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RESEARCH ARTICLE

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Analysis of Swiftlet House Agribusiness Sustainability in Its Contribution to Development in Banten Province

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ABSTRACT

Sustainable development is aimed at achieving a better quality of life. The quality of swiftlet house production influences the sustainability of swiftlet bird nest (SBN) exports. Banten Province is a producer of high-quality SBN. Analysis of the swiftlet house business sustainability encompasses the ecological, economic, and social aspects. The sample consisted of thirty-eight (38) swiftlet houses in the coastal, hills, and plains ecological areas located in the regencies of Banten Province. The analysis used was the RAPFISH (Rapid Appraisal for Fisheries) method, which is an analysis tool or method based on Multidimensional-Scaling (MDS). The levels of sustainability on the coast, hills, and plains were 53.16%, 55.44%, and 56.94%, respectively. A value greater than or equal to 50% indicates sustainable status; thus, all these areas have a sustainable status. The results of the MDS leverage analysis were carried out by looking at the shape of the change in Root Mean Square (RMS). The greater the RMS value, the more significant the role of attributes in influencing the sustainability of swiftlet house operations. The RMS value impacts the success of the swiftlet house based on ecological and economic aspects. Pests and disease outbreaks are threatening factors that impact the loss of economic value. An important social aspect of sustainability is coordination between institutions and standardized public services. This coordination has the highest sensitivity level, indicating that inter-agency synergy plays an important role in policy formulation, effectiveness regulation implementation, and integrated supervision.

Introduction

Swiftlet Bird Nest (SBN) is a product derived from the solidified saliva [1]. The largest SBN-producing countries in Asia are Indonesia, Malaysia, Thailand, Vietnam, Philippines, and China. Indonesia is the largest SBN-producing country, exporting to China as a swiftlet-nest market [2,3]. Indonesia contributes 85% of the world's market, followed by Malaysia, which contributes 13% [4]. Indonesia fulfills as much as 75% of its global market needs. According to BPS [5], SBN exports reached 1,312.5 tons with a value of 540.4 million US dollars in 2020. China and Taiwan are the largest markets for Indonesian SBN exports. In addition, according to the customs documents of the Directorate General of Customs and Excise (PEB and PIB) for 2023, Indonesia has one of the world's largest SBN exports. The destinations include Hong Kong, Singapore, the USA, Vietnam, Canada, China, Thailand, Taiwan, Cambodia, and Japan [6,7].

The Badui Dalam tribe is an indigenous Sundanese Banten tribe that maintains anti-modernization traditions regarding clothing and lifestyle [8]. The Badui-Rawayan tribe lives in the Kendeng Mountains Cultural Heritage area, which covers 5,101.85 hectares in the Kanekes Village area, Leuwidamar District, and Lebak Regency. Based on the global market potential and the very high price, many people in Indonesia cultivate SBN by building multistory houses or buildings to be used as places that resemble the original habitat of swiftlets. Various factors, including ecological or environmental conditions, and economic and social factors, influence SBN production [9].

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According to BPS data related to the social and economic analysis of Banten Province in 2023, Banten Province is considered to have recovered from the economic recession and grown faster than the national growth. Data from 2023 shows that Banten will experience a controlled recovery with 4.75% economic growth. This increase was driven by demand, with the net export component providing additional growth of 1.52%. Banten's economy in 2022, after the COVID-19 pandemic, did not experience great pressure. This was because the global economic conditions improved after a recession and even the economic crisis in the previous years due to the COVID-19 pandemic [10]. The foreign demand for Banten's goods and services products in 2022 increased. This was marked by an increase in exports from 13.5 billion US dollars in 2021 to 14.1 billion US dollars in 2022. The export increase was a response to the increasing demand for products in Banten's processing industry, including the rise in domestic demand in both Banten and Indonesia. In addition, the increase in community income in Banten in aggregate data is confirmed by the increase in community savings in rupiah and foreign currency at commercial banks and BPRs (Bank Perkreditan Rakyat/rural banks) in Banten. Savings increased from 257.5 trillion to 279.0 trillion rupiah in December 2022 [11].

