

Sustainability Status of Social Forestry Management in Yeh Sumbul Village Forest, Jembrana District, Bali Province

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ABSTRACT

This study investigates the sustainability status of social forestry management in Yeh Sumbul Village forest, Jembrana Regency, Bali Province. Multidimensional Scaling (MDS) technique was employed through RSITM (rapid sustainability index) software. The findings indicate a highly sustainable level of 55.48%, 68.40%, 52.75%, and 52.76% for the environmental, economic, socio-cultural and legal/institutional dimensions respectively. Also, the leverage analysis (sensitivity) outcome revealed three most sensitive management attributes out of 31, with capacity to impact sustainability status, consisting of 1) agricultural fields supplementation from the forest with 27.43 as value, 2) understanding, concern, and community responsibility for the forest of 27.43 value and 3) cross-sectoral and inter-regional cooperation technique in forest resource management with 26.23 as value.

KEYWORDS:

Village forest,
Sustainability status,
Multidimensional scaling
(MDS), Yeh Sumbul

1. Introduction

The protected forest area of Yeh Sumbul Village is reported as 210 ha by Bali Provincial Forestry Service in 2019, and located within West Bali Forest Management Unit, Technical Implementation Unit (UPT, FMU). Furthermore, this is where one of Jembrana Regency's social forestry projects is executed, with authorization under the Village Forest Management Rights (HPHD) program from the Ministry of Environment and Forestry. The strategy employed to lessen growth of wood degradation, deforestation, and tackle negative effect of local village agriculture actions by engaging the community to perform forest management is called social forestry [14], aimed at farmers wellbeing enhancement and sustainable woodland task improvement.

Field assessment indicates several forest management implementation barriers exist while communal policies are uncontrollable due to non-existent governmental socialization from just two forestry extension workers present in all West Bali FMU's 37,182.13 hectares. Also, the village executed forest undertakings before procuring management authorization, and not tackling this fosters forest task degradation or conversion to agricultural land. The weak legal implementation causes anomalies including sale and purchase of forest lands and cutting all trees, because of forestry police workforce absence according to 2020 Bali Provincial Forestry Service data. Also, communal policies compete for land ownership despite not coming from border villages, caused by weak law implementation and restricted ownership of cultivated plantation and rice field lands. The 2018 village profile statistics of Yeh Sumbul revealed 116 families lacked plantation land or own rice fields, and therefore, farmers perform agricultural tasks hoping for production growth and higher earnings [15].

The European Conference of Ministers on forest protection defined sustainable forest management as forest/ land utilization to maintain present biodiversity, output, regeneration ability, vigor, potential for existing or future environmental, economic, social purposes, significant at communal, state and international levels without harm to other ecosystems. Furthermore, this means balancing forest welfare/diversity protection and local demand enhancement for forest health or diversity, crucial for dependents wellbeing and woodland survival.

The use of this concept is important for efforts to optimize forest management in Yeh Sumbul Village, and founded on a mutually connected and intertwined four-dimensional structure comprising environmental, economic, socio-cultural, and legal/institutional elements.

Also, this incidence in various regions including Sesaot village, West Lombok district, West Nusa Tenggara Province accomplished agroforestry replantation of destroyed logged-over lands [10]. Sadly, the success-rate is low in various areas including Bali Province [3]. The Yeh Sumbul village forest situation requires assessment to discover whether sustainable forest management principles were followed, and this study investigates the subject matter.

Therefore, this research aims to evaluate the condition and extent of social forestry management sustainability in Yeh Sumbul Village forest area, Jembrana Regency, Bali Province.

2. Literature Review

The communal economic needs determine maximization of protected forests use, and therefore, several forestry rules and policies are created, with villages granted authorization on stipulations to implement mixed-garden or agroforestry planting and not monocultural system [18]. Furthermore, the Jembrana Regency comprises protected (permanent and limited production) and conservation woodland, administered by the West Bali Forest Management Unit (FMU) and National Park, respectively. The FMU Bali Barat possess five Forest Management Resorts (RPH), including RPH Yeh Embang with a protected area of 12,196.08 hectares, covering Yeh Sumbul. Also, all woodland management community involvement schemes were amalgamated and simplified in 2016 through the Minister of Environment and Forestry Regulation No. P.83/Menlhk/Setjen/Kum.1/10/2016 policy on social forestry. Therefore, five schemes were created including customary, village, partnership, community, and plantation forest.

According to Karlina (2016), the elements impacting protected forest management sustainability comprise 1) area boundaries partitioning, 2) zone designation suitability, 3) tree seeds availability, 4) flora and fauna protection, 5) government income, 6) forest farmer income, 7) conflict management methods, 8) local intellect, 9) forest management institutions, 10) communal participation [11].

Multidimensional Scaling (MDS) analysis is employed to examine each attribute on an ordinal scale based on individual sustainability criteria per dimension, while supportable index and status of existing conditions generally and specifically, is compiled through ordination analysis [7].

3. Methodology

This study was performed in Yeh Sumbul Village social forestry area from 2020 to 2021, specifically selected as a protected woodland of 210 hectares with Ministry of Forestry governmental authorization and tourist attractions proximity. Furthermore, two data sources were employed comprising primary data derived straight from in-depth interviews of experts, Forestry and Environment Service, Bappeda, business players, forestry/ agroforestry planning academics, and community farmers growing forest lands. This comprised socio-economic, ecological, economic, social, cultural and legal/institutional outlooks and practices of residents.

