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fapertabis@unmas.ac.id
@fapertabisunmas
Fakultas Pertanian dan Bisnis
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Sekretariat Fakultas Pertanian dan Bisnis Universitas Mahasaraswati Denpasar
Jln . Kamboja No. 11 A Telp. (0361) 265322 Denpasar-Bali.
e-mail: agrimetaunmas@gmail.com

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THE IMPACT OF GIANYAR TRADITIONAL MARKET REVITALIZATION ON THE INCOME OF VEGETABLE AND FRUIT TRADERS

Arintus Hatu, Ida Ayu Made Dwi Susanti*, I Made Tamba
Universitas Mahasaraswati Denpasar, Denpasar, Indonesia
*) Corresponding author: dwisusanti1989@unmas.ac.id

Abstract

The revitalization of traditional markets is a strategic effort by the government to enhance competitiveness, particularly in response to declining infrastructure quality and reduced consumer interest. This study is motivated by the condition of the Gianyar People's Market, which was considered inadequate, prompting a revitalization program aimed at improving traders' welfare. The study focuses on analyzing how the revitalization of markets affects the income of vegetables and fruits traders. The study was conducted at the Gianyar People's Market, Gianyar Regency. From primary and secondary sources, both qualitative and quantitative data were collected and combined using a mixed-method methodology. In gathering the data, techniques such as observation, interviews, as well as documentation were utilized. The process of analyzing the data involved income analysis, descriptive methods, and the McNemar test in order to assess changes in traders' income before and after revitalization. The results indicate that the implementation of the revitalization program led to a significant decrease in the income of vegetable and fruit traders. This decline was primarily attributed to a reduction in the number of visitors, suboptimal market management, and ineffective governance by the local authorities. The statistical findings provide additional confirmation that traders' income is significantly influenced by the implementation of market revitalization. In conclusion, the revitalization of the Gianyar People's Market has not yet achieved its intended objective of improving traders' income. Therefore, improvements in market management and governance are necessary to ensure the effectiveness of future revitalization programs.

Keywords: *market revitalization, traders' income, traditional market, market management*

Introduction

Markets refer to spaces where transactions between buyers and sellers take place in various forms, allowing the demands of the community to be fulfilled (Utari and Sudiana, 2017). Along with the advancement of time and increasingly sophisticated technology, markets no longer function solely as places for local community transactions; rather, they have evolved into key drivers of economic activity on a larger scale (Paramita and Ayuningsasi, 2013). Markets play a crucial role in the economy, serving three main functions: as a distribution channel, a price-setting mechanism, and a means of promotion.According to studies by Shiu and Dawson (2001) and Dewi et al. (2017), young people aged 15 to 30 tend to avoid traditional markets, while consumers in their thirties and forties generally prefer supermarkets. In an effort to position traditional markets as a driving force in the economic development of both urban and rural areas, it is necessary to ensure their effectiveness and optimal operation. Therefore, the government has implemented market revitalization programs to improve their efficiency and ability to meet community needs.

The revitalization of traditional markets aims to enhance their competitiveness in comparison to modern markets. Market development is expected not only to generate financial benefits but also to support the growth of small-scale traders and encourage creative management approaches (Paramita and Ayuningsasi, 2013). Following revitalization, the spatial arrangement and infrastructure of the Gianyar People's Market have become more organized. In addition to restoring the vital functions of the traditional market, this revitalization is expected to improve traders' welfare by increasing their income and stimulating consumer purchasing interest. Aims of the research are outlined as follows: (1) to analyze the impact of revitalization on the income of vegetable traders after the revitalization of the Gianyar People's Market, and (2) to analyze the impact of revitalization on the income of fruit traders after the revitalization.

Study Area and Period

This study was conducted at the Gianyar People's Market, located in Gianyar Village/Subdistrict, Gianyar District, Gianyar Regency. The study site was selected

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purposively based on several considerations: the market has undergone a revitalization program, it is one of the largest traditional markets in Bali, and limited similar studies have been conducted in this context. Conducted from March to May 2023, the research covered a total duration of three months.

Types and Sources of Data

Research incorporated qualitative as well as quantitative data types. Qualitative data consist of descriptive aspects like respondent characteristics, traders' experiences, and a general depiction of the research site, whereas data in numerical and measurable form, including traders' income before and after revitalization, are considered quantitative. Both primary and secondary data serve as sources in the study. Direct collection of primary data was carried out through structured interviews with vegetable and fruit traders using questionnaires, while secondary data were sourced from market authorities, related literature, monographs, and additional supporting references.

Population and Sample

All traders of vegetables and fruits operating in Gianyar People's Market formed the population of the study, with a total of 171 individuals, including 100 vegetable traders and 71 fruit traders. As respondents in the research, every member of the population was included by applying a census sampling method. Therefore, the total sample size in this study was 171 respondents.

Data Collection Techniques

Observation, involving direct field observation of traders' activities in the market.

Information related to differences in traders' income and market management, both before and after the revitalization program, was obtained through interviews.

Documentation study, involving reviews and analysis of relevant documents obtained from respondents and related institutions.

Operational Variables

The variables examined in this study include the income of vegetable traders and fruit traders. Each variable was measured using two indicators: income before revitalization and income after revitalization. All variables were measured quantitatively in monetary units (Indonesian Rupiah).

Data Analysis Methods

For the purpose of analyzing data, the study made use of descriptive analysis, income analysis, along with inferential statistical analysis through the McNemar test. Descriptive analysis was used to describe respondent characteristics and to compare traders' income before and after revitalization. Income analysis was conducted to measure changes in traders' earnings. Furthermore, the McNemar test, a non-parametric statistical test for paired (dependent) samples, was used to examine differences in income before and after the revitalization program. The analysis was performed using SPSS software. By comparing the probability value (p-value) to the significance level ($\alpha = 0.05$), or by contrasting the calculated Chi-square value with the critical Chi-square value, the decision criteria were established.

Listed below are the hypotheses tested in the study:

- H_0 (null hypothesis): The income of traders remains not significantly different between the periods before and after market revitalization.
- H_1 (alternative hypothesis): The income of traders differs significantly between the periods before and after market revitalization.

Results and Discussion

Results

Respondent Characteristics

The respondents in this study were vegetable and fruit traders at the Gianyar People's Market, Gianyar District, Gianyar Regency, with a total of 171 individuals. Gender, age, and level of education were used as the basis for analyzing respondent characteristics.

Gender

The results show that with 105 individuals (61.4%), female respondents dominated the sample, while 66 individuals (38.6%) were male. This indicates that vegetable and fruit trading activities at the Gianyar People's Market are predominantly carried out by women, who generally play an active role in traditional market activities.

Age of Respondents

In terms of age distribution, the largest group is 36–45 years old with 75 individuals (43.8%), meanwhile the 26–35 group accounts for 60 individuals (35.1%), lastly the 46–55 group consists of 36 individuals (21.1%). This suggests that most traders are within the productive age range, possessing adequate physical capacity and experience to manage their businesses.

Education Level

The education level of respondents is dominated by primary school graduates (elementary level), totaling 75 individuals (43.8%), followed by junior high school graduates with 60 individuals (35.1%), and senior high school graduates with 36 individuals (21.1%). This indicates that most traders have relatively low educational attainment, which may influence their

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business management skills and decision-making abilities.

Impact of Revitalization on Vegetable Traders' Income

The results show that prior to revitalization, the majority of vegetable traders were in the income category of IDR 8,000,000 per month, totaling 35 individuals (35%). However, after revitalization, there was a shift in income distribution toward lower categories, with most traders earning IDR 1,500,000 per month, totaling 50 individuals (50%). This indicates that the market revitalization has not had a positive impact on increasing vegetable traders' income; instead, it has led to a decline in income levels.

Table 1. Respondents' Monthly Income Before the Revitalization of the Gianyar People's Market

No	Class Income	Before The Revitalization (people)	%	Type of Commodity
1.	1.500.000	10	10	Vegetable
2.	3.000.000	20	20	Vegetable
3.	5.500.000	25	25	Vegetable
4.	8.000.000	35	35	Vegetable
5.	10.000.000	10	10	Vegetable
	Total	**100**	**100**	

Table 2. Respondents' Monthly Income After the Revitalization of the Gianyar People's Market

No	Class Income	After The Revitalization (people)	%	Type of Commodity
1.	1.500.000	50	50	Vegetable
2.	3.000.000	25	25	Vegetable
3.	5.500.000	15	15	Vegetable
4.	8.000.000	10	10	Vegetable
5.	10.000.000	0	0	Vegetable
	Jumlah	**100**	**100**	

The statistical analysis using the McNemar test shows a Chi-square value of 8.491 with a p-value of 0.002 (< 0.05). The alternative hypothesis (H_1) is therefore accepted, showing that income differs significantly before and after the revitalization. In other words, market revitalization has a significant effect on vegetable traders' income.

Table 2. Results of the McNemar Test for the Vegetable Traders Variable

Test Statistics[a]	Before Revitalization & After Revitalization
N	100
Chi-Square[b]	8.491
Asymp. Sig.	.002
a. McNemar Test	
b. Continuity Corrected	

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Impact of Revitalization on Fruit Traders' Income

Before revitalization, the majority of fruit traders earned approximately IDR 5,500,000 per month, totaling 30 individuals (42.3%). However, after revitalization, most traders experienced a decline in income, with the majority earning IDR 2,500,000 per month, totaling 30 individuals (42.2%). These findings indicate a decrease in fruit traders' income following the implementation of the market revitalization program.

Table 3. Respondents' Monthly Income Before the Revitalization of the Gianyar People's Market

No	Class Income	Before The Revitalization (people)	%	Type of Commodity
1.	2.500.000	6	8,5	Fruit
2.	3.000.000	15	21,1	Fruit
3.	5.500.000	30	42,3	Fruit
4.	10.000.000	15	21,1	Fruit
5.	12.000.000	5	7,0	Fruit
	Jumlah	**71**	**100**	

Table 4. Respondents' Monthly Income After the Revitalization of the Gianyar People's Market

No	Class Income	After The Revitalization (people)	%	Type of Commodity
1.	2.500.000	30	42,2	Fruit
2.	3.000.000	20	28,2	Fruit
3.	5.500.000	15	21,1	Fruit
4.	10.000.000	6	8,5	Fruit
5.	12.000.000	0	0	Fruit
	Jumlah	**71**	**100**	

The McNemar test results reveal that the Chi-square value is 10.811 with a p-value of 0.001, indicating a value lower than 0.05. Consequently, the results support the alternative hypothesis (H_1), indicating that a substantial variation exists in income before and after revitalization. It is confirmed that the revitalization of the market brings a notable effect on the income earned by fruit traders.

Tabel 5 Results of the McNemar Test for the Fruit Traders Variable

Test Statistics[a]	
	Before Revitalization & After Revitalization
N	71
Chi-Square[b]	10.811
Asymp. Sig.	.001
a. McNemar Test	
b. Continuity Corrected	

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Discussion

Based on the findings, efforts to revitalize Gianyar People's Market have not resulted in an improvement in traders' income, for both vegetable and fruit traders. Instead, a decline in income was observed after the revitalization program. This decline can be attributed to several factors, including a decrease in the number of visitors, suboptimal market management, and low compliance of traders with existing regulations. These findings suggest that physical infrastructure improvements, along with market management practices and trader behavior, play a role in the achievement of market revitalization. Therefore, improvements in market management, enhanced promotional strategies, and more effective regulatory systems are necessary to ensure that the objectives of market revitalization—namely improving traders' welfare and increasing market attractiveness—can be achieved optimally.

