Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

Sustainability Analysis of Rice Seed Breeding Business in Subak Guama, Marga District, Tabanan Regency

I Gede Vibhuti Kumarananda[1], Ni Luh Prima Kemala Dewi[2*], I Dewa Ayu Sri Yudhari [3]

[1]Faculty of Agriculture, Udayana University, Denpasar, Indonesia
[2]Faculty of Agriculture, Udayana University, Denpasar, Indonesia
[3]Faculty of Agriculture, Udayana University, Denpasar, Indonesia
[1]Email: vibhuti.kn10.@gmail.com
[2]Email: kemaladewi@unud.ac.id
[3]Email: sriyudhari@gmail.com

ABSTRACT

The availability of certified rice seeds is one of the input production factors in rice cultivation whose availability needs to be maintained. Subak Guama as one of the rice seed breeders in Bali Province needs to maintain its sustainability in terms of ecological, economic, socio-cultural, institutional and technological aspects in order to meet the need for rice seeds in Bali Province. This research aims to analyze the sustainability status, sensitive attributes and scenarios for improving the sustainability status of rice seed breeding businesses in Subak Guama. The types of data used are quantitative data and qualitative data. Quantitative data in this research were obtained based on questionnaires distributed to key informants. Qualitative data in this research were in the form of field observations and interviews with key informants. The data sources in this research are primary data and secondary data. The analysis method of this research uses multiaspect sustainability analysis (MSA). The results of the research showed that the sustainability status value of the rice seed cultivation business in Subak Guama was 66.11 and was included in the sustainable category. A sensitive attribute in the ecological aspect is the use of organic fertilizer. Sensitive attributes in the economic aspect are selling price of certified rice seeds with shipping costs per kg. Sensitive attributes in the socio-cultural aspect are farmer participation in rice seed cultivation efforts. Sensitive attributes on the institutional aspect are the Assistance Program provided by the Bali Provincial Government from the APBD funds. Sensitive attributes on technology are the availability of rice seed dryers in Subak Guama. The conclusion and suggestion of this research is that the sustainability status value of the rice seed breeding business in Subak Guama is classified as sustainable but of course needs to be optimized again.

Keywords: Sustainability, Rice Seed Breeder, Subak

*Corresponding Author:
E-mail: kemaladewi@unud.ac.id (Ni Luh Prima Kemala Dewi)
Fakultas Pertanian, Universitas Udayana, Denpasar, Indonesia

1. INTRODUCTION

The availability of certified rice seeds is one of the input factors of production in rice cultivation that needs to be maintained. In 2024, there were various phenomena that threatened the sustainability of rice seed cultivation efforts in Bali Province, one of which was in Subak Guama. Subak Guama as one of the rice seed breeders in Bali Province needs to maintain its sustainability in terms of ecological, economic, socio-cultural, institutional and technological aspects in order to meet the needs of rice seeds in Bali Province. The current condition (das sein) which is the basis for conducting research is reviewed from ecological, economic, socio-cultural, institutional and technological aspects.

From an ecological aspect, it is illustrated by the condition of not applying solid

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

organic fertilizer which can affect the sustainability of soil fertility in Subak Guama. From an economic aspect, the development of rice seed production in Subak Guama in 2024 is also the same as in previous years, which is around ± 200 tons. The stagnation of rice seed production in Subak Guama is caused by several things, one of which is market uncertainty regarding the type of variety or the absence of mapping the needs of a rice variety in one year. The needs of farmers' seed varieties do not match those produced by Subak Guama, which causes a loss of IDR 2,000/kg due to the conversion of the use of grain from initially dry rice field seeds to consumption grain.

In terms of socio-culture, viewed from the number of members who carry out rice cultivation activities, it is around 60 people from a total of 544 members or an area of around 20 Ha from 187 Ha. In terms of institutional aspects, other problems are also caused by the constraints of KUAT Subak Guama's capital as an off taker or one who buys prospective dry rice field seeds from cultivation, so it really needs support from the government.

