Ecodevelopment

Journal homepage: http://ecodev.pasca.unpad.ac.id/

Evaluating The Level of Economic Sustainability of Forest Resources in Forest Management Unit (FMU) of Yogyakarta

Dwi Rama Nugraha[1]*, Parikesit[1], Teguh Husodo[1]

[1]Graduate Program on Environmental Studies, Postgraduate School, Universitas Padjadjaran, Jl. Dipati Ukur No. 35, Bandung 40132, Indonesia

ARTICLE INFO

Article history:
Received 13 August 2018
Revised 13 September 2018
Accepted 26 November 2018

Keywords:
dimension, economy, FMU, management, sustainability, management

ABSTRACT

The purpose of this research is to know the status of economic sustainability of forest resource management in Forest Management Unit (FMU) Yogyakarta, Indonesia. This research uses Multi-Dimensional Scaling (MDS) to analyze the economic sustainability dimension with Rapid Appraisal Analysis Program (RAp). Using a 0-100 scale of the sustainability index, this study estimates the level of sustainability of the economic dimension. Root Mean Square (RMS) shows the indicators which contribute to the sustainability of the economic dimension. The value of the sustainability measurement obtained is 58.14% with the stress value 0.13 and R^2 is 0.95. This indicates that the category of economic sustainability of forest resource management in the FMU is categorized as sustainable enough. Each indicator has a different influence on the sustainability of economic dimension based on RMS value on the sensitivity analysis, namely: (1) feasibility of forestry business (12,60%); (2) community income (8,99%); (3) types of forest products (8,97%); (4) community employment opportunities (7,22%); (5) contribution of forestry sectors (7,20%); and (6) forest products (2,24%). In addition, sustainability assessment for other dimensions and strategy for sustainable forest resource management in FMU of Yogyakarta are needed.

1. Introduction

Sustainable forest management is a must in Indonesia. The Ministry of Environment and Forestry is now implementing a form of sustainable forest management through a site-level forest management unit known as Forest Management Unity (FMU). This activity is regulated in Peraturan Pemerintah Nomor 3 Tahun 2008 jo Peraturan Pemerintah Nomor 6 Tahun 2007 (Baplan, 2006).

One of the Forest Management Units in Indonesia is the FMU of Yogyakarta. FMU of Yogyakarta is located in Yogyakarta Province which has forest area in 3 regencies, that is Gunung Kidul Regency, Bantul Regency and Kulon Progo Regency. Budiningsih et al (2016) conducted research on typology and strategy of development of forest management unit in Indonesia where classified FMU of Yogyakarta asthe only KPH with type A, or KPH with good value in understanding the concept of forest management, adequate and capable human resources, strong stakeholder support, and good business potential.

Such good business potential would contribute economically to the government. However, based on the Rencana Pengelolaan Hutan Jangka Panjang (RPHJP) of FMU of Yogyakarta 2014-2023, all these potentials have not been utilized. This is important because the FMU of Yogyakarta will be pushed to form the The General Service Agency which must be independent in carrying out its duties and obligations including on economic aspects. An evaluation of the sustainability of the economic dimension of forest resources management in FMU of Yogyakarta is a need, leading to know the level of sustainability by appraising the indicators of economic dimension. This research uses Multi Dimensional Scaling (MDS) to analyze economic sustainability dimension with Rapid Appraisal Analysis Program (RAp).

2. Materials and Methods

Research location in forest area managed by FMU of Yogyakarta, Special Region of Yogyakarta with area of 15,724,50 ha divided into Production Forest covering 13,411.70 ha and Protection Forest covering 2,312.80 ha located in Gunung Kidul Regency, Bantul Regency, and Kulonprogo Regency. The study

* *Corresponding author*. Tel.: +62 812 8043 7096
E-mail address: ramanugraha90@gmail.com

was conducted in September - October 2017.