Conclusion and Recommendation

The impact of market revitalization on vegetable traders at the Gianyar People's Market shows a decline in traders' income. The results derived from SPSS analysis show that the p-value equals 0.002 and the Chi-square value equals 8.491. As the calculated Chi-square value (χ^2_calculated) surpasses the critical value (χ^2_table), or as the p-value falls below the significance level (α = 0.05), the alternative hypothesis (H_1) is accepted. Therefore, a meaningful influence on vegetable traders' income is generated by the revitalization of Gianyar People's Market.

Similarly, revitalization on fruit traders impacts at the Gianyar People's Market also indicates a decline in income. From the SPSS output, a p-value of 0.001 and a Chi-square value of 8.491 are observed. Acceptance of the alternative hypothesis (H_1) occurs when χ^2_calculated is higher than χ^2_table or when the p-value falls below α = 0.05. Thus, the income of fruit traders is substantially influenced by the revitalization of Gianyar People's Market.

For both the government and traders, several recommendations can be put forward based on the results and discussion presented in the previous section. The local government is expected to improve the market management system to ensure fairness for traders and to strengthen its role, particularly in market management and in addressing issues related to market operations. As the authority responsible for regional development, the government should also pay closer attention to stakeholders' interests and optimize the implementation of market revitalization programs to enhance traders' economic conditions. Furthermore, traders are encouraged to comply with established regulations in order to create a more organized and conducive market environment for all market participants.

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STRATEGIC DEVELOPMENT OF COMMUNITY-BASED AGROTOURISM IN SUBAK LEPUD

I Dewa Ayu Tita Permata Tabita*, I Gusti Agung Sasih Gayatri
Universitas Triatma Mulya; Badung

*) Corresponding author: permata.tabita@triatmamulya.ac.id

Abstract

Mass tourism development tends to prioritize economic growth while neglecting environmental sustainability. At the same time, the potential use of agricultural products for the tourism sector has not yet been fully developed. Developing alternative tourism by integrating agriculture into tourism activities as an agrotourism a viable option for achieving sustainable development. This study aims to identify the agricultural potential of Subak Lepud in Baha Village and to formulate strategies for developing as agrotourim. Research data were collected through observation and interviews and analyzed using SWOT analysis. Based on the SWOT analysis, strategies to build synergy between agriculture and tourism in Subak Lepud include: a) developing tourism attractions based on agricultural activities and rituals within the subak system; b) expanding market opportunities by leveraging the strengths of local wisdom embedded in the subak system and utilizing agricultural products and unique tourism attractions through the establishment of subak-based economic institutions; c) accelerating the empowerment of subak members by providing additional sources of income from tourism activities alongside their farming income; d) implementing incentives and disincentives regulated in awig-awig and perarem (customary rules) to control land-use conversion, optimize labor participation among subak members, and ensure the sustainability of agricultural land and the continued existence of the subak system..

Keywords: *Agriculture, Atraction, Agrotourism, Subak*

Introduction

In Bali, tourism has become one of the industries that have a major impact on economic. The tourism sector, particularly accommodation and food and beverage services, is the largest contributor, accounting for approximately 22.76% of Bali's GRDP (BPS Bali, 2025). On the other hand, the contribution of the agricultural sector in Bali has been structurally declining due to the dominance of tourism, and in 2025 it accounts for around 12.9% (BPS Bali, 2025). However, the economic benefits derived from the tourism sector are often accompanied by negative impacts such as environmental degradation, land-use conversion, socio-cultural exploitation, and rising crime rates (Sumantra et al. 2020). The decline in agricultural land indirectly impacts food availability (Pastini et al., 2023), as well as reduces biodiversity and local cultural diversity (Primdahl et al., 2013). Furthermore, population growth and the increasing demand for land for development activities have continuously influenced land-use patterns. The disparity between the tourism and agricultural sectors in Bali is also driven by the unequal distribution of agricultural benefits to support the tourism industry (Sumantra and Eka, 2022; Tabita and Suryaningsih, 2023), which in turn discourages local communities from developing the agricultural sector.

The potential for utilizing agricultural products within the tourism sector has not yet been fully developed, even though the demand from restaurants and hotels is substantial and often fulfilled by supplies from outside the region. Moreover, issues related to environmental health and food safety are highly sensitive in the tourism industry, while food production such as rice, vegetables, and fruits still relies heavily on inorganic fertilizers and pesticides (Sumantra et al., 2018). Developing alternative tourism by integrating agriculture into tourism activities is therefore an option worth considering (Tabita and Suryaningsih, 2023).

Alternative tourism refers to tourism products designed to preserve the environment while maintaining local culture to prevent its degradation or extinction (Smith, 1992). A tourism model that operates in harmony with agriculture and sustains the existence of the subak system involves integrating these sectors into new tourist attractions as well as sources of agricultural supply. One such approach is agrotourism, which combines tourism and agriculture (Widia, 2013). Agrotourism offers farming activities such as working in rice fields as key attractions. In addition to these activities, agricultural products can also be developed as tourism-based products (Sumantra et al., 2017; Sumantra et al., 2018).

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Subak Lepud, located in Baha Village, has historical, sociological, and geographical potential to support its development, reinforced by its agricultural culture (Sumantra et al., 2018). Visitors can enjoy trekking along Subak Lepud and cultural attractions such as mapeed gebogan. The access route to Subak Lepud is highly strategic, as it lies between several major tourist destinations, including the tourism routes connecting Taman Ayun and Bedugul, Taman Ayun and Ubud, and Taman Ayun and Sangeh. In addition to rice field activities and trekking routes, the area also offers recreational fishing spots.

The development planning of Subak Lepud as a tourist destination adopts a participatory, community-based approach. This program has three main characteristics: community-based, local resource-based, and sustainable (Tabita and Suryaningsih, 2023). It aims to achieve two primary objectives: enhancing community capacity and improving community welfare. The first objective: community capacity, can be achieved through empowerment, enabling community members to participate in production processes or supporting institutions, ensuring equity regardless of status or expertise, and promoting security, sustainability, and cooperation, all of which operate simultaneously (Oakley, 1991; Smith & Eadington. 1992; Oakley, 1991; UNDP, 1997).

The key issues in developing Subak Lepud are: (1) how resource potential can support tourism activities; and (2) what strategies can be implemented for subak-based agrotourism development. Accordingly, this study aims to identify agricultural potential and formulate development strategies for agrotourism in Subak Lepud.

Materials and Methods

The study was conducted in Subak Lepud, Baha Village. The data used are qualitative, consisting of descriptions of strengths, weaknesses, opportunities, and threats in developing Subak Lepud as an agrotourism destination. Data were collected through observation and interviews with the head (Kelihan) of Subak Lepud regarding past and planned efforts to develop the area as an agrotourism site.

The analysis employed SWOT analysis to formulate development and empowerment strategies. The results were further elaborated using descriptive qualitative analysis, which involves critically examining issues based on data, theories, and relevant concepts.To ensure effective data analysis, several stages were undertaken, including data collection (both internal and external), analysis, and decision-making. This process resulted in the development of: 1) strategic factor matrices (internal and external), and 2) a competitive profile matrix to determine planning strategies. The primary tool used to formulate strategic factors is the SWOT matrix, which clearly illustrates how external opportunities and threats can be addressed by aligning them with internal strengths and weaknesses.

Results and Discussion

Natural Tourism Attractions

Baha Village is characterized as a rural area with extensive agricultural land, particularly rice fields, and a strong tradition of agricultural culture. The expanse of rice fields, combined with natural scenery and farming culture, forms the basis for tourism development in the area, with trekking as its main attraction.The trekking route extends approximately 2.3 kilometers, circling a 373-hectare rice field area, allowing visitors to enjoy the beauty of the landscape and observe agricultural activities carried out by local farmers along farm roads. The natural panorama includes stretches of rice fields and terracing systems, while farming activities from land preparation, plowing, and planting to maintenance and harvesting serve as key tourist attractions. This trekking activity is closely linked with other attractions within the village. It can begin at the Subak Museum, continue through the rice fields, proceed to village tourism by visiting traditional houses, and end at the Agrotourism Park or be done in reverse. At the Subak Hall (Balai Subak), which serves as the finishing point, tourists can also enjoy traditional performances and local culinary offerings provided by the community.

Cultural Tourism Attractions

Cultural attractions in Baha Village are integrated with natural attractions in the development of the tourism village. These include the Subak Museum, traditional houses, and the War Cave (Goa Perjuangan).

1. The Subak Meseum. Baha Village is dominated by rice field land use while maintaining the traditional irrigation system known as Subak. The local subak community has a meeting hall called Balai Subak Lepud, used for meetings and agricultural ceremonies. This hall has been designated as the Subak Hall Museum, which is planned to become one of the main tourist attractions of Baha Tourism Village.The museum is equipped with facilities such as exhibition spaces for agricultural tools, a performance stage, rest areas, a jineng (rice storage structure), and toilets. It also includes a temple and meeting rooms as the main structures. The Subak Hall is planned to function as a transit point, reception area, and meeting point for tourists visiting Baha Village.

2.Traditional Houses. Historically, Baha Village was one of the bases for independence fighters in Bali. Since 1994, with government support for constructing traditional entrance gates (angkul-angkul), the village has been designated as a tourism village. The cultural life and settlement patterns of the community still preserve traditional Balinese architecture, supported by customary

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regulations requiring residents along main roads to provide a one-meter-wide green strip (adepe). This rule enhances the visual appeal of the village. Traditional houses in Baha Village are attractive for tourists, especially those interested in architecture and landscaping. One notable example is the house of Mr. Murna in Banjar Kedua, which still uses traditional building materials and Balinese architectural layout. Although it has attracted visitors, limited promotion has hindered its development as a tourism attraction.

3. War Cave (Goa Perjuangan). Baha Village has a historical war cave dating back to the Dutch and Japanese colonial periods. This cave is associated with the struggle of I Gusti Ngurah Rai against colonial forces. However, it has not yet been developed as a tourism attraction due to its location on private land and lack of maintenance.

4. Traditional Arts. Baha Village is rich in traditional arts and crafts, which support tourism development. These include performing arts such as kecak groups (male and female) and legong dance groups. Traditional crafts include wood carving, weaving, the production of Hindu ceremonial items, and other home industries. One well-developed industry is iron handicrafts, producing animal-shaped items and wall decorations. These products have reached international markets, although further training and financial support are needed for expansion.

Tourism Accessibility

Baha Village is strategically located between major tourism destinations in Badung Regency and Bali Province, particularly between Taman Ayun and Sangeh. It is approximately 19 km from Denpasar and can be accessed via the Denpasar-Baha-Mengwi-Bedugul-Buleleng route. Road conditions to the village are very good, supporting external accessibility. Internally, the village is supported by a well-developed asphalt road network with a grid pattern, enabling easy movement between attractions. Transportation options to Baha Village include travel agencies, tour buses, and private vehicles.

Tourism Facilities and Services

1. Tourist Attraction Facilities. Available facilities include:

a. Rice field trekking routes, with planned gazebos as supporting facilities
b. Agrotourism Park with trekking paths and planned rest gazebos
c. Subak Hall Museum (Balai Subak Lepud).
d. War Cave access paths (currently not optimal)
e. Parking facilities (still limited, but land is available for expansion)

2. Tourism Facilities and Businesses.To support visitors' needs, the village provides:

a. Accommodation facilities
b. Food and beverage services (e.g., fermented cassava products and salted eggs)
c. Souvenir businesses (iron handicrafts)
d. Tourism security facilities (not yet available)
e. Tourism information services (not yet available)

Institutional Aspects of Baha Tourism Village

Tourism institutions in Baha Village are not yet functioning optimally. However, several potential organizations could serve as management bodies, including the Tourism Awareness Group (Pokdarwis), community organizations (youth groups, women's groups), and subak organizations.