The expected condition (das sollen) of course Subak Guama with its institution KUAT Subak Guama can be sustainable to support the availability of seeds in Bali Province in situ. Subak Guama is also expected to increase rice seed production above 300 tons and can meet the seed needs in Tabanan Regency which is around 852 tons of certified seeds. In terms of technology, of course, there is a problem that Subak Guama does not have a rice seed dryer where this tool is very helpful for drying seeds more effectively and efficiently, especially during the prolonged rainy season. This research has three objectives, namely: 1) To analyze the sustainability status of rice seed breeding efforts in Subak Guama.; 2) To analyze sensitive attributes that affect rice seed breeding efforts in Subak Guama; 3) To analyze the scenario for improving the sustainability status of rice seed breeding efforts in Subak Guama.

The problem is solved through research using sustainability science theory with a five-aspect approach, including ecology, economy, socio-culture, institutions and technology using the multiaspect sustainability analysis method. Multiaspect Sustainability Analysis (MSA) is used to find the value of sustainability status, performance index, or performance index of activities, places, activities, institutions, or companies in order to self-assess or assess conditions and their descriptions, to determine the strategies that must be carried out in the future (Firmansyah, 2022)

2. METHODS

This research was designed to determine the sustainability status and sensitive aspects that affect rice seed breeding efforts in Subak Guama. Data interpretation is in the form of qualitative research that is quantified through an approach that combines qualitative and quantitative elements.

2.1 Research Location

The research was conducted in Subak Guama Marga District, Tabanan Regency. The planned research period is from September to December 2024.

2.2 Data Types

The types of data used in this research are quantitative and qualitative data. Quantitative data in this research were obtained based on questionnaires distributed to key informants in

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 | p-ISSN: 2722-919X

determining the sustainability status of rice seed breeding efforts in Subak Guama by reviewing ecological, economic, socio-cultural, institutional and technological aspects. Qualitative data in this research were in the form of field observations and interviews with key informants involved in seed breeding efforts in Subak Guama.

2.3 Data Sources

The data sources used in this research can be divided into two, namely primary data and secondary data. Primary data in this research were obtained from the results of observations, questionnaires and interviews conducted by researchers to key informants. Key informants in this research include two elements, namely leaders in Subak Guama and government agencies related to seed cultivation. Secondary data in this research were obtained through several references related to rice seed cultivation efforts in Subak Guama.

2.4 Data Collection Methods and Techniques

Data collection methods are techniques for collecting data and information that supports research through data collection techniques that can be carried out through observation, interviews and documentation.

2.5 Research Variables

Variables in this researched were reviewed from each indicator of the ecological, economic, socio-cultural, institutional and technological aspects. These variables were studied to show the results of the sustainability status and sensitive aspects in the sustainability of seed breeding efforts in Subak Guama. Aspects or indicators in each aspect or variable were evaluated based on the assessment of key informants based on the current situation against applicable standards and normal conditions using an ordinal scale.

2.6 Data Analysis Techniques

The data analysis technique used in this research is Multiaspect Sustainability Analysis (MSA) to analyze the sustainability status and aspects that influence the sustainability of seed breeding efforts in Subak Guama. The application used to analyze Multiaspect Sustainability Analysis (MSA) is Exsimpro. The Multiaspect Sustainability Analysis (MSA) assessment is based on the expertise of key informants who know or are competent in the field being studied and data collection is carried out through Focus Group Discussion. The number of key informants must be odd to anticipate bias in the assessment.

The stages of analysis in multiaspect sustainability analysis are by assessing aggregate status, aspect status, future conditions, sustainability status, aspect leverage factors, uncertainty errors, validation with random iterations, and policy priority scenarios (Sanda, 2024)). Validation tests are carried out through Random Iteration analysis, which is calculated by looking at the random values that appear from opinion values or mode values in factor assessments. The error value limit from random is an absolute difference of 0.5 from the mode value, while the status limit for the difference is no more than 10% (Firmansyah, 2022). Random iteration describes the difference in simulation values from random values to mode values on factors. This random iteration value will describe the comparison of each factor and the permissible difference of 0.5 from the existing assessment (Sanda, 2024).

