

Development of Sustainability Assessment Framework in Hydropower sector

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Abstract. Nowadays, Malaysian demand in energy sector was drastically increase due to technological developments. Since, hydropower is one of potential renewable energy source in Malaysia. The largest electricity utility company, Tenaga Nasional Berhad was provide an electricity to more than seven million people via independent suppliers in peninsular Malaysia and Sabah by intended a potential sustainable hydropower system. In order to increasingly the power capacity from current use, 1882 MW to more than 3000 MW by years 2020. In this study, the environmental issues and also the penalty to the responsible company especially on Tenaga Nasional Berhad (TNB) towards their project or business are one of the problems. Other than that, every project or business has to prepare a sustainability statement or sustainability report as vital to Bursa Malaysia Securities Berhad under their listing requirements. Next, the sustainability performance on their project cannot be determined to achieve the key performance indicators (KPI) satisfaction from Government, stakeholder or any responsible agencies. This study presents an exhaustive review of these studies and suggests a direction for future developments. Sustainability Assessment framework or self-assessment is decidedly as a significant framework to assist towards sustainability reporting and to produce a Sustainability index for Hydropower sector using a mathematical model study. The results reveal that, the quantitative measurement from Sustainability Assessment framework to Systematic Sustainability Assesment tool can be produce. In doing so, it is possible to improve the performance of the project especially in hydropower planner.

1. Introduction

In recent years, there has been an increasing interest in sustainability at many sector and project all over the world. The first serious discussions and analyses of Sustainability emerged during 1983 at new World Commision on Environment and Development (WCED, 1987)[1] by Norwegian prime minister Gro Harlem Brundland. Then, after four years they release their own report about sustainability in 1987 [2]. The purpose of that report is to provide long-term environmental strategies, to define shared perceptions of long-term environmental issues and to concern into greater co-operation among developing countries and between countries at different stages of economic and social development that interrelationship between people, resources, environment and development[3].

In Malaysia, Bursa Malaysia always encourage a sustainability idea as the key success of their business today. W. Stubbs et al., [4] was surveyed the performance of sustainability at Malaysia. The majority of the companies in Malaysia which is 77%, only 40% embed a sustainability concept in their overall project or business. S. B. Thai et al. [5] with their research on Companies that are listed in Bursa



Malaysia review that predicting the business can help corporation or investors in prudent decision making either in term of financial, management and others.

To remain competitive to other country in the world, Malaysia was prioritizing and limit number of key growth engines behind the support policy. Thus, the Economic Transformation Programme was announced in the Tenth Malaysia Plan (ETP) are focus on 12 National Key Economic Area (NKEAs) such in healthcare, Greater Kuala Lumpur/Klang Valley, Wholesale, Financial Services, Education, Palm oil & Gas, Business Services, Communication contents & Infrastructure, Oil & Gas (energy), Agriculture, Tourism and Electrical and Electronics [6]. In this paper, hydropower as case study is under energy sector. Energy is an important main player towards Malaysia's economic growth which creating about 20 percent of the nation's Gross Domestic Product (GDP) [7].

Nowadays, most of company in Malaysia are practicing green at their project management. However, green practicing only covered up in environmental aspect without emphasize other important aspects. Thus, by incorporating a sustainability assessment problem, it is very important to increase the business's profit and to protect people and environment. Sustainability assessment is a process of evaluation and optimization that aim to establishment the integration of sustainable development in governmental planning and a decision making processes across all parts [8]. In the earlier of sustainability assessment that include in government planning process, the greater the policy design liberty and optimization scope, and it will be more effective. Since the sustainability assessment is very useful for many organization, therefore, many researcher have been develop tools that can claim for assessing sustainability and providing a better application guidelines, data and case study experiences. Since the sustainability assessment become associated with impact assessment tools that consisting of e.g. Environmental Impact Assessment and Strategic Environmental Assessment [9]. The development of tool is very important to quantify the performance of the sustainability. From J.Voeten [10] found that Elkington theory is incorporate a sustainability between three elements which are people, planet and profit such in figure 1 below.