Tourism Marketing

To strengthen the positioning of Subak Lepud as a tourist attraction, it is necessary to reinforce its identity, with the Agrotourism Park serving as a potential icon.Currently, Subak Lepud has not attracted significant tourist interest, whether local, domestic, or international. Although visitors pass through Baha Village, tourism potential has not yet been effectively packaged into marketable products. Promotion efforts remain limited and lack coordination among the government, tourism stakeholders, and the local community.

Public Infrastructure and Facilities

1. Public Infrastructure: a) Water Supply: Provided by PDAM and groundwater; access is adequate. b) Electricity: Fully supplied by PLN to all households c) Telecommunications: Mobile networks are widely available with no blank spots; Wi-Fi and 3G services are accessible . d) Sanitation and Waste Management: Integrated waste management facility produces compost; wastewater is managed individually

2. Public Facilities : a) Education: 1) kindergarten and 2 elementary schools; no secondary schools. 2) Health: 7 community health posts and 1 auxiliary health center; higher-level services accessed nearby, including regional hospitals 3) Economic Facilities: Traditional market (Catus Patha Mengwi), minimarkets, 1 village credit institution, and 7 cooperatives

Strategy for Development Agrotourism in the Subak Lepud Area

Based on the results of field research, a matrix was developed identifying internal factors (strengths and weaknesses) and external factors (opportunities and threats) in building synergy between the agricultural and tourism sectors in Subak Lepud as an agrotourism area (Tables 1 and 2). Based on the IFAS matrix analysis (Table 1), four dominant strength factors of Subak Lepud in integrating agriculture and tourism are as follows:

a. Subak leaders and members agree and are willing to support the development of Subak Lepud as a tourism area (score: 0.36);
b. Strategic location and very easy accessibility (score: 0.32);

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c. Government support in the form of regulations on subak, policies, and funding; and
d. Attractive subak landscape and panorama (score: 0.28).

The dominant weakness factors in integrating agriculture and tourism are:

1. Subak has a predominantly social orientation rather than a business orientation, resulting in weak marketing of agricultural products (score: 0.24);
2. The absence of professional tourism management;
3. The continued shift of agricultural labor to non-agricultural sectors; and
4. Limited community awareness of existing tourism potential (each with a score of 0.18)

Table 1. IFAS Matrix (Strengths and Weaknesses) of Subak Lepud Agrotourism

No.	Strengths	Weight	Rating	Score
1	Strong philosophical foundation and clear objectives	0.06	4	0.24
2	Subak leaders and members agree and are willing to support the development of Subak Lepud as a tourism area	0.09	4	0.36
3	Subak is the only farmers' organization; if empowered, it has strong bargaining power	0.06	4	0.24
4	The organization operates democratically based on customary regulations (awig-awig)	0.06	3	0.18
5	Government support in the form of laws, policies, and funding related to subak	0.07	4	0.28
6	Attractive subak landscape and panorama	0.07	4	0.28
7	Strategic location and very easy accessibility	0.08	4	0.32
8	Some farmers have developed organic agriculture	0.06	3	0.18
9	Cropping patterns and abundant water availability	0.03	3	0.09
No.	Weaknesses	Weight	Rating	Score
1	Subak has a predominantly social orientation rather than a business orientation, resulting in weak marketing of agricultural products	0.06	4	0.24
2	Lack of professional tourism management	0.06	3	0.18
3	The community lacks knowledge of the steps required to develop Subak Lepud as a tourism area	0.06	2	0.12
4	Significant labor shift out of the agricultural sector	0.06	3	0.18
5	Low community awareness of existing tourism potential	0.06	3	0.18
6	Land conversion due to private land ownership	0.03	3	0.09
7	Subak members have not yet implemented integrated cropping patterns	0.03	2	0.12
8	Organizational operations focus more on production, while administrative and financial systems are still managed in a simple manner	0.06	3	0.18
	Total internal factor	1.00		3.4

Table 2 shows that the opportunity factor score is higher than the threat factor score, with a total external factor score of 3.11. The four dominant opportunity factors of Subak Lepud in integrating the agricultural and tourism sectors are as follows:

a. Government assistance from the Badung Regency for subak preservation (score: 0.40);
b. Government support aligned with the vision of cultural tourism development;
c. The highly strategic location of Subak Lepud, close to both the provincial and regency capitals, which provides strong potential for development and synergy with the tourism sector; and
d. Agricultural products produced by farmers have strong market potential, both for tourists visiting Subak Lepud directly and for supply to hotels and restaurants.

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Meanwhile, the threats faced include:

a. The possibility that Subak Lepud may offer tourism products similar to those of surrounding areas (score: 0.18);
b. Land conversion, which threatens the existence of the subak system (score: 0.15);
c. The influx of labor from outside the subak (score: 0.15); and
d. The shift from a socio-agrarian society to an industrial society, which may threaten the sustainability of tourism activities and affect the existence of the subak.

Tabel 2. Matrix EFAS (Oportunities and Threats) agrotourism of Subak Lepud.

No.	Opportunities	Weight	Rating	Score
1	Market opportunities for tourists, hotels, and restaurants	0.08	4	0.32
2	Opportunities for crop diversification with high market value	0.07	3	0.21
3	Bank funding for agricultural credit as a priority program	0.06	3	0.18
4	Government support aligned with the vision of cultural tourism development	0.09	4	0.36
5	Government assistance provided to subak	0.10	4	0.40
6	Strategic location close to the provincial capital	0.10	3	0.30
7	Expectation of synergy between agriculture and tourism within the subak	0.09	4	0.36
8	Potential synergy among agriculture, livestock, and fisheries sectors	0.09	2	0.18
No.	Threats	Weight	Rating	Score
1	Shift from a socio-agrarian society to an industrial society, reducing interest in agricultural work	0.06	2	0.12
2	High taxes on agricultural land	0.05	2	0.10
3	Population growth and conversion of rice fields to non-agricultural land	0.05	3	0.15
4	The emergence of professionally managed private agribusiness enterprises as competitors to subak communities	0.05	2	0.10
5	Increasing replacement of local farm labor by workers from outside the subak	0.05	3	0.15
6	Similarity or overlap of tourism products with those of other regions	0.06	3	0.18
	Total External Factor Score	1.00		3.11

Based on the analysis of Table 1 and Table 2, the total internal factor score is 3.40, while the total external factor score is 3.11. This indicates that the strategic position of Subak Lepud in integrating the agricultural and tourism sectors lies in Quadrant I of the I–E matrix, which reflects a growth strategy through vertical integration by maintaining strengths and optimizing opportunities.

This strategy requires Subak Lepud to develop its tourism attractions by enhancing tourism facilities, strengthening subak institutions as the main support and driving force of tourism activities, increasing awareness among subak members regarding tourism activities, and improving the economic benefits for both the subak institution and its members.

The strategy can be implemented through the development of new products and services or by diversifying existing tourism products and services. To support market penetration, improved promotional efforts are necessary, including expanding to broader target markets. Equally important is establishing partnerships with tourism service providers such as hotels, villas, and travel agencies.

The SWOT analysis results in four alternative strategic groups: SO (Strengths–Opportunities), WO (Weaknesses–Opportunities), ST (Strengths–Threats), and WT (Weaknesses–Threats), as presented in Table 3.

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Table 3. Agrotourism Development Strategies for Subak Lepud

Internal factor / External factor		Strength (S)		Weakness (W)	
		Factor	Skor	Factor	Skor
	1	The management and members of Subak agree and are willing to support the development of Subak Lepud as a tourism area.	0,36	1 Subak is predominantly social in nature rather than business-oriented, resulting in weak performance in marketing agricultural products.	0,24
	2	Government support in the form of legislation on Subak, policies, and funding.	0,28	2 There is no tourism management yet.	0,18
	3	Attractive subak landscape and panorama;	0,28	3 Significant labor shift away from the agricultural sector;	0,18
	4	Strategic location with very easy accessibility	0,32	4 Lack of community awareness regarding its tourism potential	0,18
Opportunities (O)			SO Strategies (Strengths–Opportunities)	WO Strategies (Weaknesses–Opportunities)	
Factor	Skor				
1 Market opportunities for tourists, hotels, and restaurants;	0,32		1. Expand the market by highlighting the local wisdom of the subak system. Its philosophical foundations and customary rules (*awig-awig*), while creating synergy between the agricultural and tourism sectors. *(S1, S4, O1, O2, O4)* 2. Collaborate with the government to integrate agricultural potential, landscape attractiveness, and subak local wisdom with the tourism sector. *(S1, S3, O3, O4)*	1. Encourage subak to establish professional management bodies with a stronger business orientation to capture opportunities, enabling agriculture to create employment, reduce land conversion, and limit the shift of labor out of the agricultural sector. *(W1, W2, W3, O1, O2, O4)* 2. Subak, in collaboration with the government, should improve tourism infrastructure to raise awareness and empower members in developing the subak's potential. *(W3, W4, O2, O3)*	
2 Government support aligned with the vision of cultural tourism development;	0,36				
3 Availability of government assistance for subak;	0,40				
4 Subak expects synergy between agriculture and tourism	0,36				
Threats (T)			ST Strategies (Strengths–Threats)	WT Strategies (Weaknesses–Threats)	
Factor	Skor				

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1	The shift from a socio-agrarian society toward an industrial society is reducing interest in agricultural work;.	0,12	1. Strengthen and enforce subak regulations, both for business support and for controlling the conversion of rice fields into non-agricultural land. *(S1, S3, T1, T2)* 2. Develop unique attractions and select distinctive crop types based on local wisdom with high market value, in order to create employment opportunities and improve the welfare of subak members. *(S2, S4, T3, T4)*	1. Collaborate with the government to develop the potential of subak local wisdom in order to produce unique agricultural products and tourism attractions, while strengthening subak institutions through the establishment of subak-based economic enterprises. *(W1, W2, T1, T3)* 2. Apply strict and selective development of facilities to minimize land conversion. *(W2, W4, T2, T3)*
2	Population growth and the conversion of rice fields to non-agricultural uses;.	0,15		
3	More agricultural labor is being replaced by workers from outside the subak	0,15		
4	Similarity or overlap with other agro-tourism destinations.	0,18		

SO Strategy (Strengths–Opportunities)

This strategy is formulated by utilizing all strengths to take advantage of existing opportunities, which can be achieved through:

a. Expanding the market by highlighting the local wisdom of the subak system while creating synergy between the agricultural and tourism sectors.
b. Establishing cooperation with the government to integrate agricultural potential, landscape attractiveness, and subak local wisdom with the tourism sector.

WO Strategy (Weaknesses–Opportunities)

This strategy is based on utilizing opportunities while minimizing existing weaknesses, which can be achieved through:

a. Encouraging subak to establish management bodies with a stronger business orientation in order to capture opportunities, enabling the agricultural sector to create employment, reduce land conversion, and limit the shift of labor out of agriculture.
b. Subak, in collaboration with the government, improving tourism infrastructure to raise awareness and empower its members in developing the subak's potential more effectively.

ST Strategy (Strengths–Threats)

This strategy uses strengths to overcome threats, which can be implemented through:

a. Strengthening and enforcing subak regulations, both to support business activities and to control the conversion of rice fields.
b. Developing tourism attractions and selecting unique crop types based on local wisdom with high economic value, in order to create employment opportunities and improve the welfare of subak members.