The status value grouping has several criteria options, ranging from 2 criteria to 5 criteria used (Firmansyah, 2022). The assessment can be adjusted to the needs of the criteria grouping and can also be

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

developed according to the needs of both the score level and the naming of the criteria. This research of the Analysis of the Sustainability of Rice Seed Breeding Business in Subak Guama, Marga District, Tabanan Regency uses sustainability criteria as in Table 1.

Table 1
Criteria for Sustainability of Rice Seed Breeding Business in Subak Guama, Marga District, Tabanan Regency

Value	Sustainability Status
0-25	Unsustainable
>25-50	Low Sustainable
>50-75	Sustainable
>75-100	Very Sustainable

Data Resources: Firmansyah (2022)

The results of the sustainability status in this research then sought aspects of sensitivity that affect business sustainability by conducting a sensitivity analysis. The results of the quantitative data analysis are described in the form of narrative descriptions. This description will later be used as a recommendation or evaluation material for related stakeholders.

3. RESULT AND DISCUSSION

3.1 Sustainability Status Value

Multiaspect Sustainability Analysis (MSA) is one of the analyses that offers a holistic approach but has the challenges of complexity and uncertainty that remain the focus of debate (Smith, 2018). The sustainability status of the rice seedling business in Subak Guama is reviewed from five aspects, namely ecology, economy, socio-culture, institutions and technology. From these five aspects, there are several attributes that are identified, measured, given assessment weights and analyzed using multiaspect sustainability analysis (MSA). The results of the sustainability analysis can be seen in Table 2.

Table 2.
Sustainability Value

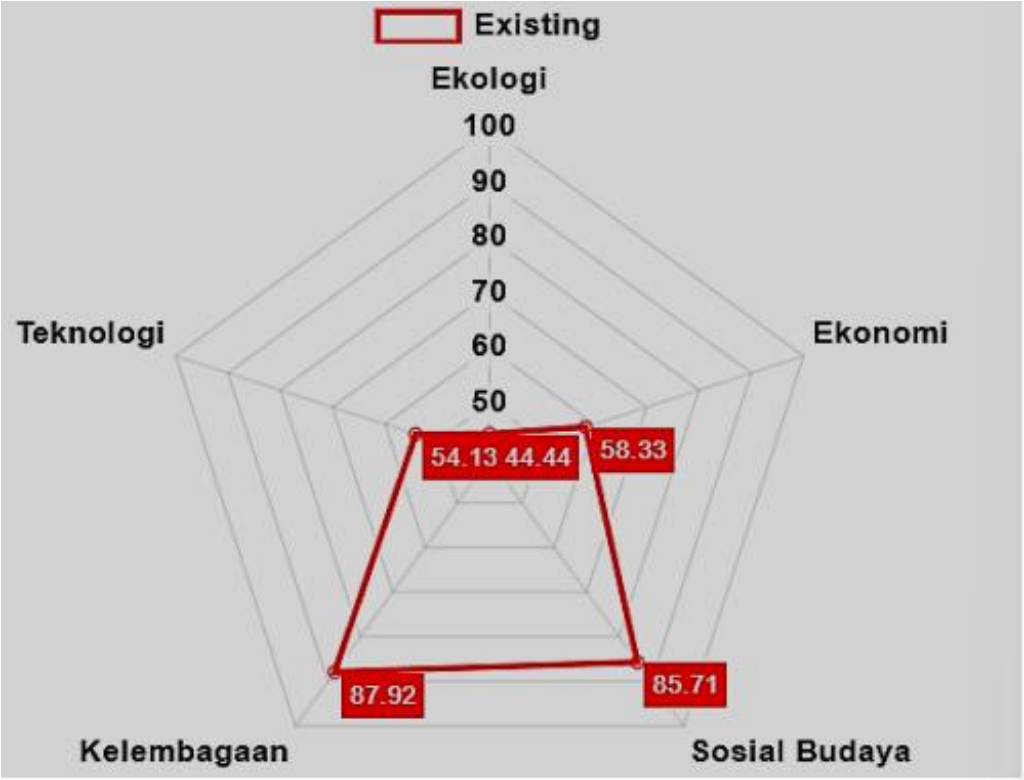
No	Aspect	Existing
(1)	**(2)**	**(3)**
1.	Ecology	44,44
2.	Economy	58,33
3.	Socio-cultural	85,71
4.	Institutional	87,92
5.	Technology	54,13
Average		66,11
Sustainability Status		Sustainable

