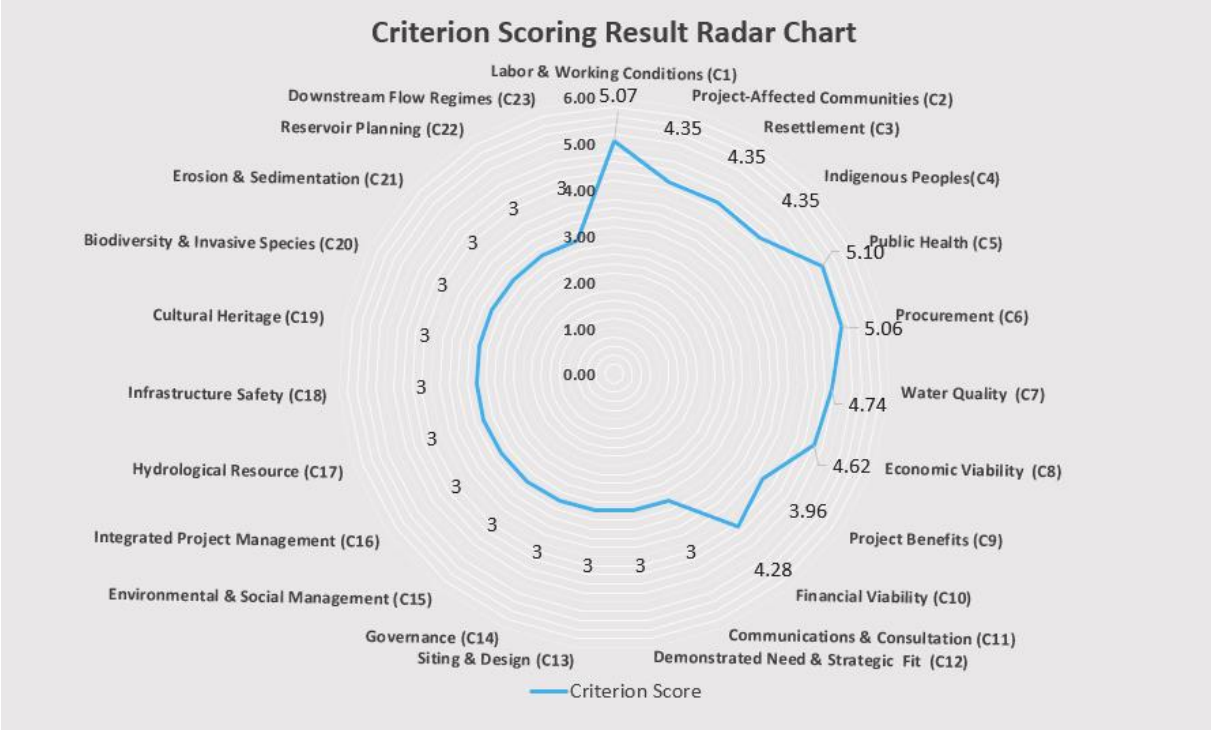

Figure 2. Overall criterion scoring result radar chart

3.3. Sustainability performance score

The result of sustainability performance obtained by using SSA calculator that based on GPM P5 for each department are being summarized as in Table 5 below. Then, this calculated result is compared with the proposed ranking of sustainability compliance.

Table 5. Comparison of sustainability performance with sustainability ranking of each department

Department	Sustainability Performance	Sustainability Ranking
1. Department of Compliance and Enforcement	3.82	Neutral
2. Department of Project Construction	3.71	Neutral
3. Department of Technical	3.75	Neutral
4. Department of Environmental Quality	3.84	Neutral
5. Department of Quality	3.86	Neutral

4. Conclusions

Consequently, this research project shows a correlation between sustainability level of hydropower project in Malaysian context and the improvement of SSA tool at one of the Malaysian energy company. Based on the results and analysis that have been done, Malaysian sustainability level is still low as it not achieved the low positive impact of sustainability yet. But, the results implied that Malaysian hydropower industry having a lot of opportunities to improve their weaknesses in some criterions that being covered in SSA especially the criteria that relates to the technical aspects. Conclusively, this research project not only provide a quality and quantitative report of sustainability performance but also act as Self-Assessment Report (SAR) to provide roadmap to achieve greater level of sustainability in a company for continuous improvement.

There are recommendations that could be useful in order to further improve the method and attain desirable result. Choose a right company to perform the survey. If possible, select a company that listed in the United Nations (UN) Global Compact as most of the UN Global Compact participants have an idea what sustainability is all about.

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