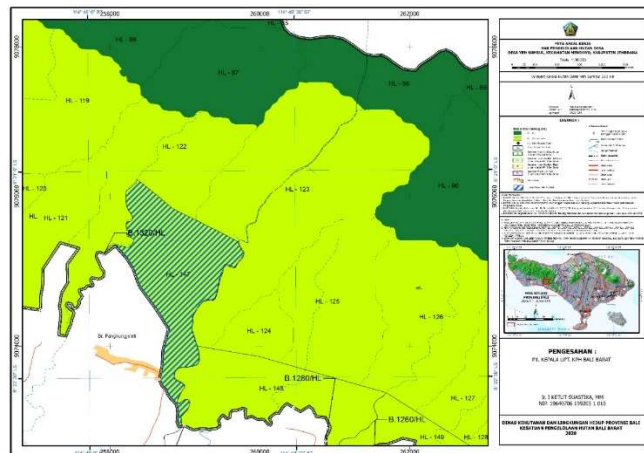


Figure 1. Map of Yeh Sumbul Village Forest Working Areal

The secondary data was indirectly derived from sources including Ministry of Environment and Forestry, Central Bureau of Statistics and Forest Service encompassing data on flora vegetation/fauna type/water discharge, 2015-2020 regional figures and Regional Forestry Report, respectively. Furthermore, selected respondents for status and condition analysis of the social forestry management sustainability comprised various planters, farmer groups head, diverse experts and related agencies.

Table 1
Respondents number in the research

No	Respondents	Total
Expert Respondents		
1	Provincial Environment and Forestry Agency and West Bali FMU	2
2	Head of the Unda Anyar Watershed and Protected Forest Management Center (BPDASHL), the Java Bali Nusra Social Forestry and Environmental Partnerships (BPSKL)	2

3	Head of Community and Village Empowerment Service (PMD), Environment, Bappeda Jembrana Regency	3
4	Village Forest Management Institution (LPHD)	3
5	Academics	2
6	Perbekel and Indigenous Bendesa	2
7	Non-governmental organization	1
8	Village Owned Enterprises, KUPS	7
9	Kelian Subak and subak abian	5

Respondents LPHD members

1	Farmers working on village forest land	3
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The sustainability analysis for forest land resources function is performed in diverse stages, comprising attributes determination phase encompassing four dimensions (environmental, economic, socio-cultural, and legal/institutional). Also, MDS analysis was applied at ordination process stage to evaluate forest land sustainability status through created RSITM (Rapid Sustainability Index) software [9], a package improved from RAPFISH (Rapid Assessment Techniques for Fisheries) program created by Fisheries Center, University of British Columbia, Canada [12].

The Multidimensional Scaling (MDS) technique encompasses several elements of forest land existence dimension by determination of two reference basis comprising good and bad. Figure 2 shows detailed stages modified by Budiharsono and Firmansyah with an outline listed below [1]:

- a. The dimensions and attributes determination is founded on several literature research and expert discussions for definition and creation of a rating scale.
- b. Obtained data from opinions and real conditions in the research area are weighted (pairwise comparison) according to the importance scale by Saaty (1993) to compare dimensions and scoring for individual variable/attribute.
- c. Good and bad main references are ascertained by scoring each on all variables/attributes.
- d. Two additional main points called "midpoint" are categorized as bad or good, and serve as references for vertical directions ("up" and "down").
- e. Creation of additional reference points called anchors is utilized to aid ordination results, and function as stabilizer points forming a kind of control loop. Therefore, the status value points are not external, and valuable in regression analysis execution to calculate the "stress" associated with MDS.
- f. The scores for each attribute is standardized with the following technique:

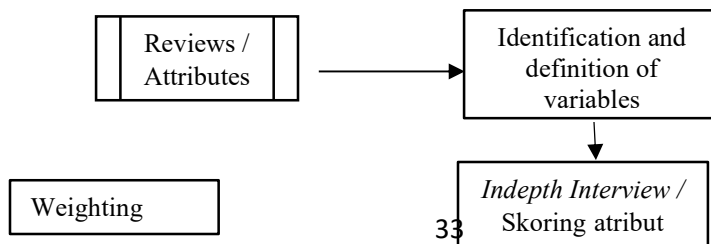
$$X_{ik} sd = \frac{X_{ik} - X_k}{S_k} \dots\dots\dots (1)$$

Description:

- $X_{ik} Sd$ = standard score values (including reference points) to $i = 1, 2, \dots n$, at v each attribute to $k = 1, 2, \dots p$;
- X_{jk} = the initial score of the research location (including its reference point) to $i = 1, 2, \dots, n$ in each attribute to $k = 1, 2, \dots, p$;
- X_k = mean score on each attribute to $k = 1, 2, \dots, p$;
- S_k = standard deviation of scores for each attribute to $k = 1, 2, \dots, p$.
- K = attributes

- g. The calculation of distance between positions using Euclidean distance technique with dimension n is as follows:

$$D^2_{(ij)} = \sum (X_{ik} - X_{jk})^2 \dots\dots\dots(2)$$



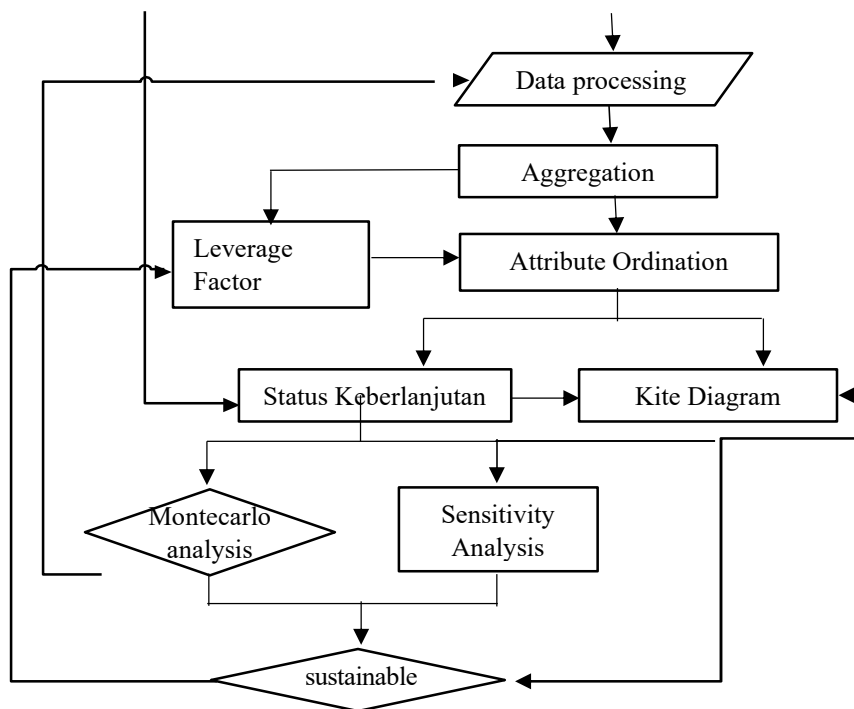


Figure 2. Stages of multidimensional scaling analysis (Budiharsono and Firmansyah, 2016)

- h. Ordinate each of numerous dimension's attributes according to the multidimensional scaling analysis algorithm parts, to become two comprising X and Y axes. Therefore, the finding is a matrix V (n x 2) where n equals amount of observed locations.
- i. The distance between objects is calculated by Euclidean distance (dij) and origin (dij) regression, with the equation as follows:
 The MDS regression analysis involves stress assessment through Goodness of fit, and is very crucial since this is a pointer to the magnitude of S value (stress > 0.25). Also, to modify a sustainable scale (sustainability) from "Not Good" to "Good" (0 to 100) on x-axis, the top and bottom point is +50 and -50, respectively on -y axis scale, meaning i = 1, 2, ..., n;
 obtained : $V_f(i,2) = V_f(i,2) - V_f(I\ good,2) \dots\dots\dots(6)$
 The sensitivity analysis was implemented by "attribute leveraging" to discover changes in MDS findings. Furthermore, each attribute effect is apparent, since index value as ≥ 50 or < 50 signifies the aspect/dimension of rice fields existence is good or unsustainable respectively. The MDS analysis after implementation also indicated changes in the root mean square (RMS), particularly on the x-axis and resource sustainability scale, while variations in the y-axis were not considered. The RMS formula is:
 $V_f(i1) = \text{MDS result value (after rotation and flipping)}$ $V_f(, 1) = \text{median MDS result value in Column 1}$
- j. Monte Carlo analysis is implemented to investigate impact of errors by estimating certain statistical value, and is beneficial in learning:
 - The effect of attribute scores errors due to understanding the conditions
 - The scoring variation effect caused by opinion or assessment disparities from diverse analysis
 - The repeated (iteration) MDS analysis process stability and grasping reference point of method employed.
 - Error entering data or missing statistics
 - High stress values from the analysis result
- k. To enhance sustainability status, a score change of the highly sensitive attribute (leverage factor) was developed as policy intervention for good value.
 - l. The same steps are performed to run the MDS simulation, and therefore, acquire intervened sustainability status
 - m. Kite diagram visualization to discover ways status change compares with pre-intervention simulation
 - n. The greatest sensitivity assessment of leverage factor among dimensions to enhance the value.

The MDS analysis findings shows: (1) each dimensions' status or index, (2) leverage / sensitive attribute, comprising ones requiring improvement for each dimensions (3) techniques to maintain forest land existence. Also, the RSI™ procedure is

applied to analyze 4 (four) dimensions including environment, economy, socio-culture, and law/institutions using a kite diagram. Table 2 shows the used sustainability category divided into four.

Table 2
Category of resource function sustainability status forest land based on index value

Index Value	Category
0 - < 25	Not sustainable
25 \geq Index value < 50	Less sustainable
50 \geq Index value < 75	Quite sustainable
75 \geq Index value \leq 100	sustainable

4. Results and Discussion

4.1 Management Sustainability Status

The MDS analysis method discovered highly sustainable index value of >50% for social forestry management comprising environmental, socio-cultural, economic, legal/institutional dimensions in Yeh Sumbul village forest. Furthermore, the socio-cultural and law/institutions dimensions was lower compared to others with 52.75% and 52.76% value respectively, requiring higher attention and prioritized interventions.