WT Strategy (Weaknesses–Threats)

This strategy is defensive in nature, aiming to minimize weaknesses and avoid threats, and can be implemented through:

a. Collaborating with the government to develop the potential of subak local wisdom in order to produce unique agricultural products and tourism attractions, while strengthening subak institutions through the establishment of subak-based economic enterprises.
b. Applying strict and selective policies in the development of facilities to minimize land conversion.

Conclusion and Recommendation

Based on the analysis conducted, the strategies for building synergy between the agricultural and tourism sectors in Subak Lepud are as follows:

1. Developing tourism attractions based on agricultural activities and subak rituals through collaboration with the government and private sector, in order to empower subak and prevent land conversion as well as labor shifts to other sectors that may threaten the existence of subak.
2. Expanding the market by highlighting the competitive advantages based on subak local wisdom and building cooperative networks with various stakeholders.
3. Developing the potential of subak local wisdom to produce unique agricultural products and tourism attractions, while strengthening subak institutions through the establishment of subak-based economic enterprises.
4. Providing adequate tourism facilities for visitors to accelerate the empowerment of subak members and increase income from tourism activities, in addition to agricultural income, in accordance with existing

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norms to ensure the sustainability of agricultural land and the continued existence of the subak system.

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EFFECTS OF BIOCHAR DOSE AND MEDIA MOISTURE CONTENT ON THE GROWTH OF LOCAL EBAN COFFEE SEEDLINGS IN AGROFORESTRY SYSTEMS

Yakobus P.E. Saba Agu*, Krisantus Tri Pambudi Raharjo, Robertus Anin
Timor University, Kefamenau, Indonesia
*) Corresponding author: jechoforester@gmail.com

Abstract

According to BPS data (2021), the North Central Timor Regency has a potential coffee production of 210.00 tons, with a planting area reaching nearly 1,152 ha, predominantly distributed in the West Miomaffo region. Water availability and soil fertility levels are the primary limiting factors in coffee cultivation practices. This study aims to determine the effect of biochar dosage and soil moisture levels on the growth of coffee seedlings (*Coffea sp.*).
This research utilized a Split Plot Design with two factors and three replications. The results showed that a higher watering discharge significantly increased soil temperature. An application of 40 g of biochar significantly increased plant height at 84 DAP (Days after Planting) and stem diameter across all observation periods. While the combination of 60 g biochar and a watering discharge of 4 mL/second produced the tallest plants at each observation, the 40 g biochar dosage was sufficiently influential and not significantly different from the 60 g dosage across all watering levels. The application of biochar dosage is closely related to the increase in soil organic carbon content, which subsequently influences the increase in plant height, stem diameter at 70 DAP, and 84 DAP. The treatment of 60 g biochar and 4 mL/second watering was found to be the most optimal in enhancing the growth of coffee seedlings.

Keywords: *Biochar, Eban Coffee, Soil Moisture, Agroforestry. Timor*

Introduction

Geographically, North Central Timor (TTU) Regency covers an area of 2,669.70 km^2, or approximately 5.48 % of the total land area of East Nusa Tenggara (NTT) Province. Administratively, TTU Regency consists of 24 districts and 193 villages/sub-districts (BPS North Central Timor 2015, cited in Damasius, 2017). The topography of TTU Regency is generally undulating and hilly with varying elevations: 1) 177.60 km^2 (6.63%) at less than 100 meters above sea level (mdpl); 2) 1,499.45 km^2 (56.17%) at 100–500 mdpl; and 3) 993.19 km^2 (37.20%) at more than 500 mdpl (Sasi, 2017).

Coffee production in TTU Regency reached 210.00 tons in 2021, with a plantation area of 1,152 hectares (BPS East Nusa Tenggara Province, 2021). Noepesu Village is one of the 13 coffee-producing villages in the West Miomaffo District. Farmers in this region often practice conventional farming, including coffee cultivation that relies solely on natural regeneration by "dictating nature." Noepesu Village is located in a highland area ranging from 600 - 1,200 mdpl (BPS TTU, 2018), with an average temperature of 18°C. The topography is predominantly hilly, with most land having a slope of ± 45°, utilized as fields planted once a year during the rainy season with various food crops such as maize, rice, cassava, long beans, red beans, peanuts, garlic, carrots, and other horticultural crops. The rainy season is typically very short, lasting only four months. Given the constraints of dryland conditions, farming activities are mostly limited to land preparation just before the rainy season.

Consequently, the primary obstacles faced by coffee farmers in Noepesu Village are limited water availability and low rainfall (drought), resulting in low production and productivity. Besides drought, soil moisture levels significantly influence the growth and yield of coffee plants. Soil moisture refers to the water filling part or all of the soil pores. Therefore, one effort to overcome water shortages and increase soil moisture is through the use of biochar as a soil amendment. The application of biochar is expected to maintain soil and environmental productivity, preserve soil humidity, enhance soil moisture, and promote the growth of coffee seedlings.

Biochar is an emerging and prospective agricultural cultivation technology for dryland applications, serving as an innovation to mitigate the effects of drought on plant growth and yield. Biochar technology involves managing
agricultural waste—such as rice husks, straw, furniture waste (sawdust), and other dry organic materials—through a process of incomplete combustion with limited oxygen (pyrolysis), ensuring the final product is charcoal rather than ash. The production of biochar can be carried out traditionally, and the resulting charcoal is used as a soil conditioner (*Agu et al.,* 2025). Coffee planting is conducted within an agroforestry scheme. Agroforestry, known as *"Wanatani"* in Indonesian, combines agricultural and forestry sciences through intensive land

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use, integrating forest trees with agricultural crops to increase economic, environmental, and socio-cultural benefits (Agu et al., 2025). Based on the background described above, the research problem is formulated as follows: *How does the application of biochar dosage affect the medium moisture levels within a coffee-based agroforestry scheme?*

Materials and Methods

This research was conducted in Noepesu Village, West Miomaffo District , North Central Timor Regency from August 2025 to November 2025

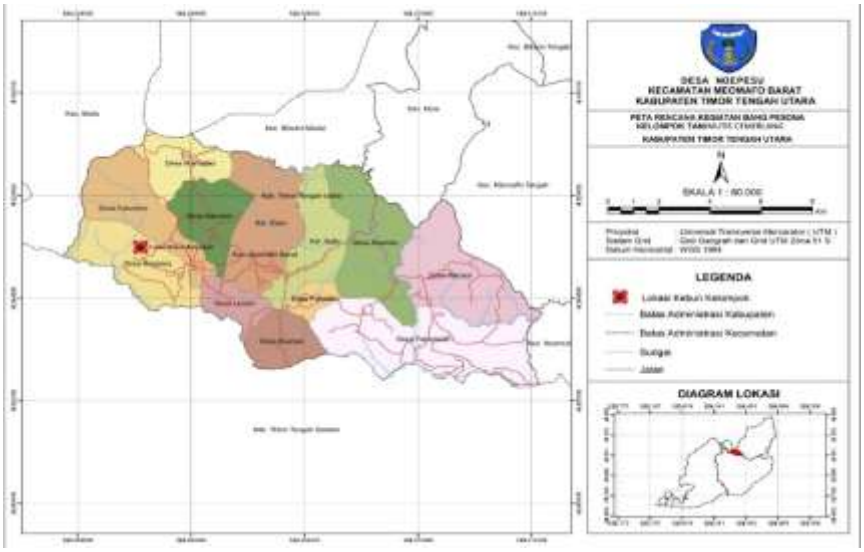

Figure 1 Research Location Map

This research was conducted using a split plot design method *with 2* factors . Observations and data processing were carried out once every 7 days when the plants were 7 days after planting to 84 days after planting .

Growth Observation

1. Plant Height (cm)
   Plant height was measured using a ruler on each plant, from the soil surface to the growing point. Measurements were taken every two weeks from 14 to 84 days after planting.
2. Bar Diameter (mm)
   Stem diameter was measured using a vernier caliper by clamping the stem (1 cm above the base of the stem) of each plant. Measurements were carried out every 2 weeks until the plant was 84 days after planting. Number of leaves (Sheets)
3. Number of leaves (blades)
   The number of leaves was counted every two weeks while measuring plant height and stem diameter until the plants were 84 days after planting. Leaves counted were those that were fully open and not yellow or dry.

Environmental Observation

1. Moisture Content (%)
   Measurements were made by taking soil samples in the form of lumps of soil at a depth of 10 cm in the research area and then weighing them to obtain the wet weight (BB) of the soil, then oven-dried at 150°C for 24 hours and then weighed using an analytical balance to obtain the dry weight (BK) of the soil. According to the 2005 Soil Research Center, moisture content can be calculated using the formula:

   $$KL(\%) = \frac{BB - BK}{BK} \times 100\%$$

   Description: KL = Soil moisture content, BK = Dry weight of soil (oven) BB = Wet weight of soil
2. Soil Temperature (ºC)
   Soil temperature measurements using a thermometer measuring instrument are carried out every 7 days after planting until the plants are 84 days old.
3. DHL Land (mS)
   Take a 10 gram soil sample and weigh it, then put it in a shaker bottle, and add 30 mL of distilled water, then record the results listed on the shaker bottle.
4. Cation Exchange Capacity (CEC) (me/100g)

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Take a soil sample and analyze it in the laboratory. Then calculate it using the formula:
CEC (me/100 grams) = ml. blank – ml. sample x N. NaOH x 100 x Fka.

5. C- Organic (%)
Take soil samples at a depth of 0-10 cm, then air dry them. After drying, crush them and sieve them with a 2 mm sieve. Take the soil that passes through the sieve and is ready to be analyzed in the laboratory. According to Ohorella *et al.,* (2011) C-organic is calculated using the Walkey and Black method with the formula:

$$\text{Organic C content (\%)} = \frac{(mek2cr207 - mefeSO4)x0{,}0003xF}{BKM} \text{ X } 100\%$$

Information:
- *f = 1.33>C which is oxidized 77% = 100/77 = 1.03*
- *me = N x V*
- *N = Normality*
- *V = Volume*
- *BKM = absolute dry weight 105°C*
- *00.003 = valence of oxidized Cr = 3 x 0.001 (mg to grams)*
- *% B – organic = %C organic x 1.724.*

Data analysis

The observation data were then analyzed using a split -*plot analysis of variance (ANOVA*) . The treatment averages were then further tested using *the Duncan Multiple Range t -Test* (DMRT) with a significance level of 5%, as directed by Gomez and Gomez (2010). Data analysis used the SAS 9.1 program.

Results and Discussion

Results

1. Soil Temperature

The results of the analysis of variance showed that the interaction between biochar dosage treatment and irrigation discharge did not occur in soil temperature observations at 14, 28, 42, 56, 70, and 84 days after planting (DAP). The single effect of biochar treatment showed that soil temperature was not significantly different in observations at 14, 56, 70, and 84 days after planting, but was significantly different in observations at 28 and 42 days after planting and the lowest soil temperature occurred in plants treated with 20 g of biochar.

The single effect of irrigation discharge treatment showed that the soil temperature was not significantly different in the 70 HST observation, but was significantly different in the 14, 28, 42, 56, and 84 HST observations, the lowest soil temperature occurred in plants given the irrigation discharge treatment of 2 ml/second.