Assessment of economic sustainability on forest resource management in FMU of Yogyakarta using Multi Dimensional Scaling (MDS). MDS is a multivariate statistical analysis method that determines the position of a concept based on similarity or inequality with other principles or concepts (Borg and Groenen; 1997; Groenen and van de Velden 2004; Groenen and Terada, 2015). Yaoung (2009) suggests that MDS is a data analysis technique that presents conceptual similarities in the form of geometric images based on Euclidean distance between concepts, based on questionnaire responses. This analysis takes place through several stages. (i) Determination of dimensions or indicators of economic sustainability of forest resources in FMU of Yogyakarta. Each indicator of the dimension is then measured using attribute values (Pitcher and Preiksho, 2001); (ii) The assessment of each attribute on an ordinal scale is based on the sustainability criteria of each dimension. Certain respondents use scientific assessments to find out the indicators of economic dimensions. Experts rate indicators with a scale between 0 and 2; (iii) Last, this method is used to calculate the index of economic sustainability and analyze the status of sustainability.

By using MDS, sustainability point positions can be visualized through the horizontal and vertical axes. The position of a point can be visualized on the horizontal axis with the value value of the sustainability index score. The estimated score of each dimension is expressed from the lowest (unsustainable) 0% to the best (sustainable) score 100% (Fig 1), and grouped into four categories namely; 0-25.00% (bad or unsustainable), 25.01-50.00% (less sustainable), 50.01-75.00% (sustainable enough), and 75.01-100.00% (sustainable). The sustainability index includes the value of each dimension to describe the total sustainability level (Pitcher, 1999). Table 1 illustrates the index and ranking of sustainability.

Sensitivity analysis indicates the level of influence of the indicator on the value of the sustainability of the economic dimension. The influence of each attribute is observed in the Root Mean Square (RMS) change, especially on the x axis for resource sustainability scales (Kavanagh, 2001). The RMS formula is as follows:

$$\text{RMS} = \sqrt{\left[\frac{\sum\{Vf(i,1) - Vf(,1)\}^2}{n}\right]} \quad (1)$$

Vf(i,1) : MDS score output

Vf(,1) : MDS Average in 1st collum

Table 1. The category of sustainability value of forest management

Index score	Category
00.00-25.00	Unsustainable
25.01-50.00	Less sustainable
50.01-75.00	Enough sustainable
75.01-100.00	Sustainable

Sources : (Fauzi and Anna, 2005)

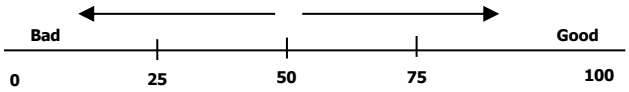

Figure 1. Scale of index sustainability 0 (bad) – 100 (good)

Monte Carlo analysis is used to evaluate the effect of error. The error effect can be caused by various conditions, including errors in the assessment due to an imperfect understanding of the indicators or field conditions, variations in scores of respondents or different assessments of the researchers, repeated MDS analysis, errors in data input or missing data, iterative stability, and high stress score (acceptable stress score should be <25%) (Kavanagh and Pitcher 2004; Fauzi and Anna, 2005). The conformity of MDS is indicated by the value of stress calculated based on the value of stress and R^2. A lower stress score indicates a good fit while a higher stress score indicates otherwise. In approach with RAp, a good model contains stress values of less than 0.25 or stress <0.25 (Fauzi and Anna 2005) and a relatively better fitting model has R^2 approaching 1.0.

3. Results and Discussion

Level of Economic Sustainability

The economic dimension being the focus of this study is downgraded to six indicators such as contributions to government, product markets, forest product products, employment opportunities for communities, and income of society. The result of MDS analysis using RAp shows the sustainability index of economic dimension of 58.14% (sustainable enough) (Fig 2). The stress value of the calculation is 0.13 and R^2 is 0.94. This indicates the calculation is done well and correctly because stress value 0.13 < 0.25 and R^2 is 0.94 close to 1.0 (Fauzi and Anna, 2005).

Individual indicators have different effects on the sustainability of the economic dimension: (1) forestry business feasibility (12.60%); (2) community income (8.99%); (3) types of forest products (8.97%); (4) community employment opportunities (7.22%); (5) forest sector contribution (7.20%); and (6) forest products (2.24%) (Fig 3).