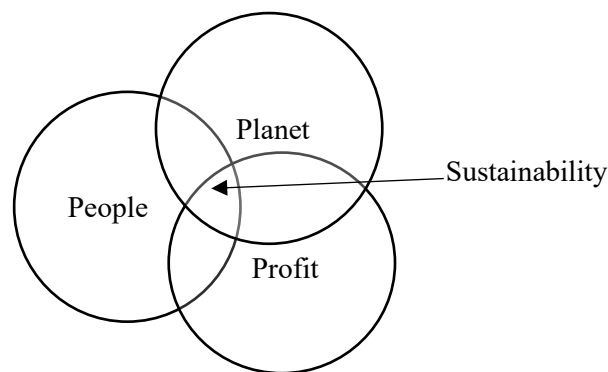


Figure 1: Sustainability concept of Triple-P according to Elkington's theory

Since every company in Malaysia were registered under Bursa Malaysia, it is compulsory them to return the sustainability reporting of their business. Thus, Systematic Sustainability Assessment (SSA) Tool is designed in advancing of sustainability reporting. At the same time to promote sustainable practices. Since, energy is important player in this country, this paper will focus on sustainability of energy sector at hydropower project by integrating the concept of Triple-P Bottom Line (TBL) by Elkington (1999). Lastly, the study of Sustainability Assessment framework will provide an indicator to access the level of sustainability compliance in Hydropower sector.

2. Case study of Hydroelectric project

A selected case study at Tekai River, Pahang Darul Makmur. It is located at Pahang, East Coast of Malaysia at latitude of 4.3378°N and longitude of 102.0682°E in an equator climate zone and nearby to Bukit Batu Lebah, Kemajuan Tanah Keca Satu and Kampung Dusun. The average elevation of Tekai hill at 155 meters High or 509 feet from earth.

3 Methodology

The development of Sustainability Assessment Framework is to quantify the sustainability performance of Hydropower in energy sector [11]. This methodology based on real data with considering any related criteria which assume to be improve the Sustainability Assessment framework by presenting the best sustainability in hydropower sector. The goal of this research, when compared with other hydropower system without sustainability the performance of hydropower much better. This sustainability Assessment Framework concept is to amend the performance of sustainability in hydropower especially at Malaysia.

3.1 Flow chart of Sustainability Assessment Framework

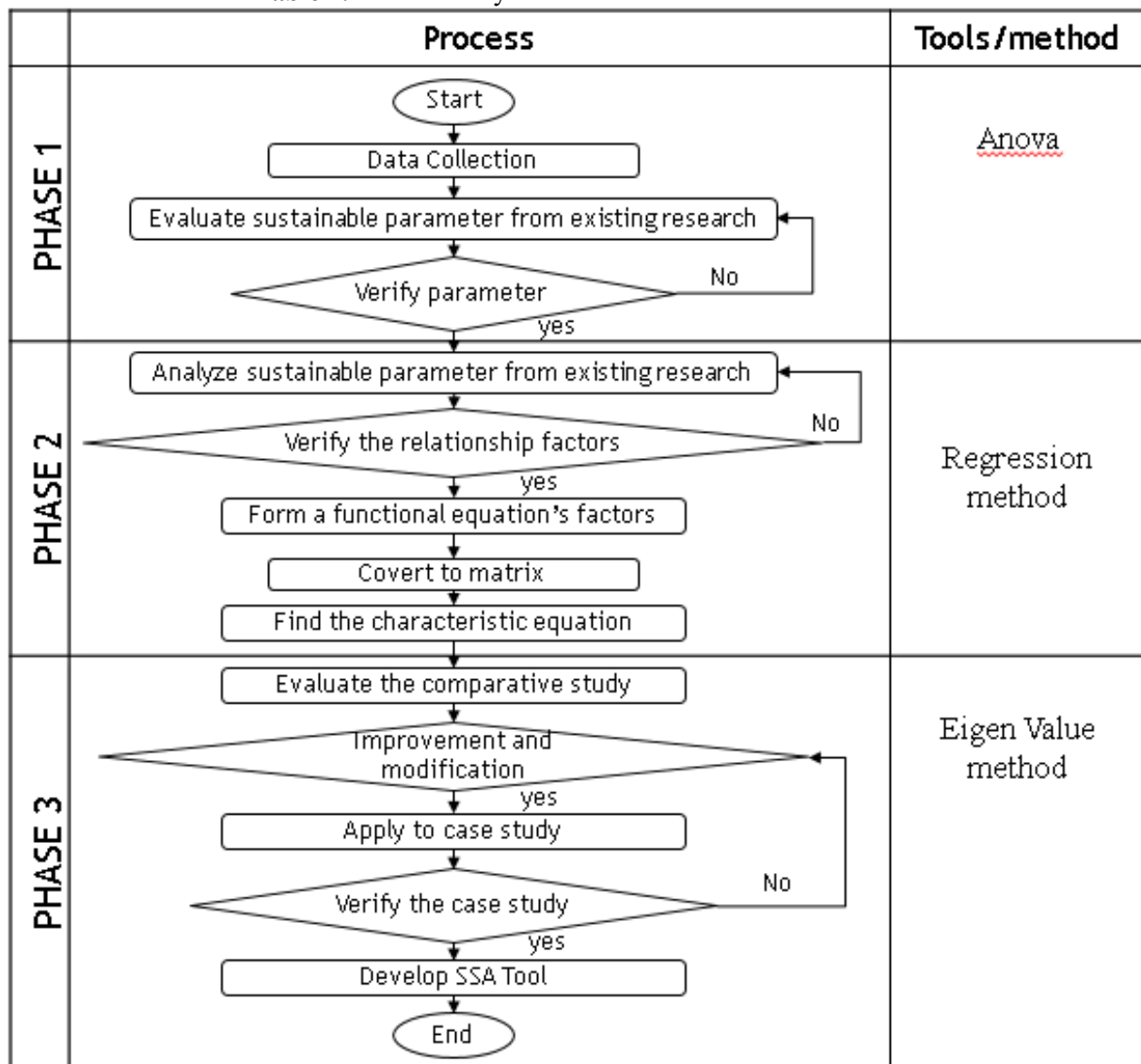
By preparing the Sustainability Assessment Framework, there are three phase with different method and tools. The overall framework of Sustainable Assessment Framework as in table 3 below. The collection of data for this study is assign in first phase. From this phase, the analysis of variance (ANOVA) is using to evaluate the sustainable parameter from existing hydropower project. The collection of data is collecting from a group of project management in Hydropower project with same parameter and criteria of surveying.