Table 1. Effect of biochar dosage and irrigation flow rate on soil temperature

Time Observation (HST)	Dose Biochar (grams)	Irrigation Debit (ml/sec)		Average
		2	4	
14	0	24.34	24.33	24.33a
	20	23.67	25.50	24.59a
	40	24.00	25.50	24.75a
	60	24.34	25.34	24.84a
	Average	24.09b	25.17a	(–)
28	0	23.67	23.67	23.67bc
	20	22.50	23.84	23.17c
	40	23.17	25.17	24.17ab
	60	24.17	25.34	24.75a
	Average	23.38b	24.50a	(–)
42	0	24.17	25.34	24.75a
	20	23.50	24.84	24.17b
	40	24.50	25.67	25.08a
	60	24.34	25.67	25.00a
	Average	24.13b	25.38a	(–)
56	0	22.50	24.83	23.67a
	20	22.84	25.34	24.09a

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	40	24.00	25.00	24.50a
	60	23.67	24.84	24.25a
	Average	23.25b	25.00a	(–)
	0	24.34	24.83	24.58a
	20	24.00	24.34	24.17a
70	40	24.50	24.83	24.67a
	60	24.50	24.67	24.58a
	Average	24.33a	24.67a	(–)
	0	24.00	25.17	24.59a
	2h0	24.33	24.84	24.58a
84	40	23.84	24.67	24.25a
	60	24.17	25.00	24.59a
	Average	24.08b	24.92a	(–)

Description: Numbers in the same row and column followed by the same letter indicate no difference at the 5% real level (α) according to the DMRT test, (–) there is no interaction between factors.

2. Plant Height (cm)

The results of the analysis of variance showed that the interaction between the biochar dose treatment and the watering rate occurred at each observation time of plant height. The application of a biochar dose treatment of 60 g with a watering rate of 4 ml/second produced the tallest plants at each observation time and was significantly different from other treatment combinations where at 14 HST observations the combination gave a coffee plant height value of 18.49 cm, becoming 18.60 cm at 28 HST observations and then increasing to 19.10 cm at 42 HST observations, 19.60 cm at 56 HST observations, 20.30 cm at 70 HST observations and 21.09 cm at the end of the observation (84 HST). Based on the research data, the growth of coffee plant height at each observation time increased.

Table 2. Effect of biochar dosage and irrigation flow on coffee plant height

Time Observation (HST)	Dose Biochar (grams)	Irrigation Debit (ml/sec)		Average
		2	4	
	0	14.47abc	12.09bc	13.28
	20	12.34bc	12.97bc	12.65
14	40	16.35ab	15.77ab	16.06
	60	11.70c	18.49a	15.09
	Average	13.71	14.83	(+)
	0	14.09abc	13.00bc	13.54
	20	12.62bc	13.19bc	12.90
28	40	16.50ab	16.07ab	16.28
	60	11.90c	18.60a	15.25
	Average	13.78	15.21	(+)
	0	14.33abc	13.20bc	13.77
	20	12.84bc	13.45bc	13.14
42	40	16.79ab	16.52ab	16.65
	60	12.15c	19.10a	15.63
	Average	14.03	15.57	(+)
	0	14.70abc	13.52bc	14.11
	20	13.12bc	13.87bc	13.49
56	40	17.08ab	16.75ab	16.92
	60	12:43c	19.60a	16.02
	Average	14.33	15.93	(+)
70	0	15.52abc	14.20bc	14.86
	20	13.88bc	14.60bc	14.24

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	40	17.73ab	17.57ab	17.65
	60	13.07c	20.30a	16.68
	Average	15.05	16.67	(+)
	0	16.37abc	14.92bc	15.64
	20	14.82bc	15.85abc	15.34
84	40	18.62ab	18.47ab	18.54
	60	13.78c	21.09a	17.43
	Average	15.90	17.58	(+)

Description: Numbers in the same row and column followed by the same letter indicate no difference at the 5% real level (α) according to the DMRT test, (+) there is interaction between factors.

2. Number of leaves (strands)

The results of the analysis of variance showed that the interaction between the biochar dose treatment and the watering rate did not occur on the number of leaves at each observation time. The single effect of each treatment was also not significantly different at each observation time, the results of the DMRT further test showed that at the level of the 40 gram biochar dose treatment gave the highest number of leaves, namely 5.67 strands at the observation time of 14 HST, then in other observations the 20 gram biochar dose treatment gave the highest number of coffee leaves until the end of the observation and was significantly different at the observation of 70 HST and very significantly different at the observation of 84 HST. At the level of the 2 ml/second watering rate treatment, the highest number of coffee leaves was given at each observation time to give the highest number of leaves at the end of the observation, namely 7.54 strands and was significantly different from the level of the 4 ml/second watering rate treatment.

Table 3. Effect of biochar dosage and irrigation flow rate on the number of leaves

Time Observation (HST)	Dose Biochar (grams)	Irrigation Debit (ml/sec)		Average
		2	4	
	0	5.00	5.67	5.34a
	20	5.67	4.34	5.00a
14	40	5.67	5.67	5.67a
	60	4.67	4.50	4.58a
	Average	5.25a	5.04a	(–)
	0	6.33	5.83	6.08a
	20	8.50	6.33	7.42a
28	40	5.50	6.17	5.84a
	60	5.67	5.50	5.59a
	Average	6.50a	5.96a	(–)
	0	6.67	5.84	6.25a
	20	9.34	7.50	8.42a
42	40	7.00	8.34	7.67a
	60	6.33	6.17	6.25
	Average	7.33a	6.96a	(–)
	0	5.34	6.67	6.00a
	20	8.50	7.00	7.75a
56	40	7.17	7.67	7.42a
	60	6.50	6.00	6.25a
	Average	6.88a	6.83a	(–)
	0	6.50	6.33	6.42b
70	20	9.17	7.50	8.33a
	40	7.34	8.00	7.67a

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	60	6.50	6.33	6.42b
	Average	7.38a	7.04a	(–)
84	0	6.34	6.00	6.17c
	20	9.17	7.17	8.17a
	40	8.00	6.67	7.33ab
	60	6.67	6.00	6.34bc
	Average	7.54a	6.46b	(–)

Description: Numbers in the same row and column followed by the same letter indicate no difference at the 5% level of significance (α) according to the DMRT test, (–) there is no interaction between factors.

3 Bar Diameter (mm)

The results of the analysis of variance showed that there was no interaction between the biochar dosage treatment and the irrigation discharge on the stem diameter parameter. The results of the DMRT further test showed that the application of the 40 gram and 60 gram biochar dosage treatment provided the widest stem diameter value of 0.25 mm at the observation time of 14 HST, then in other observations, the 60 gram biochar dosage treatment provided the widest coffee stem diameter value until the end of the observation and was significantly different at each observation time. The application of the 2 ml/second and 4 ml/second irrigation discharge treatment provided the widest coffee stem diameter value at the observation time of 14 HST. Furthermore, in other observations, the 4 ml/second irrigation discharge treatment provided the widest coffee stem diameter value until the end with a value of 0.31 mm.

Table 4. Effect of biochar dosage and irrigation flow rate on coffee stem diameter.

Time Observation (HST)	Dose Biochar (grams)	Irrigation Debit (ml/sec)		Average
		2	4	
14	0	0.25	0.23	0.24ab
	20	0.20	0.23	0.22b
	40	0.27	0.24	0.25a
	60	0.24	0.27	0.25a
	Average	0.24a	0.24a	(–)
28	0	0.24	0.25	0.24b
	20	0.25	0.29	0.27ab
	40	0.29	0.25	0.27ab
	60	0.25	0.34	0.29a
	Average	0.26a	0.28a	(–)
42	0	0.25	0.25	0.25b
	20	0.25	0.29	0.27ab
	40	0.29	0.25	0.27ab
	60	0.25	0.35	0.30a
	Average	0.26a	0.28a	(–)
56	0	0.25	0.25	0.25b
	20	0.25	0.29	0.27ab
	40	0.29	0.25	0.27ab
	60	0.25	0.35	0.30a
	Average	0.26a	0.28a	(–)
70	0	0.28	0.30	0.29ab
	20	0.27	0.30	0.29ab
	40	0.29	0.28	0.28b
	60	0.30	0.37	0.34a
	Average	0.28a	0.31a	(–)

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	0	0.28	0.30	0.29ab
	20	0.27	0.30	0.29ab
84	40	0.29	0.28	0.28b
	60	0.30	0.37	0.34a
	Average	0.28a	0.31a	(–)

Description: Numbers in rows and columns followed by the same letter indicate a difference at the 5% level of significance (α) according to the DMRT test, (–) there is no interaction between factors.

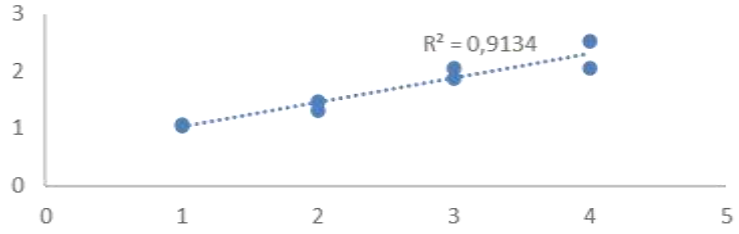
Discussion.

Correlation analysis is a statistical term commonly used to study the relationship between variables. The purpose of this analysis technique is to identify patterns and the closeness or strength of the relationship between two or more variables, expressed by the correlation coefficient. The correlation coefficient in regression analysis is a measure of the strength of the linear relationship between the independent variable (X) and the dependent variable (Y). This correlation coefficient is symbolized by *r* . Its values vary from -1 to +1. A correlation coefficient of -1 indicates a perfect negative correlation, while +1 indicates a perfect positive correlation. Using the correlation regression analysis approach, the results of this study can be described as follows: When the increasing biochar application data is correlated with the organic C content in the medium, it shows that biochar application is closely related to the increase in organic C content in the medium. The square root of R2 = 0.9134 is 0.96, proving that the application of biochar in this study increased organic C in the medium. Organic C is useful for helping the sustainability of soil fertility and water related to the nutrient cycle, thus increasing plant growth.

Table 5. Biochar dosage data (g), water irrigation flow rate (ml/sec) and C organic (%)

Treatment		C Organic (%)
Biochar Dosage (g)	Water irrigation discharge (ml/sec)	
0	2	1.04
	4	1.07
20	2	1.30
	4	1.47
40	2	2.05
	4	1.87
60	2	2.04
	4	2.52

Figure 2. Relationship between Biochar and organic C



Information :
Horizontal line: Biochar variable
Vertical Line: C-Organic Variable

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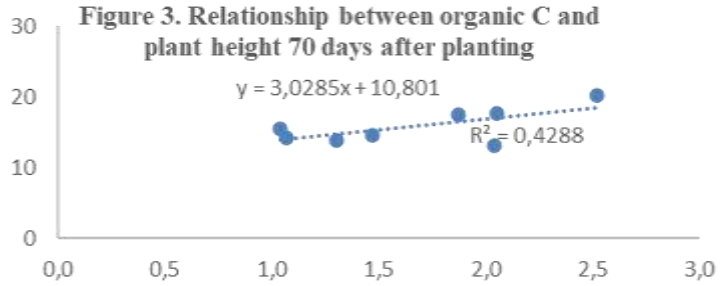
When the organic C content data in the media is correlated with the plant height data, it shows that the organic C content in the media is closely related to the increase in plant height 70 HST. The square root of R^2 = 0.4288 is = 0.655 proving that the increase in organic C in the media plays a role in increasing plant height in the 70 HST observation.