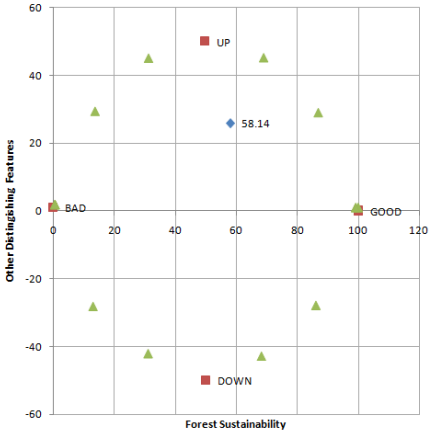

Figure 2. Result of RAp Analysis

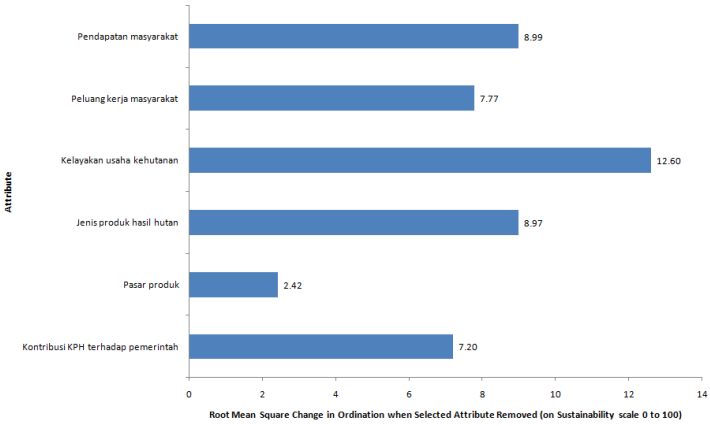

Figure 3. Score of RMS

Economic Contribution From Forestry Sector to Government

The economic contribution of FMU of Yogyakarta can be classified into two, namely Original Income of Yogyakarta Special Region and Forest Product's Tax for the central government. The economic contribution from forest areas managed by FMU of Yogyakarta come from the production of timber forest products, non-timber forest products (eucalyptus oil), as well as environmental services in the form of tourism (Table 3).

Table 3. Economic contribution for goverment

Commodity	Year	Type of Contribution	
		Original income	FP. Tax
Timber	2016	1.293.487.085,00	86.646.934,00
Cajuput Oil	2016	5.311.990.000,00	20.040.000,00
Tourism	2017	1.260.159.375,00	-

Market of Product

Forest areas managed by FMU of Yogyakarta produce timber and non-timber forest products marketed through a trading system, so the selling price is the highest price offered by bidders. Trader will deliver the forest product products to the downstream industry on a national scale for further processing. domestic and international tourists visited to tourism managed by FMU of Yogyakarta.

Forest Products

Forest products produced and utilized by FMU of Yogyakarta include timber forest products, non-timber forest products, and tourism. The potential of timber in the forest area of Balai FMU of Yogyakarta is from teak, mahoni, acacia, gmelina, gliricecidea, sonokeling, and bamboo species planted in production forest. This timber potential provides hope for better timber production both in quality and quantity and in the form of both woodworking and firewood.

NTFp's potentials in the forest area of FMU of Yogyakarta include species of cajuput oil, pines, kesambi, and murbai. Besides that, in the framework of community empowerment in the forest area also developed intercropping plants with the utilization of growing space through the cultivation of rattan, pineapple, honey bee, and porang by involving forest farmer groups around the forest.

The potential of tourism in forest area and or land area adjacent to forest area in FMU of Yogyakarta is large, but not all most have not been touched in tourism development both local and regional. Mangunan and Kalibiru very famous for domestic and international tourist but FMU of Yogyakarta have another potential of tourism. The potential of tourism in FMU of Yogyakarta is presented in Table 4.

Table 4. The potential of tourism in FMU of Yogyakarta

Potential of tourism
Rancang Cave
Sri Gethuk Waterfall
Pindul Cave
Semanu Cave
Bengkung Water
Sermo Dam Landscape
Gebang Cave
Pucanganom Fish Pool
Ngingrong Cave
Luweng Cave
Bagus Mount

Source : RPHJP FMU of Yogyakarta 2013-2023

Forest Business Feasibility

Payback of the forest resource management business period at FMU of Yogyakarta based on business review by Balai Pemantapan Kawasan Hutan Wil XI Java Bali will only occur in the 15th years if calculated from the management of 2013. However, business feasibility by FMU of Yogyakarta has a good prospect if seen from several parameters such as NPV, BCR, IRR, at an interest rate of 14%. The value of these parameters can be seen in Table 5.