Sustainable development is related to both the economy and ecology, where economic growth is supported by the sustainability of the ecological function of the surrounding environment so that the economy can experience unlimited growth. These three aspects of development must be balanced without dominating each other. Sustainability is defined as developing a multidimensional agreement to achieve better quality of life for everyone. The analysis of the level of sustainability of the swiftlet house business is carried out in three aspects: (1) the ecological aspect, (2) the economic aspect, and (3) the social aspect.

Swiftlet bird nests are one of the contributors to exports, and have improved the economy of Banten Province's citizens. The swiftlet house business is highly dependent on an ecological or environmental system to support the life of swiftlets [12]. The ecological system benefits the production of SBN in swiftlet houses and greatly benefits the economy, welfare, and health of humans [13]. One ecological advantage is that, biologically, swiftlets are effective for biological control of most insect orders because swiftlets prey on several insects that are pests of cultivated plants [14]. The economic advantage of SBN is its high economic value owing to its scarcity. The number of SBNs is limited, as swiftlets are tropical birds found only in a few Asian regions. International trade encourages opportunities for countries to conduct export and import activities by eliminating various obstacles. Differences in the geographical conditions of a country result in differences in the available natural resources, thus causing differences in the superior commodities cultivated in each country. Increasing exports can stimulate domestic demand and encourage the development of large industries in a country, thereby increasing the export value. This study provides recommendations for the ecological system for the sustainability of swiftlet house businesses in Banten Province [15].

Materials and Methods

Study Area

Banten Province is between 105°01'11"–106°07'12" East Longitude and 05°07'50"–07°01'01" South Latitude. The total area of Banten Province is 9,352.77 km^2 based on BPS data sourced from the Decree of the Minister of Home Affairs Number 100 of 2022. The largest regency in Banten Province is Lebak, which is 3,312.18 km^2, followed by Pandeglang, which is 2,771.41 km^2; Serang, which is 1,469.91 km^2; and Tangerang, which is 1,027.76 km^2. The elevation in Banten Province from sea level ranges from 19 m above sea level in Cilegon City to 258 m above sea level in the Pandeglang Regency. The livelihoods of the people of the Banten Province are generally in the agricultural, trade, industrial, and service sectors. Most of the population lives in rural areas. Based on the 2010 Indonesian Population Census, Banten Province had a population of 10,601,515 people, consisting of various ethnic groups, with the local indigenous tribe, including a small group of Sundanese Badui people, totaling 4,321,991 (40.77%). The other large ethnic groups from Java are the Priangan Sundanese, with 2,402,236 people (22.66%), followed by the Javanese, with 1,657,470 people (15.64%), and Betawi, with 1,365,614 (12.88%). The study area is shown in Figure 1.

Research Method

This study illustrates this aspect of swiftlet-house agribusiness. These aspects are divided into ecological, economic, and social. The ecological aspect explains the absence of natural resources, ecosystems, and human resources. The economic aspect includes switflet house management, production, labor, and sales. The social aspect includes regulations, levels of knowledge, partnerships, as well as safety and comfort for stakeholders. The overall thought framework flow of this study is in Figure 2.

Figure 1. Study area.