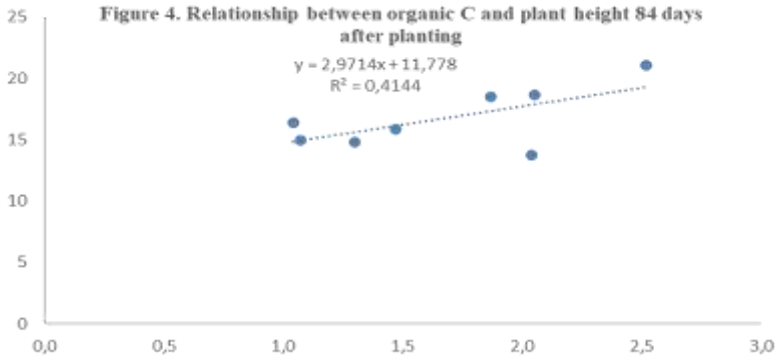
Table 6 Data on biochar dosage (g), water irrigation flow (ml/second) and organic C (%), plant height 70 HST and 84 HST (cm)

Treatment		C Organic (%)	Tall Plants 70 HST (cm)	Plant height 84 HST (cm)
Biochar Content (g)	Water spraying rate (ml/second)			
0	2	1.04	15.52	16.37
	4	1.07	14.20	14.92
20	2	1.30	13.88	14.82
	4	1.47	14.60	15.85
40	2	2.05	17.73	18.62
	4	1.87	17.57	18.47
60	2	2.04	13.07	13.78
	4	2.52	20.30	21.09



Information :
Horizontal Line: Variable C-organi
Vertical Line: Variable Plant Height 70 HST

When the organic C content data in the media is correlated with plant height data, it shows that the organic C content in the media is closely related to the increase in plant height 84 HST. The square root of R^2 = 0.4144 is = 0.644 proving that the increase in organic C in the media plays a role in increasing plant height in the 84 HST observation.



Information :
Horizontal Line: C-organic Variable

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Vertical Line: Variable Plant Height 84 HST

When the organic C content data in the media is correlated with the plant stem diameter data, it shows that the organic C content in the media is closely related to the increase in plant stem diameter at 70 HST. The square root of R^2 = 0.3742 is = 0.612 proving that the increase in organic C in the media plays a role in increasing the plant stem diameter at 70 HST observations.

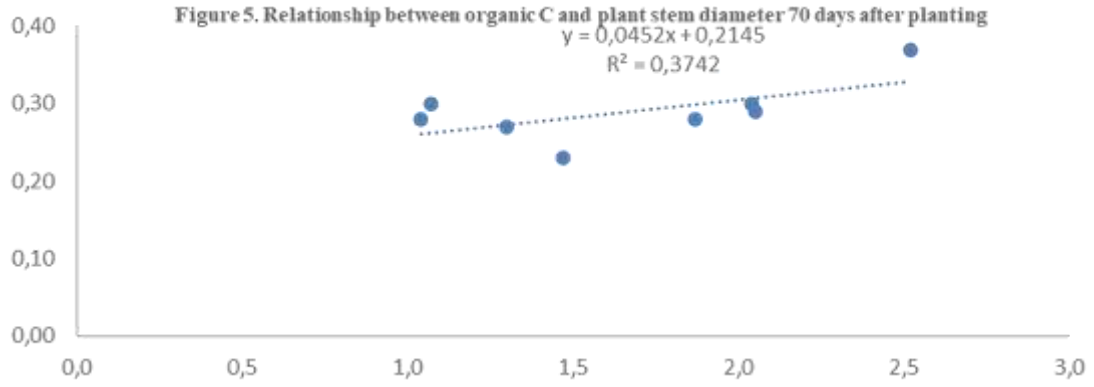

Figure 5. Relationship between organic C and plant stem diameter 70 days after planting

Table 7 Data on biochar dosage (g), water irrigation flow rate (ml/second) and Organic C (%), stem diameter 70 HST and 84 HST (cm)

Treatment		C Organic (%)	Stem diameter 70 HST (mm)	Stem diameter 84 HST (mm)
Biochar Dosage (g)	Water spraying rate (ml/second)			
0	2	1.04	0.28	0.28
	4	1.07	0.30	0.30
20	2	1.30	0.27	0.27
	4	1.47	0.23	0.30
40	2	2.05	0.29	0.28
	4	1.87	0.28	0.29
60	2	2.04	0.30	0.30
	4	2.52	0.37	0.37

Information :*Horizontal Line : C- organic*, *Vertical Line: Variable stem diameter 70 HST.*

When the organic C content data in the media is correlated with the plant stem diameter data, it shows that the organic C content in the media is closely related to the increase in plant stem diameter 84 HST. The square root of R^2 = 0.3719 is = 0.640 proving that the increase in organic C in the media plays a role in increasing the plant stem diameter in the 84 HST observation.

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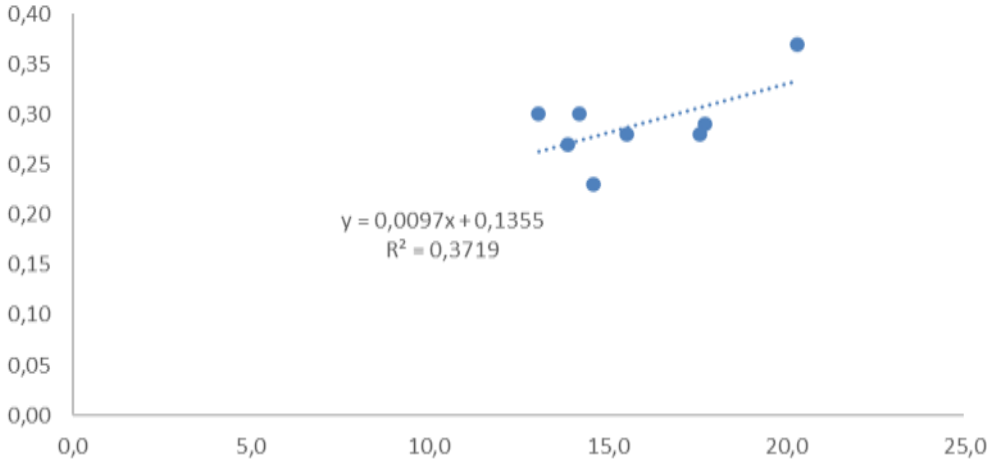
Figure 6. Relationship between Plant Height and Plant Stem Diameter 84 HST



Information:
Horizontal Line: Variable Plant Height 84 HST
Vertical Line: Stem Diameter Variable 84 HST

Conclusion and Recommendation

The results of this study conclude that:

1. The highest irrigation discharge had a significant effect on increasing soil temperature at each observation time.
2. The administration of a biochar dose of 40 g had a significant effect on increasing plant height growth at 84 HST and stem diameter at each observation time.
3. The application of a biochar dose treatment of 60 g with a watering flow rate of 4 ml/second produced the highest plants at each observation time.
4. The application of a biochar dose of 40 g had a significant effect at all levels of irrigation discharge to increase the growth of coffee seedlings and was not significantly different from the biochar dose of 60 g at all levels of irrigation discharge.
5. The application of biochar dose treatment is closely related to increasing soil organic C content, increasing plant height and stem diameter at 70 HST and 84 HST.

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COST AND PROFIT ANALYSIS OF BALI GOLDFISH FARMING AT POKDAKAN KOIYOGAN KAZOKU RANA

Ni Luh Desi Puspitayanti, Ni Putu Anglila Amaral*, I Made Budiasa
Universitas Mahasaraswati Denpasar, Denpasar, Indonesia

Corresponding Author: anglilaamaral@unmas.ac.id

ABSTRACT

The waters in Indonesia are very vast and consist of freshwater and seawater. Indonesia has a high diversity of freshwater resources, one of which is goldfish. This study aims to analyze the costs and benefits of Bali goldfish farming at the Koiyogan Kazoku Rana fish farming group and the feasibility of Bali goldfish farming at the Koiyogan Kazoku Rana fish farming group. This research was conducted from July to August 2024 at the Koiyogan Kazoku Rana fish farming group located in Bunutin Village, Bangli District, Bangli Regency, Bali Province. This study uses a quantitative method using cost and income data analysis, business feasibility. The results of this study indicate that the production cost of Bali goldfish at the Koiyogan Kazoku Rana fish farming group is IDR 3,919,042 per harvest, consisting of fixed costs of IDR 1,658,542 per harvest and variable costs of IDR 2,260,500 per harvest. The income generated is 11,280,958 with a revenue value of Rp 15,200,000 and a production cost value of Rp 3,919,042 per harvest. The R/C value is greater than 1, which is 3.8. An R/C value greater than one indicates that the Bali goldfish farming business at the Koiyogan Kazoku Rana Layal Pokdakan is suitable for development.

Keywords: goldfish, analysis, income, cultivation

I. INTRODUCTION

Regions with continuously increasing market demand and strong marketing potential have made the cultivation of goldfish (*Carassius auratus*) a promising ornamental fishery business. Bali is one of the regions with the greatest potential for goldfish cultivation businesses. As one of the world's international tourist destinations, Bali has a high demand for ornamental fish, not only in the local market but also for export purposes. Their attractive colors and unique body shapes make goldfish a highly sought-after ornamental fish commodity among collectors, fish enthusiasts, as well as hotels and restaurants.

However, like other agricultural or aquaculture businesses, goldfish farming also faces challenges related to efficient production cost management and the optimization of potential profits. In goldfish cultivation, it is necessary to optimize the management of production costs, including both variable and fixed costs, in order to ensure business profitability. Several cost components in goldfish farming include seed costs, feed, labor, pond equipment, and other operational costs related to maintaining water quality and fish health.

As public interest in goldfish continues to increase, the main challenge for goldfish farmers in Bali is how to manage production costs efficiently without sacrificing the quality of the fish produced. In addition, fluctuating selling prices and increasingly intense market competition also affect the level of profit that can be obtained. Therefore, a comprehensive understanding of cost and profit analysis in goldfish cultivation is crucial for farmers and other business actors in order to make proper and accurate business management decisions.

Through cost and profit analysis, farmers can identify in detail the cost components incurred at each stage of production, calculate the profits earned, and determine factors that can improve business efficiency. Thus, this analysis will provide a detailed representation of the economic feasibility of goldfish cultivation businesses in Bali and whether these businesses can be expanded on a larger scale in the future.

Bangli is known as one of the regions in Bali Province famous for ornamental fish cultivation. The presence of goldfish and tilapia as endemic ornamental fish is one of the distinctive characteristics of Bangli Regency. Currently, goldfish are among the most popular ornamental fish among fish enthusiasts. This condition occurs because goldfish have more attractive shapes and colors compared to other ornamental fish. In general, ornamental fish have relatively high economic value.

Pokdakan Koiyogan Kazoku Rana is recognized as an ornamental fish farming group that has been actively conducting cultivation activities since 2017 and was officially inaugurated in 2022. The advantage of Pokdakan Koiyogan lies in the cultivation of Balinese goldfish, which have distinctive characteristics such as

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short egg-shaped bodies, butterfly-shaped fins (generally longer than the fish body), longer tail fins, and protruding telescope eyes. The uniqueness of Balinese goldfish demonstrates strong potential for development as an export commodity because they possess different characteristics compared to other goldfish varieties. In addition, Pokdakan has continuously experienced an increase in Balinese goldfish sales. In 2019, sales peaked with revenue reaching IDR 5,000,000 per month for fish measuring 4–5 cm, and sales have continued to increase annually by approximately 10%.

II. RESEARCH METHODS

This research was conducted at Pokdakan Koiyogan Kazoku Rana, located in Bunitin Village, Bangli Regency. The location was selected purposively based on several considerations, namely that Pokdakan Koiyogan Rana is one of the active groups cultivating Balinese ornamental goldfish. The researcher also considered several additional reasons for determining this research location, including:

1. The farming business had not yet carried out cost calculations or breakdowns effectively and efficiently.
2. Marketing strategies had not been optimized.
3. Research related to this topic or location was still very limited, and no previous studies had specifically discussed it.
4.