Table 5. The value of these parameters

No.	Parameter	Score
1	Interest of rate	14,00%
2	*Net Present Value* (NPV)	Rp. 63.634.536.932,95
3	BCR	1,48
4	*Internal Rate of Return* (IRR)	25,41
5	*Payback Period*	15th years

Source: Feasibility business of FMU of Yogyakarta 2014-2019

Community Employment Opportunities

Job opportunities and businesses for communities living

around of forest areas that are agroforestry, cajuput leaf collection, pecan harvesting, pine-tapping, tourism management, and other forms of work and business.

Community Income

The problem of poverty is a complex problem and cannot be solved if only viewed from one sector alone. FMU of Yogyakarta, has an important role in poverty alleviation both in job opening, increasing community income and food security through various forest activities that are prosperity approach such as farmer groups and various forestry business development.

The poverty in Yogyakarta Special Region is based on BPS data in March 2010 of Rp. 224.258, - per capita per month. This means that people who earn the same income or less than the income limit are categorized as poor. Communities dependent on the forest area of FMU of Yogyakarta quite a lot and it turns out their income is still on the income line poverty. The number of poor people whose lives relate to the management of forest resources in FMU of Yogyakarta will be presented in Table 6.

Table 6. The number of poor people

Location	The number of poor people
BDH Playen	5.660
BDH Karangmojo	2.722
BDH Kulonprogo	94
BDH Bantul	334
BDH Panggang	637
BDH Paliyan	662

Source: RPHJP FMU of Yogyakarta 2014-2023

4. Conclusions

The level of economic sustainability of forest resource management in FMU of Yogyakarta is categorized a enough sustainable (58,14%). This value is influenced by the results of the assessment of each indicator that is the contribution of the forestry sector to the government, product markets, types of forest products, employment opportunities for the community, and income society.

There is a need for sustainability assessment on other dimensions such as ecology, social, technology, and law / institutional so that each dimension can be known the value of its sustainability and the need to formulate strategies to improve the sustainability of forest resources management in FMU of Yogyakarta.

ACKNOWLEDGMENT

Acknowledgments author give to Mr. Aji Sukmono, Head of FMU of Yogyakarta.

REFERENCES

[Baplan] Badan Planologi Departemen Kehutanan (2006). Penyusunan kriteria dan standar kelembagaan FMU. Jakarta (ID): Departemen Kehutanan.

Budiningsih, K., Sulistya, E., Gamin, Sylviani, Elvida, Salaka (2016). Tipologi dan Strategi Pengembangan Kesatuan Pengelolaan Hutan di Indonesia. *Jurnal Analisis Kebijakan Kehutanan*, 13 (1), 283 – 298.

Groenen, P.J.F., Terada, Y (2015). Symbolic Multidimensional Scaling (No. EI 2015-15).available at www.repub.eur.nl/pub/78189/EI2015-15.pdf

Groenen, P.J.F., van de Velden, M (2004). Multidimensional Scaling. (No. EI 2004-15). available at www.repub.eur.nl/pub/1274/ei200415.pdf

Fauzi, A., Anna, Z., (2005). Modeling of Fisheries and Marine Resources. Gramedia. Jakarta [Indonesian].

Hasanuddin, A (1995). Sistem Pengelolaan Hutan Produksi Lestari. Prosiding Simposium Penerapan Ekolabel di Hutan Produksi. Jakarta, 10-12 Agustus 1995.

Kavanagh, P (2001). Rapid Appraisal of Fisheries (Rapfish) Project: Rapfish Software Description (for Microsoft Excel). University of British Columbia, Vancouver.

Kavanagh, P., Pitcher, T.J. (2004). Implementing Microsoft Excel Software for Rapfish: A Technique for the Rapid Appraisal of Fisheries Status. Tech. Rept. 12 (2). Fisheries Centre Research Reports, Vancouver

[FMUP Yogyakarta] Kesatuan Pengelolaan Hutan Produksi Yogyakarta. 2014. Rencana Pengelolaan Jangka Panjang Kesatuan Pengelolaan Hutan Produksi Yogyakarta (RPHJP) 2014-2023. Dinas Kehutanan Yogyakarta. Daerah Istimewa Yogyakarta.

Pitcher, T.J. (1999). Rapfish, a Rapid Appraisal Technique for Fisheries, and it Application to the Code of Conduct for Responsible Fisheries. University of British Columbia, Vancouver.

Young, F.Y. (2009). Multidimensional Scaling (MDS). University of North Carolina, Chapel Hill.