Data Source: Primary data, processed (2024)

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 | p-ISSN: 2722-919X

Based on Table 2. it can be explained that the sustainability status value of the rice seed breeding business in Subak Guama is 66.11 and is included in the sustainable category. Based on these five aspects, a sustainability diagram of the rice seed breeding business in Subak Guama is obtained in Figure 1.



Data Source: Primary data, processed (2024)

Figure. 1
Sustainability Graph Existing

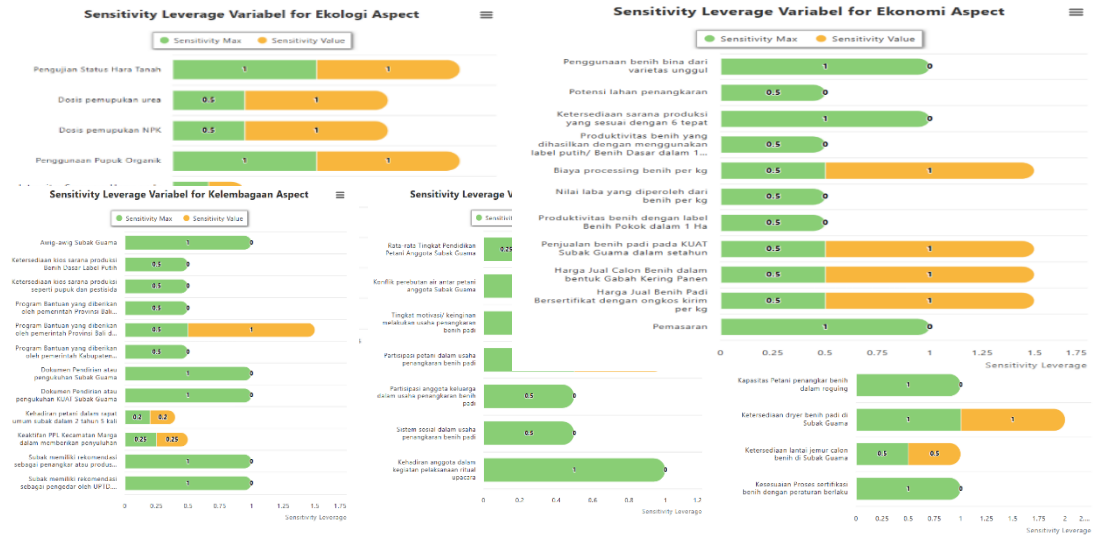
Based on Table 2 and Figure. 1 above, it can be explained that the highest aspect value is in the institutional aspect with a value of 87.92 in the very sustainable category. The lowest aspect value is in the ecological aspect with a value of 44.44 in the low sustainable category. There are also other aspects that fall into the very sustainable category such as the socio-cultural aspect with a value of 85.71 and two other aspects such as the economic aspect with a value of 58.33 and the technological aspect 54.13 fall into the sustainable category.

3.2 Sensitive Attributes

Sensitive attributes are obtained through the calculation of the sensitivity leverage of variables in each aspect. The results of the calculation of sensitivity leverage in each aspect of the sustainability of rice seed cultivation efforts in Subak Guama can be seen in Figure 2.