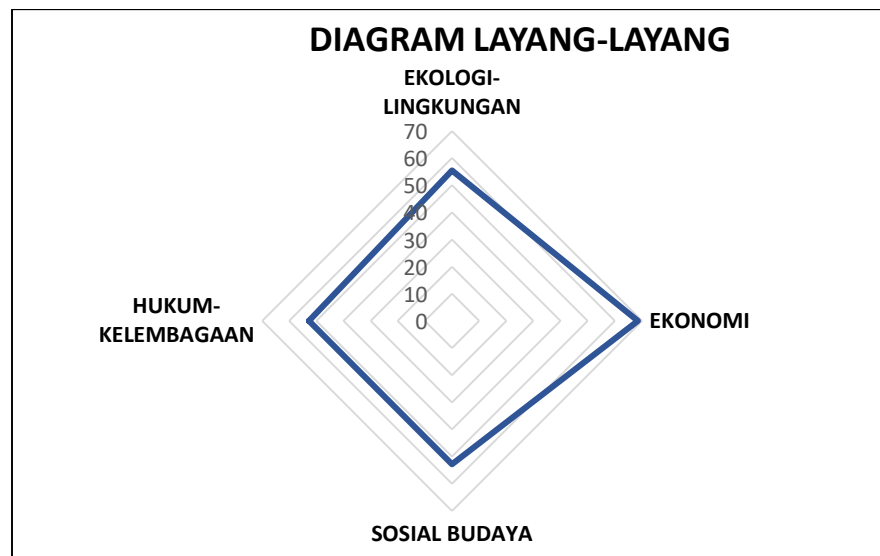


Figure 3. Kite Diagram

Table 3 shows the RSITM analysis results to display attributes requiring improvement (leverage). Furthermore, moderate policy involvement is capable of execution where a highly sensitive attributes is acquired from each dimension, including 1) agricultural fields supplementation from forests, 2) Reforestation funds return rates, 3) Understanding, concern, and community responsibility for woodlands, 4) Cooperation mechanisms across sectors and between regions in forest resources management. Policies optimization is implemented through optimistic simulations, comprising intervention of first and second sensitive attributes per dimension. Figure 4 presents a comparison of the moderate and optimistic intervention simulations.

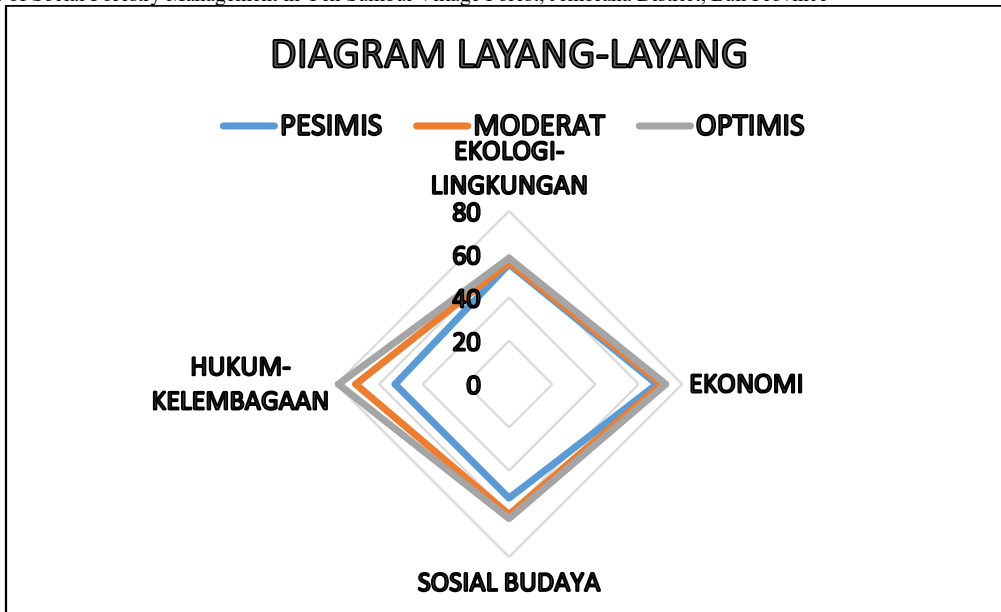


Figure 4. Simulation Results

4.2 Environmental Dimension Sustainability Status

The analysis findings from environmental dimension was 55.48%, and categorized as sufficiently sustainable. Figure 5 shows the environmental dimension sustainability status.

The leverage analysis findings indicate the environmental dimension obtained the most sensitive attribute to the sustainability index value, comprising agricultural fields supplementation from forests with 27.43 value. Also, crop cultivation and trees chopping dominates pressures to expand agricultural land, while forest sustainability difficulties also arise from absence of trees in social woodland areas. Generally, observations signify about 80% and 20% of covered lands in Yeh Sumbul comprise mixed garden stands and natural forest respectively. The non-timber forest products (NTFPs) potential comprises mixed stand pattern of timber and Multi Purposes Trees Species (MPTS) plants (RPHD, 2020), with the latter stands partly planted since 2017 simply to reduce land openness, including cacao, nutmeg, candlenut, durian, bamboo, mangosteen, and vanilla.

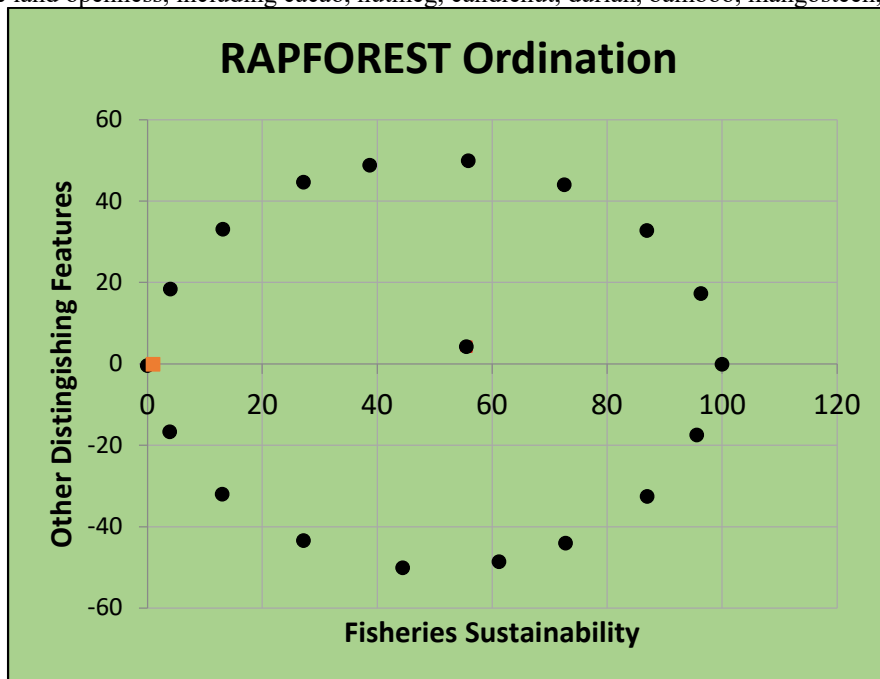


Figure 5. Sustainability status of environmental dimensions: 55.48% (Sufficiently Sustainable)