III. RESULTS AND DISCUSSION

General Overview of Pokdakan Koiyogan Kazoku Rana

The demographic composition of Pokdakan Koiyogan Kazoku Rana includes residents of Banjar Dukuh, Bunitin Village, and surrounding areas who engage in feasible business activities according to the established business type. The management structure consists of three positions: chairman, secretary, and treasurer. The management board may be re-elected for a maximum of two terms, provided that another management board has served for at least one term beforehand.

The business operated by Pokdakan Koiyogan Kazoku Rana focuses on freshwater ornamental fish cultivation, particularly Balinese goldfish. Initially, this farming business was established because, in 2019, I Wayan Juniarta, as chairman of the Pokdakan, enjoyed keeping ornamental fish, and his child also liked purchasing ornamental fish from the market. Consequently, he started an ornamental fish cultivation business. He also had the idea to breed Balinese goldfish. Over time, he realized that ornamental fish cultivation had excellent business prospects. This motivated I Wayan Juniarta to invite several colleagues with similar interests to establish an ornamental fish cultivation organization called "Pokdakan Koiyogan Kazoku Rana," which was officially legalized on March 7, 2022, in Banjar Dukuh, Bunitin Village, Bangli District, Bangli Regency.

Fixed Costs

Fixed costs refer to costs whose amount does not depend on production volume. In this study, fixed costs are defined as equipment depreciation costs, including scoop nets of sizes 20 and 30, sorting nets, artemia and water flea nets, natural feed containers, nickel air faucet connectors, aerator hoses, circular maintenance ponds, MD 150 pumps, aerators, spawning ponds, aquariums, and broodstock.

One production season for Balinese goldfish farming at Pokdakan Koiyogan Kazoku Rana requires 3 months as the effective production period. The fixed costs per production season are described in Table 1.

Table 1. Average Fixed Costs of Balinese Goldfish Farming

Cost Type	Quantity	Unit	Price (IDR)	Depreciation Period	Total Depreciation
Aquarium (50 × 30 × 200) 8 mm thickness	10	Units	250,000	5 years	41,667
Circular spawning pond D3	2	Units	2,100,000	5 years	70,000
MD 150 Pump Capacity 3M	1	Unit	550,000	5 years	9,167
Circular post-harvest maintenance pond	6	Units	2,100,000	5 years	210,000
Aerator type ACO 003	1	Unit	450,000	5 years	7,500
Aerator hose per meter	20	Meters	1,000	3 years	556
Nickel air faucet connector branch 4	2	Units	35,000	3 years	1,944
Natural feed container	2	Units	25,000	3 years	1,389
Water flea & artemia net	1	Unit	10,000	2 years	417

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Cost Type	Quantity	Unit	Price (IDR)	Depreciation Period	Total Depreciation
Sorting net	1	Unit	10,000	2 years	417
Scoop net size 20	1	Unit	15,000	2 years	625
Scoop net size 30	1	Unit	20,000	2 years	833

Total per Month: IDR 344,514
Total per 3 Months: IDR 1,033,542
Based on Table 1, the total fixed cost of Balinese goldfish farming at Pokdakan Koiyogan Kazoku Rana amounted to IDR 1,033,542 per production season or every 3 months. The highest costs were for the D3 spawning ponds and post-harvest maintenance ponds, each valued at IDR 2,100,000.

Variable Costs
Pokdakan Koiyogan Kazoku Rana also incurs variable costs in Balinese goldfish farming activities. These include crystal salt, probiotic bacteria, methylene blue medication, broodstock, labor wages, PE packaging plastic (40 × 70 cm with 0.10 cm thickness), electricity, Saki Hikari Growth pellet feed, natural water flea feed, and tubifex worms.

Table 2. Average Variable Costs of Balinese Goldfish Farming

Cost Type	Quantity	Unit	Price (IDR)	Total
Tubifex worm feed	4	Kg	25,000	100,000
Broodstock (1 female + 1 male)	10	Fish	500,000	5,000,000
Water flea feed	2	Kg	30,000	60,000
Saki Hikari Growth pellets	4	Kg	122,000	488,000
Electricity (3 months)	3	KWH	100,000	300,000
Methblue medicine	1	Bottle	25,000	25,000
Probiotic bacteria	1	Bottle	22,500	22,500
Crystal salt	1	Kg	15,000	15,000
PE packaging plastic 40 × 70	500	Pieces	1,500	750,000
Employee salary	1	Person	500,000	500,000

Total Variable Cost: IDR 7,260,500
Based on Table 2, the average variable cost expenditure by farmers was IDR 7,260,500 per harvest every 3 months. The largest variable cost expenditure was broodstock procurement, averaging IDR 5,000,000.

Total Costs
Total cost refers to the overall expenses incurred by farmers after adding fixed costs and variable costs. The total cost of Balinese goldfish farming at Pokdakan Koiyogan Kazoku Rana is presented in Table 3.

Table 3. Average Total Costs of Balinese Goldfish Farming

No	Cost Type	Value (IDR)
1	Fixed Costs	1,033,542
2	Variable Costs	7,260,500
	Total Production Costs	8,294,042

Based on Table 3, the total cost required for Balinese goldfish farming at Pokdakan Koiyogan Kazoku Rana was IDR 8,294,042 every 3 months.

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Farm Income

Table 4. Average Farm Income of Balinese Goldfish Farming

No	Income Component	Value (IDR)
1	Revenue	15,200,000
2	Production Costs	8,294,042
	Farm Income	6,905,958

Based on Table 4, the revenue from Balinese goldfish farming at Pokdakan Koiyogan Kazoku Rana was IDR 15,200,000, while the production costs amounted to IDR 8,294,042. Thus, the total income earned per harvest period of 3 months was IDR 6,905,958.

Feasibility of Balinese Goldfish Farming

The R/C Ratio analysis was applied to evaluate the feasibility level of Balinese goldfish farming. The R/C Ratio is understood as the comparison between revenue (total income) and cost (total expenditure). Through this calculation, farmers can determine whether the farming business is economically feasible.

At Pokdakan Koiyogan Kazoku Rana, there are three grades of Balinese goldfish, each having different characteristics based on color brightness, fins, quantity, and body shape. Each grade also has different selling prices, as presented in Table 5.

Table 5. Average Grades of Balinese Goldfish

Product	Quantity	Unit Price (IDR)	Total
Grade A fry (3 months, size 6–7 cm)	50	Fish 150,000	7,500,000
Grade B fry (3 months, size 6–7 cm)	80	Fish 50,000	4,000,000
Reject grade fry (3 months, size 6–7 cm)	370	Fish 10,000	3,700,000
Total Revenue: IDR 15,200,000			

The production of Balinese goldfish farming at Pokdakan Koiyogan Kazoku Rana is expected to significantly contribute to farming profits. Moreover, the R/C Ratio calculation is intended to assess the feasibility level of this farming business for further development.

Table 6. Average Feasibility of Balinese Goldfish Farming

Revenue	Total Farming Cost	R/C Ratio
15,200,000	8,294,042	1.83

Based on Table 6, the Balinese goldfish farming business achieved an R/C Ratio value of 1.83 > 1. This means that for every IDR 1 spent, the expected revenue obtained is IDR 1.83. Financially, Balinese goldfish farming is considered feasible to operate.

Break Even Point (BEP)

The application of Break Even Point (BEP) analysis aims to determine the break-even point, namely the condition when total costs are equal to total income obtained, both in terms of product units and monetary value. In addition, BEP can indicate the number of products that need to be sold or produced, total revenue obtained, and price levels.

The BEP analysis showed that the break-even point for Balinese goldfish sales would be achieved when the price reached IDR 16,588. This result indicates that at this price, total sales revenue would be equal to the total costs incurred, including both variable and fixed costs.

IV. CONCLUSION

Based on the findings and discussion presented previously, several conclusions can be drawn:

1. **Production Costs**
   The average total farming cost was IDR 8,294,042 for one harvest period over 3 months. These costs consisted of variable costs amounting to IDR 7,260,500 and fixed costs amounting to IDR 1,033,542.
2. **Farm Income**
   Total revenue from Balinese goldfish farming reached IDR 15,200,000, resulting in a profit of IDR 6,905,958.

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3. **R/C Ratio**
   The R/C Ratio value obtained was 1.83, meaning that every IDR 1 spent generated IDR 1.83 in revenue. Therefore, this farming business is feasible to continue.
4. **Break Even Point (BEP)**
   The break-even point for Balinese goldfish sales was determined at IDR 16,588, indicating the balance point between total costs and revenue.

V. SUGGESTIONS

1. Pokdakan Koiyogan Kazoku Rana should increase the number of members cultivating Balinese goldfish.
2. Although the profits are already quite good, there is still potential to increase them further by optimizing the use of variable costs, such as finding cheaper but high-quality feed sources or implementing innovations in the cultivation system to reduce water and electricity consumption.
3. Future researchers are encouraged to further explore digital marketing strategies for Balinese goldfish products in order to provide insights into increasing sales through digital platforms and social media, as well as expanding market reach effectively.

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FEASIBILITY ANALYSIS OF PIG FARMING BUSINESS AT POKDAKAN DUKUH GANGGA SEDANA IN BUNUTIN VILLAGE, BANGLI DISTRICT

I Dewa Made Oka Subrawa Uye Dana[1], Ida Bagus Gede Surya Danata[2]*
[1)]Dinas Pertanian, Ketahanan Pangan dan Perikanan Kabupaten Bangli
[2)]Dinas Pekerjaan Umum dan Penataan Ruang (PUPR)

*) Corresponding author: giberpunk@gmail.com

Abstract

This study aimed to analyze the feasibility of pig farming business at Pokdakan Dukuh Gangga Sedana in Bunutin Village, Bangli District. The analysis was conducted using production cost, revenue, profit, Revenue Cost Ratio (R/C Ratio), Break Even Point (BEP), and Payback Period approaches. The farming system implemented an integrated breeding and fattening model with a production capacity of approximately 100 pigs per production cycle over five months. The results showed that the total revenue reached Rp 400,000,000 with a total production cost of Rp314,334,667, resulting in a profit of Rp85,665,333 per production period. The R/C Ratio value of 1.27 indicated that the business was feasible and profitable to be developed. The BEP price value of Rp28,576/kg was lower than the actual selling price of Rp36,000/kg, indicating a sufficient safety margin against market price fluctuations. In addition, the investment payback period was estimated at 3 years and 8 months. The cost structure showed that feed was the largest production cost component; therefore, feed efficiency became the main factor in increasing business profitability. Overall, the pig farming business at Pokdakan Dukuh Gangga Sedana has good prospects for sustainable development with proper business management and optimal risk control.
Keywords : pig farming business, business feasibility, R/C Ratio, Break Even Point, feed efficiency

Introduction

Pig farming is one of the subsectors of animal husbandry that plays an important role in meeting the demand for animal protein while also increasing community income, especially in areas with high levels of pork consumption. Pigs have several advantages, such as efficiency in converting feed into meat, rapid growth rates, and the ability to adapt to various environmental conditions (Costales, 2006). These advantages make pig farming highly potential for development on both small and large scales. However, in its implementation, farmers still face various challenges, such as unstable feed prices, disease risks, as well as limited capital and managerial capabilities (Badan Pusat Statistik, 2022).

From an agribusiness perspective, pig farming business analysis is essential to assess the efficiency and feasibility of the farming operation. This analysis includes the calculation of production costs, revenues, and income, accompanied by the use of feasibility indicators such as the R/C ratio (Soekartawi, 2006). Through this analysis, farmers can evaluate the performance of their business more objectively and determine more effective management strategies. In addition, business analysis also helps identify factors that influence business success, such as production scale, technology utilization, and ease of access to markets and production facilities (Downey and Erickson, 1992).