In the second phase, the analysis and verification between the selected suitable parameter and the characteristic are determine. From the verification of the relationship factors, the functional equation factors will be form. Thus, the characteristics equation is formed. For this phase, the mathematical method such regression or bias method are using. Lastly, as in Table 1, an Eigen Value method is use to develop a sustainability assessment framework by applying the modification and improvement if needed. The Systematic Sustainable Assessment Tool will be form in extension research.

3.2 Concept of Integration in Sustainability Assessment Framework

The concept of Sustainability Assessment integration matrix is describe base on Triple-P Bottom Line (TBL) [13] concept and are describe in the following paragraph:

- a) People – An activities that focus on maintaining mutually beneficial relationship with employees, customers and community
- b) Planet – An activities that focus on the impact of resource usage, hazardous substances, waste and emissions on the physical environment.
- c) Profit – An activities that focus on business efficiency, productivity and profit

Table 1. Sustainability Assessment Framework flow chart

3.3 Design parameters for sustainability.

In performing the sustainability, there are several criteria can be consider from team project and customer requirement There are several step to map the design criteria to the sustainability which refer to the Elkington theory of Triple-P. By previous research, [12]there are 3 steps to map the criteria such categories, analyse and map with the sustainability parameter. Table 2 shows the example of design sustainability parameter based on hydropower factors that already mapped to 3 parameter in sustainability which are people, planet and profit. By grouping the possible issues with relevant criteria and base on Triple-P parameter, it is an initial step to design a sustainability parameter. Then, the classification through the Elkington Theory are implement to make a good design of sustainability.

Table 2. Example of possible issues with relevant criteria [14]

No.	List of possible issues	Triple-P Theory
1	Communications and consultation	People
2	Governance	People
3	Demonstrated need and strategic fit	Planet
4	Sitting and design	Profit, planet
5	Environmental and social management	Planet, people
6	Integrated project management	People
7	Hydrological resource	Planet
8	Infrastructure safety	Planet
9	Financial viability	Profit
10	Project benefits	People
11	Economic viability	Profit
12	Procurement	People, profit
13	Project-Affected Communities	People
14	Resettlement (Not relevant)	Profit
15	Indigenous peoples	People
16	Labour and working conditions	People
17	Cultural heritage	People, planet
18	Public health	People
19	Biodiversity and invasive species	Planet
20	Erosion and sedimentation	Planet
21	Water quality	Planet
22	Reservoir planning	Planet
23	Downstream flow regimes	Planet

3.4 Scale of “weighting criteria”

The scale between 0-6 was developed to the respondents' group for rating the evaluation criteria of hydropower project. The data will be quantify based on technical document and also prior survey by using rating value as in Table 3. There are seven stages of performances based on different parameters and criteria set up.

Table 3. Scale for “weighting criteria”

Numerical rating	Description
0	Negative impact high
1	Negative impact medium
2	Negative impact low
3	Natural
4	Positive impact low
5	Positive impact medium
6	Positive impact high

4 Conclusion

The quantitative assessment of changes in project sustainability especially in hydropower sector, regional and global level facilitates the information analysis and decision making process. From this Systematic Sustainability Assessment (SSA) Tool will improve the project and business performance. Thus, will reduce the penalty cost and also sustain three an integrated focus in Profit, people and planet

based by facilitate Sustainability reporting (SR) according to Global Reporting Index (GRI) and 17 Sustainable Development Goals (SDG).

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