There was an addition of 280.07ha of agricultural fields outside the 210 ha area defined as the Yeh Sumbul protected forest area. However, this cultivation expansion is in the utilization block within West Bali Forest Management Unit (FMU), designated as a Specific Area (Wiltu) to guide and suppress the incidence, with field observations revealing agricultural fields

inclusion outside the village. The utilization blocks regulation in protected forests is a government policy expansion aimed at offering access to community participation, promoting conflict resolution involving protected woodland cultivation, and providing legal access after fulfilling requirements and completing stages, caused by village farming violations. Antonius posited a sensitive attribute for Baning Nature Park is emergence of conflicts over area boundaries encroachment triggered by restraining businesses, while the region's high economic activity level is redirectable to ecotourism potential optimization with high communal benefit, crucial for ecological forest burden reduction [2]. Therefore, forest ecotourism growth is projected to enhance the community's economy because of job and business opportunities creation. A cause of the comparatively small economic value obtained is the limited governmental attention regarding forest ecosystem-based tourism sector. Moreover, Yeh Sumbul Village Forest Area possess excellent natural travel, with the mountainous vicinity, direct beach and sea landscapes. Therefore, building facilities and infrastructure to boost natural tourism including roads, selfie spots, and souvenir huts is crucial.

The addition of agricultural fields outside Yeh Sumbul village forest poses a threat of forest degradation where uncontrolled, unorganized and without Indonesian Ministry of Environment and Forestry authorization, despite located in the protected forest utilization block. Furthermore, West Bali FMU is compelled to record external farming activities to offer aid and discover solutions, and therefore, cultivation expansion is controllable. The arising forest damage requires rehabilitation and conservation aimed at improving biodiversity or soil and water conservation, including planting protected areas around springs and beside rivers in open conditions.

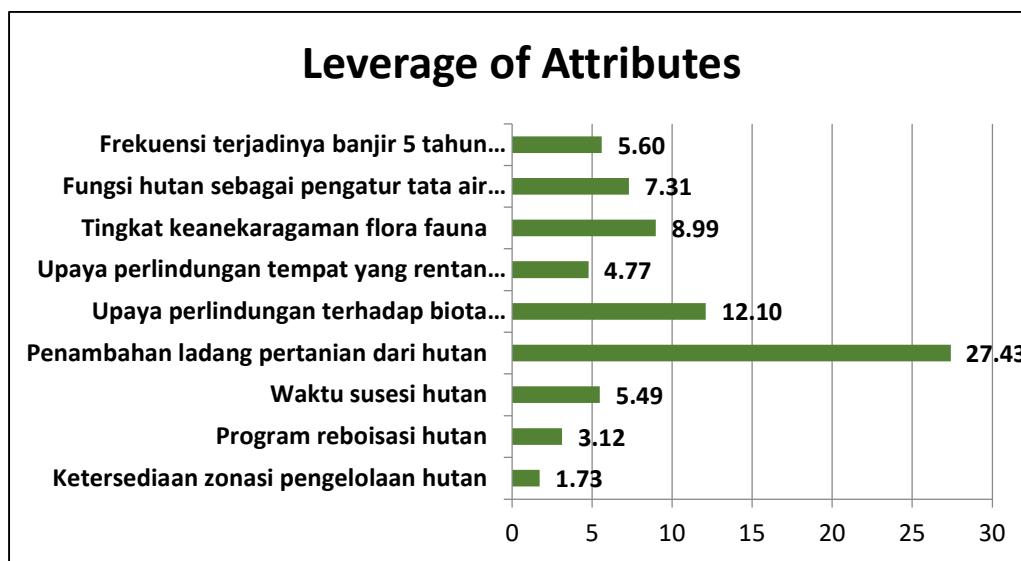


Figure 6. Sensitive Attributes

4.3 Economic Dimension Sustainability Status

The MDS analysis findings for the economic dimension indicates fairly sustainable status with 68.40% as value, necessitating attention. Figure 7 shows this.