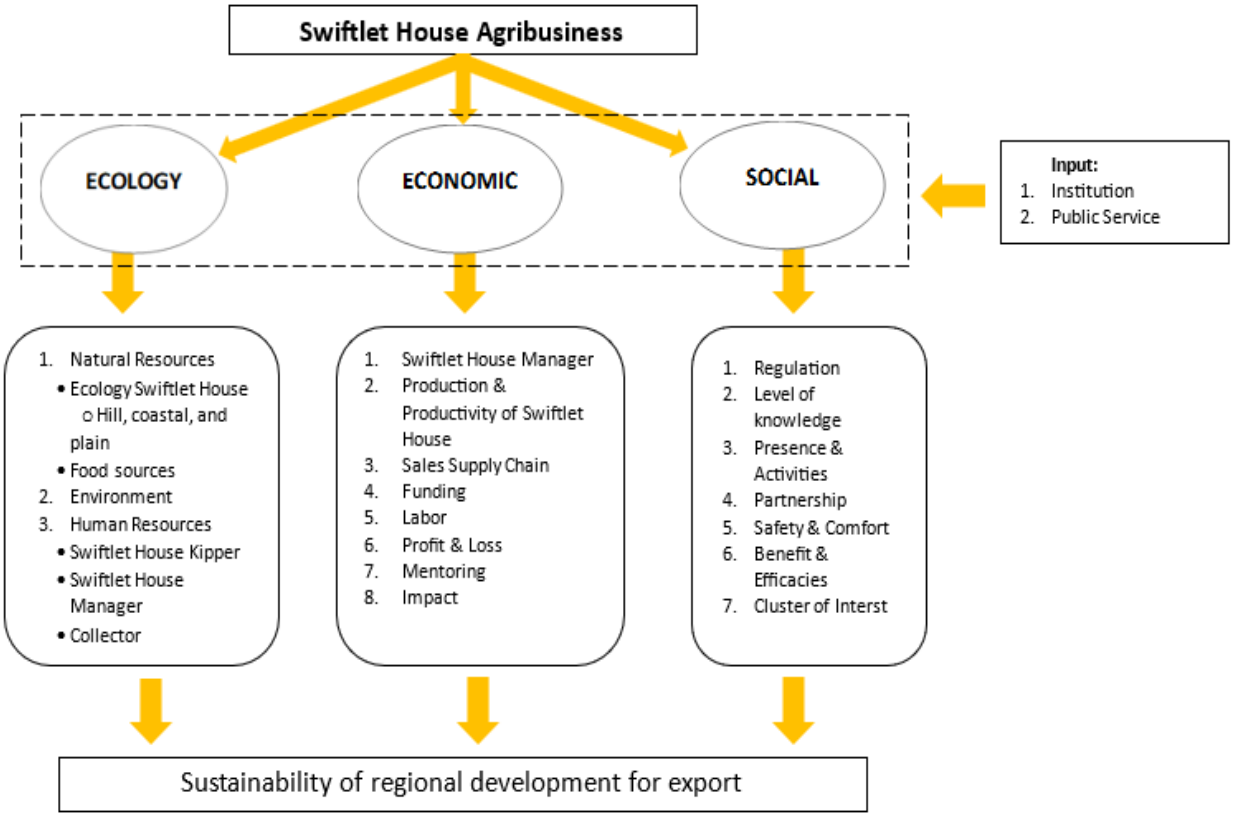

Figure 2. A topic thought flowchart illustrating the main domains of swiftlet houses considering ecological, economic, and social aspects and their contribution to the sustainability of regional development for export purposes.

The study was conducted from January to December 2023. The research focused on the sustainability status of thirty-eight (38) swiftlet house agribusinesses located in Serang, Pandeglang, and Lebak Regencies, Banten Province (Figure 1). The locations were classified into hilly, coastal, and plain areas. These areas were determined based on the elevation of the swiftlet house and its distance from the coastline. The coastal area is 500 m from the coastline/sandy zone, the hilly area is 200–500 masl, and the plains area is ≤ 200 masl. The coastal area is a natural expanse where the sea and land meet [16]. Fourteen of the locations are in the

Serang Regency in the hills (4), coast (1), and plains (9). The locations in the Pandeglang Regency are divided into hills (2), coasts (7), and plains (12). Meanwhile, those in the Lebak Regency are divided into hills (1), coasts (1), and plains (1).

The RAPFISH program was used to measure the level of sustainability contribution with a multidimensional scaling (MDS) methodology to analyze the sustainability of swiftlet houses across ecological, economic, and social dimensions. MDS is a statistical technique used to analyze economic, social, ecological, technological, and institutional aspects that simplifies complex data into a lower-dimensional form, making it easier to analyze [17]. The method of swiftlet house management is related to ecological, economic, and social aspects, with input to the swiftlet house management system coming from institutions and public services. This analysis can provide a clear and comprehensive picture of the level of sustainability of the ecological area of the swiftlet house business, with other supporting aspects seen from the economic and social aspects, with input from institutions and public services [18].