Furthermore, studies on pig farming business analysis have a strategic role in supporting sustainable agricultural development and improving farmers' welfare. The information generated from this analysis can serve as a

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reference for the government and related stakeholders in formulating policies, such as providing feed subsidies, enhancing farmers' capacity through training programs, and strengthening farmer institutions (Ministry of Agriculture of the Republic of Indonesia, 2021). Therefore, this research not only contributes academically to the field of agribusiness but also provides practical benefits in improving the competitiveness and sustainability of pig farming businesses in the future.

In the local context, pig farming businesses in Bangli Regency are predominantly operated by small- to medium-scale community farmers and are spread across all districts. Data indicate that the pig population in Bangli exceeds 10,000 heads and even experiences a surplus compared to community demand, especially ahead of religious holidays. This condition shows that pig farming has considerable economic potential; however, it also faces market dynamics such as overproduction, which may suppress livestock selling prices. In addition, the high cost of feed is one of the main factors affecting farmers' profits, thus requiring more efficient and well-planned farm management. Therefore, the study of pig farming business analysis in Bangli is important not only for increasing farmers' income but also as a basis for policy formulation in the development of a sustainable livestock sector.

Materials and Methods

This research was conducted at Pokdakan Dukuh Gangga Sedana in Bunutin Village, Bangli District, Bangli Regency, which sells pigs. The data analysis method used was :

a. Production Cost

Production costs consist of fixed costs and variable costs.

$$TBP = TBT + TBTT$$

Explanation:
TBP = Total production cost
TBT = Total fixed cost
TBTT = Total variable cost

b. Revenue

Farm revenue can be calculated using the following formula:

$$TR = Py \times Y$$

TR = Total farm revenue
Py = Price of Y
Y = Production obtained from the farming business (Soekartawi, 2006)

c. Profit

Mathematically, the formula for calculating profit is:

$$\prod = TR - TC$$

Explanation:
$\prod$ = Farm profit
TR = Total revenue
TC = Total cost of farming business (Soekartawi, 2006)

Criteria:

If the profit value is positive, the business is profitable. Conversely, if the profit value is negative, the business incurs a loss.

d. According to Suratiyah (2006), the feasibility analysis of a farming business in terms of profitability can be calculated using the following formula:

$$\frac{R}{C} \quad Rasio \quad \frac{TR}{TC}$$

Explanation:
TR = Total Revenue
TC = Total Cost / Fixed Cost

Criteria:

R/C Ratio > 1 : The farming business is feasible to operate.
R/C Ratio = 1 : The farming business breaks even.

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R/C Ratio < 1 : The farming business is not feasible to operate.

Results and Discussion

The pig farming business based on the analyzed data shows the characteristics of an integrated production system between breeding and fattening, which is considered one of the efficient business models in increasing livestock productivity. Pokdakan Dukuh Gangga Sedana has 10 breeding sows capable of producing 9–12 piglets per birth. This business has the potential to produce up to 100 market-ready pigs in one production cycle of approximately five months. The average harvest weight of ±110 kg per pig indicates that the livestock management system has been directed toward achieving optimal production performance. This integrated system provides advantages because farmers do not depend on external piglet supplies, thereby reducing production costs while maintaining sustainable livestock quality (Sihombing, 2010; Soekartawi, 2006). In general, the analysis of the pig farming business at Pokdakan Dukuh Gangga Sedana can be seen in Table 1 below.

Table 1. Pig Farming Business Costs at Pokdakan Dukuh Gangga Sedana

A. Biaya Investasi						
No.	Description	Unit Price (Rp)	Quantity	Unit	Total (Rp)	Depreciation Cost (Rp)
1	Construction of sow pens	2,000,000	12	Unit	24,000,000	400,000
2	Purchase of breeding sows	5,000,000	10	Head	50,000,000	833,333
3	Purchase of boars	5,000,000	2	Head	10,000,000	166,667
4	Construction of battery pens	700,000	100	Unit	70,000,000	1,166,667
5	Construction of farrowing pens	3,500,000	4	Unit	14,000,000	233,333
6	Construction of weaned piglet pens	3,000,000	4	Unit	12,000,000	200,000
7	Construction of pen roof, warehouse, toilet, and waste disposal system	150,000,000	1	Package	150,000,000	2,500,000
8	Shovels and hoes	200,000	2	Unit	400,000	6,667
9	300 kg digital scale	1,500,000	1	Unit	1,500,000	25,000
10	Buckets	30,000	6	Unit	180,000	3,000
Total Investment Cost					**332.080.000**	**5.534.667**
B. Fixed Costs (FC)						
	Sow Feed					
1.	Mixed feed + 157	4500	4500	Kg	20.250.000	
2.	Mixed feed + 152	4500	900	Kg	4.050.000	

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	Fattening Feed					
1.	Mixed feed + 152	5.000	50000	Kg	250.000.000	
	Additional Supplements					
1.	Medicines and vitamins	2.000.000	1	Package	2.000.000	
Total Fixed Cost					**276.300.000**	
C. Variable Costs (VC)						
1.	Electricity cost	1.500.000	5	Months	7.500.000	
2.	Labor cost	2.500.000	10	Package	25.000.000	
Total Variable Cost					**32.500.000**	
E. Total Cost (Depreciation Cost + B + C + D)					**314.334.667**	

From the cost aspect, the expenditure structure in this business is divided into fixed costs and variable costs. Fixed costs include initial investments such as the construction of pens and the purchase of breeding stock, which have a certain economic lifespan and are calculated through depreciation. This approach indicates that the business analysis has properly considered cost accounting principles, resulting in a more realistic profit estimation. Meanwhile, variable costs such as feed, medicines, and labor become the dominant components in business operations, where feed generally contributes around 60–70% of the total production cost. This is in line with the opinion that feed efficiency is a key factor in determining the success of a pig farming business (Devendra & Fuller, 1979; Soekartawi, 2006).

From the production and income perspective, the total output produced reached approximately 11,000 kg of live weight, which is categorized as a medium-scale business and economically feasible for commercial development. Business income is highly influenced by market selling prices, livestock mortality rates, and feed conversion efficiency. The lower the mortality rate and the better the feed conversion, the greater the profit obtained. However, this business also faces various risks, such as fluctuations in feed prices, disease outbreaks, and unstable market prices. Therefore, good business management is required, particularly in aspects of livestock health and production efficiency, so that the business can operate sustainably and generate optimal profits (Siregar, 2009; Soekartawi, 2006).

F. Revenue					
F.1. Total Fattening Production for 5 Months			= 11.000Kg X Rp. 36.000		
			= 396.000.000		
F.2. Assumption of Selling Piglets From 10 breeding sows, it is assumed that there are 20 remaining piglets produced every 5 months after weaning, with a net profit of Rp. 200,000 per piglet after deducting feed and medicine costs.					
			= 20 piglets X Rp. 200.000		
			= 4.000.000		

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Total Revenue (F.1 + F.2)	=396.000.000 + Rp. 4.000.000
	= 400.000.000
G. Profit	
Profit = Revenue − Total Production Cost	= Rp. 400.000.000 - Rp.314.334.667
	= 85.665.333
H. Revenue-Cost Ratio (R/C Ratio)	
R/C Ratio = Revenue ÷ Total Production Cost	= Rp. 400.000.000 : 314.334.667
	= 1,272529067
This means that every Rp. 1 spent generates a return of approximately Rp. 1.27.	
I. Break Even Point (BEP)	
BEP (Rp.) = Total Cost ÷ Total Production	= Rp. 314.334.667: 11000
	= 28.576
This means that with a production volume of 11,000 kg and a total cost of Rp. 314,334,667	
the break-even selling price for pig fattening is Rp. 28,576 per kg.	
J. Payback Period	
Payback Period = Total Investment ÷ Business Profit	= Rp. 332.080.000 : 85.665.333
	= 3,876481
This means that the investment can be recovered within approximately 3 years and 8 months.	

Based on the analyzed data of the pig farming business, financial feasibility indicators such as the R/C ratio (Revenue Cost Ratio) and BEP (Break Even Point) show that this business is profitable and feasible to be developed. The R/C ratio obtained is greater than 1, namely 1.2, which indicates that every unit of cost incurred is able to generate greater revenue. Theoretically, the R/C ratio is a comparison between total revenue and total cost, where an R/C value > 1 indicates a profitable business, R/C = 1 means break-even, and R/C < 1 indicates a loss-making business. Thus, the results of the analysis in this pig farming business demonstrate that the production activities have been efficient in managing inputs into economically valuable outputs, especially supported by a relatively large business scale and an integrated production system (Soekartawi, 2006; Gittinger, 1986).

In addition, the results of the Break Even Point (BEP) calculation show the business break-even point both in terms of production units and price. Production BEP describes the minimum number of livestock or live weight that must be produced so that total revenue equals total cost, while price BEP indicates the minimum selling price per kilogram for the business to avoid losses. In the data presented, the BEP value is below the actual production and price levels, which means the business has a fairly good margin of safety. This implies that even if there is a decline in prices or production, the business still has the potential to remain in a non-loss condition. This is important in livestock farming businesses that are vulnerable to market price fluctuations and production risks such as disease outbreaks or livestock mortality (Kadariah, 2001; Soekartawi, 2006).

Overall, the combination of an R/C ratio value greater than 1 and a BEP position lower than the actual production realization indicates that this pig farming business has a good level of efficiency and economic resilience. However, to maintain these conditions, farmers need to continuously improve cost efficiency, especially in feed components which constitute

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the largest expense, as well as enhance livestock health management. With optimal management, this business is not only financially feasible but also has the potential to be further developed on a larger and more sustainable scale (Gittinger, 1986; Siregar, 2009).

Conclusion and Recommendation

Based on the results of the pig farming business analysis at Pokdakan Dukuh Gangga Sedana, it can be concluded that this business is feasible and profitable to be developed. This is indicated by the total revenue of Rp. 400,000,000 with total production costs amounting to Rp. 314,334,667, resulting in a profit of Rp. 85,665,333 in one production period. The R/C ratio value of 1.27 indicates that every Rp. 1 of cost incurred is able to generate Rp. 1.27 in revenue, meaning that the business operates efficiently and provides profit. In addition, the Break Even Point (BEP) price value of Rp. 28,576/kg is lower than the actual selling price of Rp. 36,000/kg, indicating that the business has a relatively high margin of safety against the risk of price declines.

From the technical production aspect, the business system that integrates breeding and fattening provides advantages in cost efficiency and production independence. The business scale, which reaches 100 pigs with a total production of approximately 11,000 kg, also indicates that the business has reached an economic scale. However, the cost structure shows that feed is the largest component of production costs, making feed efficiency a key factor in the success of the business. Overall, this pig farming business is not only financially feasible but also has the potential to be further developed if supported by good business management and appropriate risk control.

recommended that farmers focus more on improving production cost efficiency, especially on feed components which constitute the largest share of production costs. Feed optimization can be achieved through proper feed formulation, the utilization of alternative local feed ingredients, and improving feed conversion efficiency so that costs can be reduced without decreasing livestock productivity. In addition, livestock health management needs to be improved through the implementation of good biosecurity practices, vaccination programs, and regular pen sanitation in order to minimize disease risks and reduce mortality rates, thereby maintaining business productivity. Furthermore, farmers should also develop business diversification to increase added value, such as selling breeding stock, utilizing waste as organic fertilizer, or processing derivative products. Strengthening business management through better financial record-keeping and well-planned production management is also essential so that farmers can control costs and maximize profits sustainably. Moreover, support from the government and related institutions is highly needed, particularly in the form of training, access to capital, and policies for stabilizing feed and livestock product prices, so that smallholder pig farming businesses can develop more optimally and achieve higher competitiveness in the future.

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