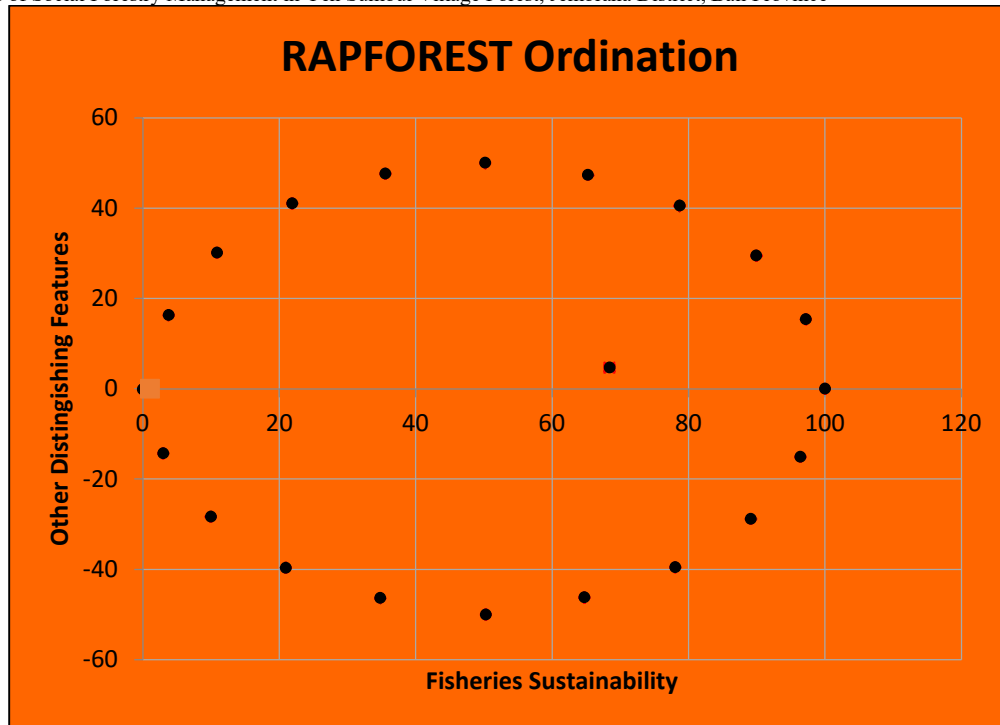


Figure 7. Status of Sustainability in Economic Dimension: 68.40% (quite sustainable)

The leverage analysis results of the economic dimension indicates the obtained highly sensitive attribute to the sustainability index value comprises reforestation funds return rate and product market type with a value of 4.18. Figure 8 shows the economic dimension attributes.

The reforestation funds refund involving payment of Non-Tax State Revenue (PNBP) by the Yeh Sumbul Village Forest Management Institution (LPHD) group encounters obstacles despite implementation. Furthermore, an increase in state's ability to finance woodland rehabilitation activities and LPHD community empowerment is expected, with the fund return rate significant due to need for financing conservation, agroforestry, and reforestation endeavours. Astana, *et al.* (2014), reported long-term forest sustainability is indicated by management costs structure, and absence including reforestation funds threatens this. According to Government Regulation number 6 of 2007, non-timber forest products collection in protected areas comprise rattan, sap, honey, fruit, mushrooms, swallow's nest, and the dominantly-produced are Multi Purposes Trees Species (MPTS) stands including cacao, candlenut, nutmeg, durian, mangosteen, avocado, fruit-producing cluring. Also, there are tubers, consisting of porang, galangal, turmeric, while vanilla and banana plants are commonly planted, with LPHD acquiring honey from nature [4].

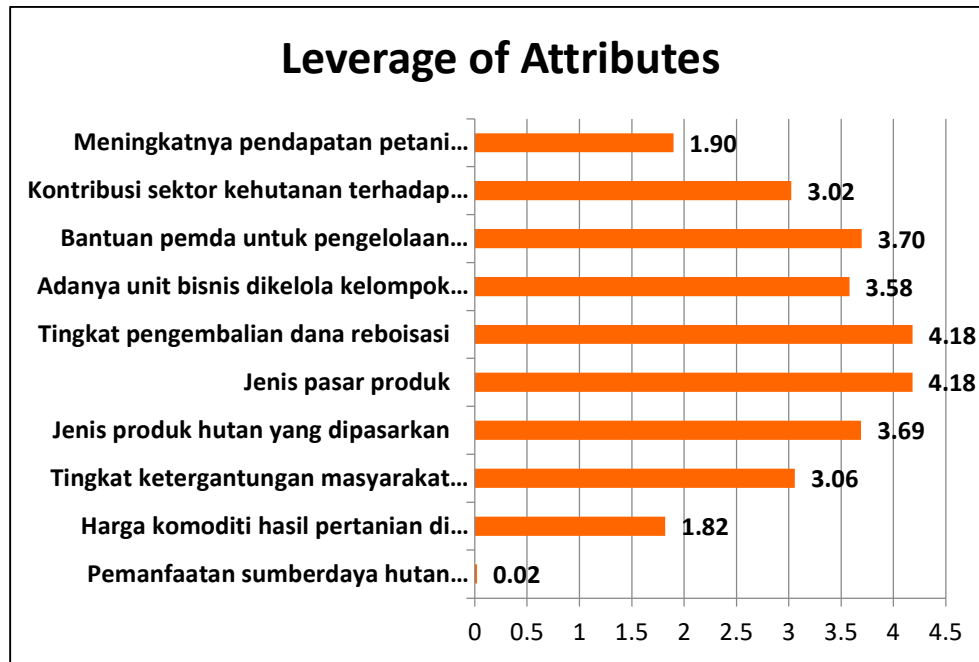


Figure 8. Sensitive Attributes

4.4 Sustainability Status of Socio-Cultural Dimensions

The MDS analysis results for socio-cultural dimension are presently quite sustainable with value of 52.75%. However, this requires maintenance by observing sensitive attributes due change susceptibility and proximity to 50% value. Figure 9 shows the social dimension sustainability status.