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 | p-ISSN: 2722-919X



Data Source: Primary data, processed (2024)

Figure 2.
Sensitivity Leverage Variable for Ecological, Economic, Socio-Cultural, Institutional, Technological Aspects

Based on Figure 2, the sensitive attributes are selected as priority attributes that influence the sustainability aspects. The priority sensitive attributes are arranged and described in Table 3.

Tabel 3
Sensitive Attributes that affect Sustainability Status

No	Aspect	Sensitive Attributes
(1)	(2)	(3)
1.	Ecology	a. Use of Organic Fertilizer b. Soil Nutrient Status Testing c. NPK fertilizer dosage d. Urea fertilizer dosage
2.	Economy	a. Selling Price of Certified Rice Seeds with shipping costs per kg b. Rice seed sales at KUAT Subak Guama in a year c. Seed processing costs per kg d. Selling Price of Prospective Seeds in the form of Harvested Dry Grain
3.	Socio-cultural	a. Farmer participation in rice seed cultivation efforts b. Average Education Level of Subak Guama Farmers
4.	Institutional	a. Assistance Program provided by the Bali Provincial Government from APBD funds b. Activeness of Marga District Field Agricultural Extension Workers in providing extension services

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 | p-ISSN: 2722-919X

No	Aspect	Sensitive Attributes
(1)	(2)	(3)
		c. The presence of farmers in general subak meetings in 2 years is 5 times
5.	Technology	a. Availability of rice seed dryers at Subak Guama
		b. Implementation of organic farming systems
		c. Availability of drying floors for prospective seeds at Subak Guama
		d. Rice Planting Index in 1 year

Data Source: Primary data, processed (2024)

Based on Table 3, it can be described the sensitive attributes that greatly influence the sustainability aspect in the rice seed breeding business in Subak Guama and have been analyzed through sensitivity leverage. These sensitive attributes will then be scenarioized to analyze the level of increase in the sustainability status of the rice seed breeding business in Subak Guama.

3.3 Sustainability Status Improvement Scenario

The scenario of increasing the sustainability status is carried out to ensure that every aspect of sustainability such as ecology, economy, socio-culture, institutions and technology can be managed optimally and in balance. The most sensitive attributes are scenarioized in the research of Sustainability Analysis of Rice Seed Breeding Business in Subak Guama using two scenarios and two driving factors. Driving factors refer to the main attributes used as drivers in the development of the sustainability status improvement scenario. Based on the sustainability status improvement scenario in the analysis of rice seed breeding business in Subak Guama, Marga District, Tabanan Regency, it can be seen in Table 4.

Table 4
Sustainability Value based on Scenario

No.	Aspect	Existing	Scenario 1	Scenario 2
(1)	(2)	(3)	(4)	(5)
1	Ecology	44.44	66.67	88.89
2	Ekonomi	58.33	81.82	95.45
3	Socio-cultural	85.71	96.43	96.43
4	Institutional	87.92	98.33	100
5	Technology	54.13	79.13	89.63
Average		66.11	84.48	94.08
Sustainability Status		Sustainable	Very Sustainable	Very Sustainable

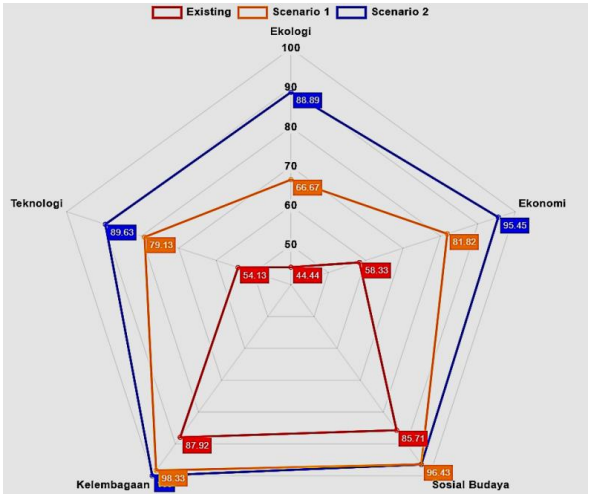
Data Source: Primary data, processed (2025)

Based on Table 4 above, it can be explained that there has been an increase in the sustainability status of the rice seed breeding business in Subak Guama from existing, namely sustainable to very sustainable in scenarios 1 and 2. A comparison of the increase in the sustainability status value can be described

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

through the sustainability graph which can be seen in Figure 3.