Results and Discussion

Results

Ecological Aspect Analysis

The swiftlet house agribusiness in the coastal, hilly, and plains ecological areas in Banten province have sustainability values of 58.06%, 60.11%, and 64.24%, respectively. This indicates that, ecologically, the development of swiftlet houses in all areas can be considered sustainable. The result of the sustainability ordination and Monte Carlo analysis in this aspect can be explained in Figure 3. The processing results of the continuous ordination of the swiftlet house ecological aspect are shown in Figure 4. The graph shows the distribution of three types of ecology with the coast (red dots) spread across the middle of the graph and several other quadrants. The plain area has a wider distribution compared to other areas, indicating that the plain area has greater variability in ecological conditions compared to the coastal and hills. The other two regional distributions have more uniform and ideal ecological conditions for the swiftlet houses agribusiness, as shown by the analysis result distribution. The Monte Carlo analysis estimates the distribution of results based on input from three different variables. Small dots show the analysis of the results spread between the three points, which symbolize the three parameters (Figure 3). This shows that there are variations in the ecological aspects of each ecology.

The results of the leverage analysis showed that of the seven attributes, there were three attributes with high sensitivity: (1) the presence of predators and pests (1.57), (2) the availability of food in nature (1.23), and (3) the presence of cave swiftlets (1.04). The attribute with a low sensitivity value was (1) the management of swiftlet house waste (0.2). The attribute sensitivity was determined based on the priority order of the leverage analysis results by observing the form of change in the Root Mean Square (RMS). The greater the RMS value, the more significant is the role of the attribute in influencing swiftlet house management sustainability.

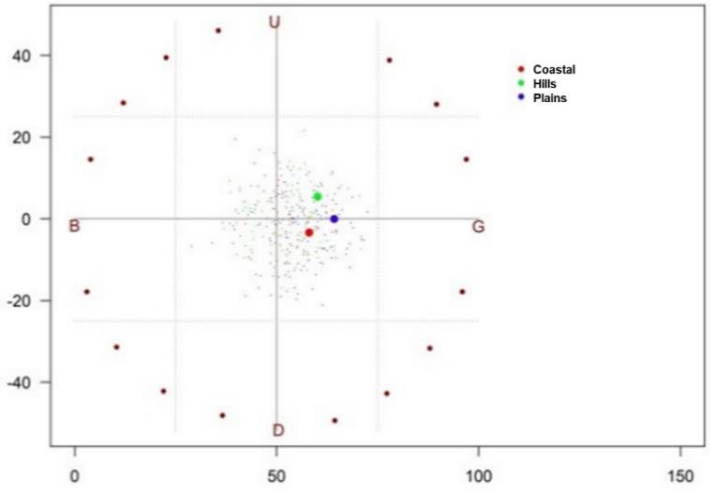

Figure 3. Sustainability ordination and Monte Carlo analysis of attribute distributions in ecological aspect.

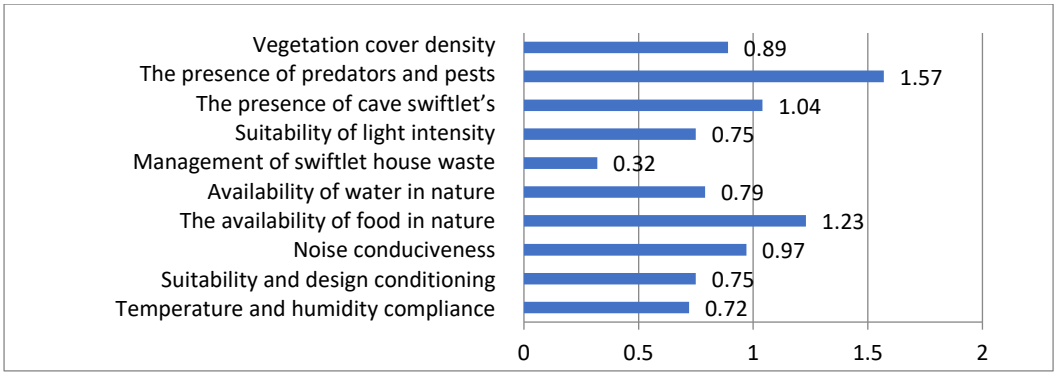

Figure 4. The ecological aspect leverage analysis illustrates the sensitivity level of each attribute to the sustainability of swiftlet houses.