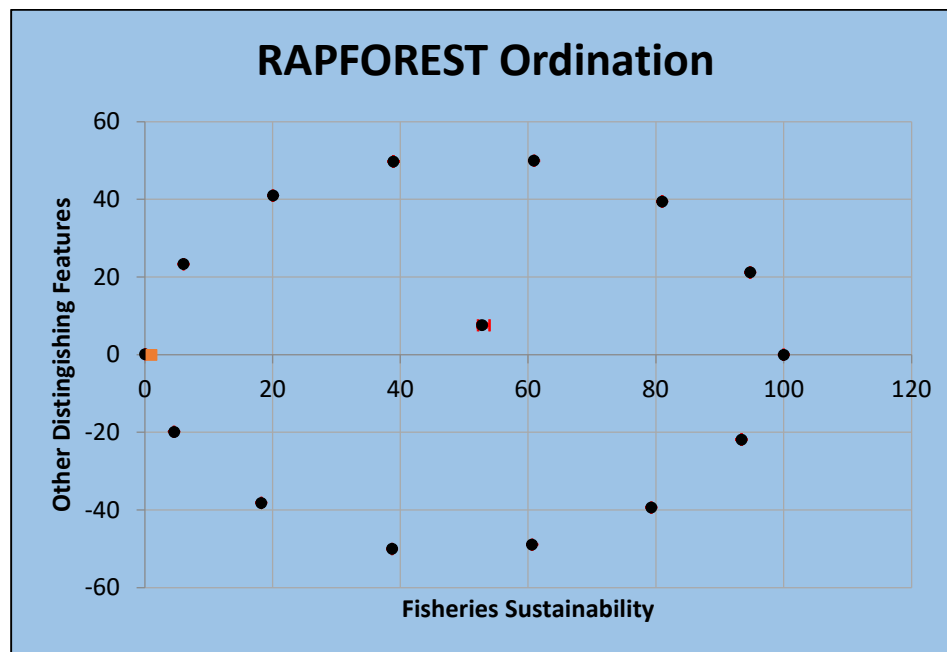


Figure 9. Sustainable status of socio-cultural dimension: 52.75% (quite sustainable)

The leverage analysis results indicate socio-cultural dimension acquired highly sensitive attributes to sustainability index value, comprising understanding, concern, and community responsibility for the forest, with 27.43 value. Furthermore, understanding social forestry through community woodland scheme is insufficient as residents chop forest trees and plant agricultural crops freely in vicinities outside the decree's stipulations with Village Forest Management Rights (HPHD) grant. The communal awareness, concern and responsibility for the forest by all societal elements is non-existent and crucial since cultivation activities outside the village forest area is permitted. Zain *et al.* (2014) affirms a factor inhibiting success of community forest

Sustainability Status of Social Forestry Management in Yeh Sumbul Village Forest, Jembrana District, Bali Province management (PHBM) is non-participation in several related activities including extension practices, social communication, forest maintenance, and land use [19].

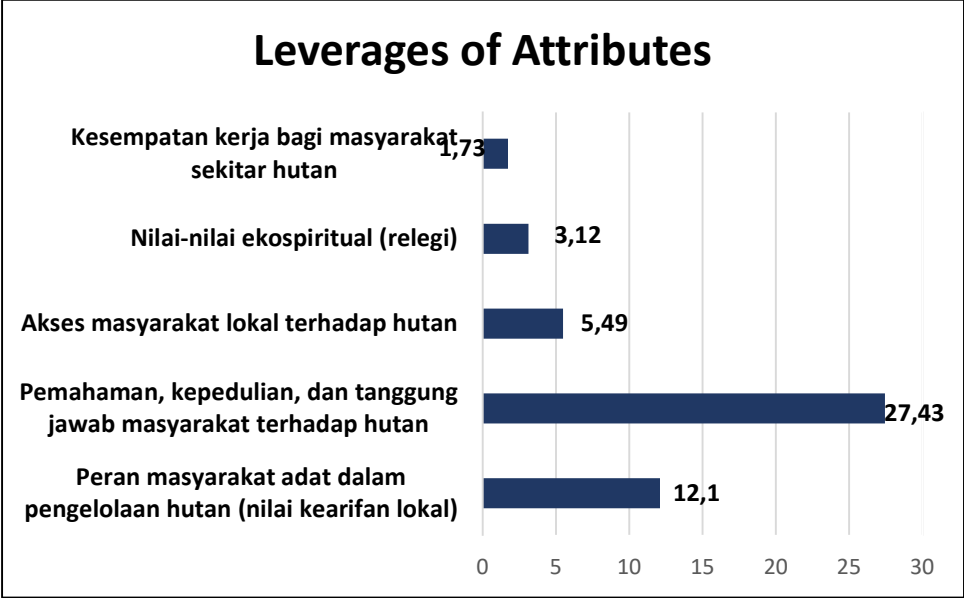


Figure 10. Sensitive Attributes

4.5 Sustainability Status of Legal and Institutional Dimensions

The legal and institutional dimensions resulted in 52.76% value, and is therefore adequately sustainable. Furthermore, present regulatory and institutional support has not been optimally implemented. Figure 11 indicates the sustainability status in the legal and institutional dimensions.

The leverage analysis results of the legal and institutional dimensions indicate the acquired highly sensitive attribute to sustainability index comprises cross-sectoral and inter-regional cooperation mechanism in forest resource management with value of 26.23. According to the 2020 Circular of the Minister of Home Affairs of Indonesia No. 522/6267 / SJ, the Government requires support from the Governor, Regent, and Mayor to boost rapid implementation of regional Social Forestry, involving coordination with Central Government, Regional Government, Ministry of State-Owned Enterprises (BUMN), Regional Owned Enterprises (BUMD), private sector, communities, and universities stakeholders for empowerment enhancement. The fostering of cooperation between local economic facilities and village growth in forest product manufacturing centers under a social Forestry-based system impacts employment and poverty alleviation. Also, these are cross-governmental, and therefore, planning and budgeting is executable through government-affairs related programs or activities in forestry, environment, public works, spatial planning, agriculture, community empowerment, employment, trade, industry, cooperatives, small or medium enterprises, and tourism.