Data Source: Primary data, processed (2025)

Figure 3.

Sustainability Graph Scenario

Based on Figure 3, it can be explained that the sustainability graph compares three scenarios in five aspects of sustainability, namely ecology, economy, socio-culture, institutions, and technology. The red color represents the existing or current conditions, the orange color shows scenario 1, and the blue color represents scenario 2. The sustainability graph shows that scenario 2 has the highest score in all aspects overall and is the most optimal choice to achieve better sustainability compared to other scenarios. The scenarios are then prioritized as an effort to optimize each aspect of sustainability in the rice seed breeding business in Subak Guama. The priority scenarios for each aspect of sustainability can be seen in Table 5.

Table 5
Sustainability Priority Scenarios

Aspect	**ΔS1S**	**ΔS2S**	**ΔS2S/ ΔS1S**
(1)	**(2)**	**(3)**	**(4)**
Ecology	22.23	44.45	2
Economy	23.49	37.12	1.58
Socio-cultural	10.72	10.72	1
Institutional	10.41	12.08	1.16
Teknologi	25	35.5	1.42
Average Scenario Priority			1.43

Data Source: Primary data, processed (2025)

Based on Table 5 above, a scenario for increasing the sustainability status of each aspect of sustainability is obtained. The ΔS1S and ΔS2S columns show the value of the changes that occur when scenario 1 and scenario 2 are applied and compared to existing conditions. Scenario 2 must have a value of at least 2 times that of scenario 1 to

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

be considered more effective in improving the condition of a particular aspect. If the value of ΔS2S/ΔS1S is more than 2, it means that scenario 2 is more effective in improving that aspect, while if the value of ΔS2S/ΔS1S <2, scenario 1 is easier to implement to improve aspects than scenario 2 (Paulus, 2023). The ecological aspect will be more effective to improve if scenario 2 is implemented, while for the economic, socio-cultural, institutional and technological aspects, it is easier to implement scenario 1 to improve aspects and maintain the value of the sustainability aspect. The following is a description of each aspect of the sustainability of the rice seed breeding business in Subak Guama.

4. CONCLUSIONS

The sustainability status value of the rice seed cultivation business in Subak Guama is 66.11 and is included in the sustainable category. Each aspect has a different sustainability status value, namely: 1) Ecological aspect with a value of 44.44; 2) Economic aspect with a value of 58.33 is included in the sustainable category; 3) Socio-cultural aspect with a value of 85.71 is included in the very sustainable category; 4) Institutional aspect with a value of 87.92 is included in the very sustainable category; 5) Technological aspect with a value of 54.13 is included in the sustainable category. The most important sensitive attribute that influences the ecological aspect is the use of organic fertilizer. The most important sensitive attribute that influences the economic aspect is Selling Price of Certified Rice Seeds with shipping costs per kg. The most important sensitive attribute that influences the socio-cultural aspect is farmer participation in rice seed cultivation efforts. The most important sensitive attribute that influences the institutional aspect is the Assistance Program provided by the Bali Provincial Government from the APBD funds. The most important sensitive attribute that influences the technological aspect is the availability of rice seed dryers in Subak Guama.

The scenario of increasing the sustainability status value is carried out on all aspects using two scenarios and two driving factors. This scenario causes an increase in the sustainability status value of the rice seed breeding business in Subak Guama from 66.11 with a sustainable status to 84.48 with a very sustainable status. The second scenario causes an increase from 84.48 with a very sustainable status to 94.08 with a very sustainable status.