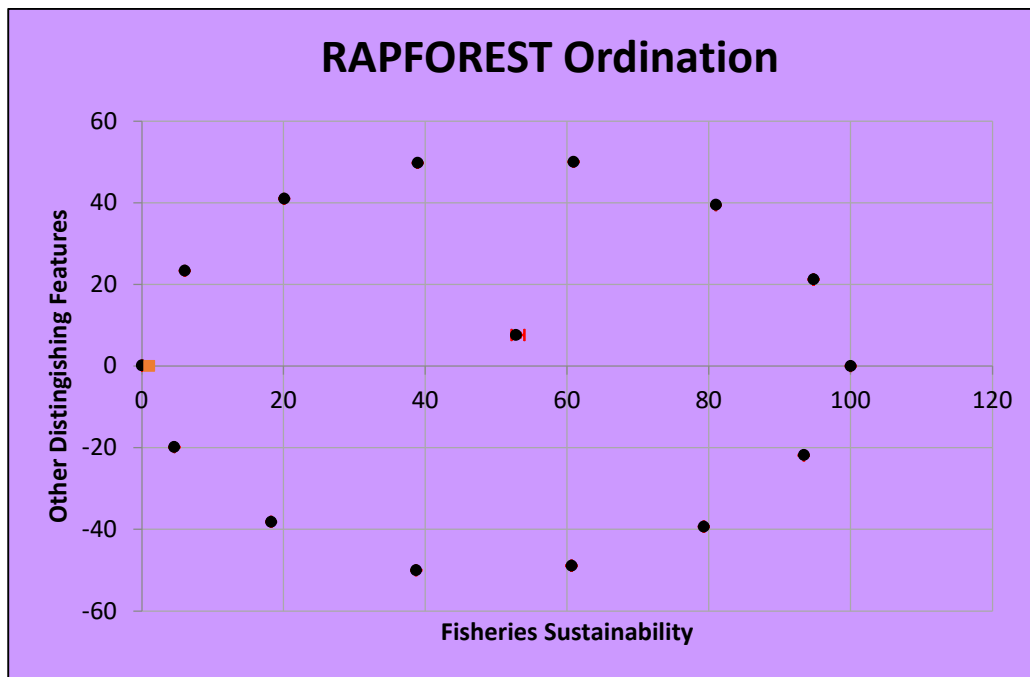


Figure 11. Legal and Institutional Dimensions Sustainability Status: 52.76% (quite sustainable).

According to Law number 23 of 2014 on Regional Government, forestry affairs (protected forest) is governed by the provincial government and in Jembrana Regency, this is managed by an arm of Bali regional government called FMU Bali West, with the local administration's function remaining important notwithstanding [5]. Furthermore, Indonesian Ministry of Environment and Forestry's task in social forestry management is through Center for Social Forestry and Environmental Partnerships for Java, Bali, West Nusa Tenggara (NTB), East Nusa Tenggara (NTT) Region. Therefore, there is need for collaboration between government agencies vertically at village level and horizontally, also with higher education establishments, Indonesian Institute of Sciences (LIPI), non-governmental organizations (NGOs), agricultural product processing industry, tourism, and other institutions aiding social forestry management growth.

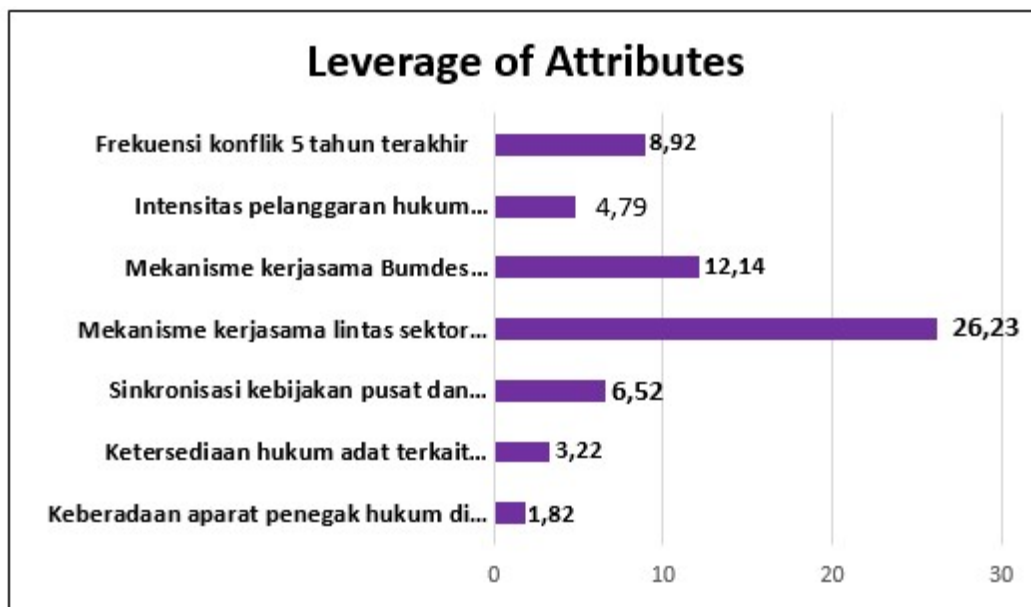


Figure 12. Sensitive Attributes

5. Conclusion

The conclusions from the study findings are as follows:

1. The sustainability status of social forestry management in Yeh Sumbul village forest is high.
2. The four dimensions employed to determine sustainability status comprise environmental, economic, socio-cultural, and legal/institutional classified as moderately sustainable.
3. The leverage analysis outcome (sensitivity) indicates the most sensitive attribute is discovered in 1) environmental dimension comprising agricultural fields supplementation from the forest with 27.43 as value, 2) socio-cultural dimension, encompassing understanding, concern, and community responsibility towards the forest with 27.43 value and 3) legal/institutional dimensions, including cross-sectoral and inter-regional cooperation mechanisms in forest resource management with value of 26.23.

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Conflict of Interest

The author declares no conflict of interest.

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