ACKNOWLEDGMENT

The author would like to thank the Subak Guama management and the ranks of the Tabanan Regency Agriculture Service who have provided permission and the opportunity to complete this research.

REFERENCE

Anggreni. M.L, Ambarawati. I.G.A.A, Ustriyana. I.N.G. (2018). *Status Keberlanjutan Usaha Padi Sawah di Kota Denpasar (Studi Kasus Subak Intaran Barat, Desa Sanur Kauh, Kecamatan Denpasar Selatan)*. Jurnal Manajemen Agribisnis, 6 (1): 55-62.

Chen, X., et al. (2021). *Development of Sustainability Indicators for Economic Analysis in MSA*. Environmental Economics Research, 10 (2): 87-104.

Dahya. (2016). *Analisis Kelayakan Finansial Usaha Penangkaran Benih Padi Di Kabupaten Konawe Sulawesi Tengggara*. Jurnal Pengkajian dan Pengembangan Teknologi Pertanian, 19 (1): 61-69.

Ekopsi, M., Susatya, A., Brata, B., Wiryono., Yurike. *Analisis Keberlanjutan Usaha Padi Sawah Di Kecamatan Tugumulyo Kabupaten Musi Rawas Provinsi*

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.

Journal of Sustainable Development Science
Vol. 7, No. 2, December 2025, pp. 89-98
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

Sumatera Selatan. NATURALIS-Jurnal Penelitian Pengelolaan Sumberdaya Alam dan Lingkungan. 12(1); 24-32.

Gallopin, G. (2003). "*A System Approach to Sustainability and Sustainable Development.Sustainable Development and Human Settlements Division"*. Nacions Unidas.Santiago, Chile.

Nurhamsiyah. (2013). *Manajemen Penangkaran Benih Tanaman Padi di Indonesia*. Jurnal Agroekoteknologi, 1(2): 45-56.

Nurmalina, R. (2008). *Analisis Indeks dan Status Keberlanjutan Sistem Ketersediaan Beras di Beberapa Wilayah Indonesia*. Jurnal Agro Ekonomi, 26 (1): 47 – 79.

Paulus. C.A., Adar. D., Yahyah., Rayzcha. M. I. Hotty., Rusdiyanto. E., Firmansyah. (2023). *Multi-Aspect Sustainability Analysis of Freshwater Fish Aquaculture in Kupang City of East Nusa Tenggara Province, Indonesia*. Russian Journal of Agricultural and Socio-Economic Sciences, 8 (140): 173-186.

Pretty, J. (2008). *Agricultural Sustainability: Concepts, Principles and Evidence*. Philosophical Transactions of the Royal Society B: Biological Sciences, 363 (1491): 447-465.

Resti Astuti M. P. (2024). *Dampak La Nina dan El Nino Bagi Kehidupan Masyarakat Indonesia*. Jurnal Ilmiah Multidisiplin. 1(5): 69–75.

Salsabila. (2014). "*Analisis Finansial Usaha Penangkaran Benih Padi (Studi Kasus: Kabupaten Serdang Bedagai)*". (skripsi). Medan: Universitas Sumatera Utara.

Suroto., Rauf. A., Saleh., Yanti. (2019). *Analisis Usaha Penangkar Benih Padi Sawah di Kabupaten Gorontalo*. Jurnal Agrinesia 3 (2), 125-131.

Sutawan. N. 2008. Organisasi dan Manajemen Subak di Bali. Denpasar: Pustaka Bali Post.

Firmansyah, I. (2022). Multiaspect Sustainability Analysis (Theory And Application). *Expert Simulation Program Article*, *1*, 1–14. https://exsimpro.com/journal-article/

Sanda, A. (2024). *Analisis Keberlanjutan Usaha Kopi di Desa Catur, Kecamatan Kintamani, Kabupaten Bangli*. Universitas Udayana.

Copyright © 2025 by the authors.
Licensed under CC BY 4.0.