Economic Aspect Analysis

The data processing results show that the development of swiftlet houses in coastal, hilly, and plain areas has sustainability values of 54.93%, 57.90%, and 59.80%, respectively. This shows that, in terms of the environment, all three are considered sustainable (Figure 5). Based on the results of the economic leverage analysis (Figure 6), the attributes that have high sensitivity in the sustainability of the economic aspect are (1) the threat of losses due to pest and poultry disease outbreaks (3.04), (2) the quality of the swiftlet's nest (1.75), and (3) labor absorption (1.54). The attributes with low sensitivity values include (1) the cost of maintaining a swiftlet house with consideration of potential risks (0.95), (2) sales supply chain (0.95), (3) business profits (1.03), and (4) business productivity (1.03).

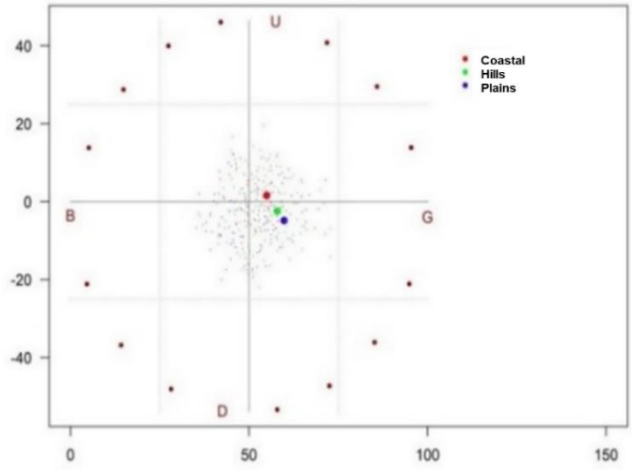

Figure 5. Sustainability ordination and Monte Carlo analysis of attribute distributions in economic aspect.

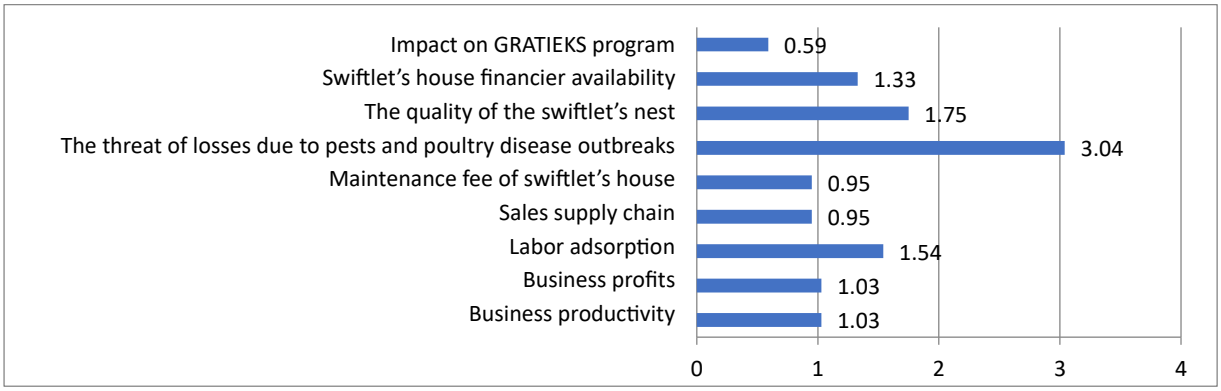

Figure 6. The economic aspect leverage analysis illustrates the sensitivity level of each attribute to the sustainability of swiftlet houses.

Social Aspect Analysis

The data processing results show that the development of swiftlet houses in coastal, hilly, and plain areas have sustainability values of 46.49%, 48.32%, and 46.79%, respectively. This indicates that in environmental terms, all three are considered quite sustainable. The sustainability ordination (Figure 7) shows that the relative positions of coastal, hilly, and plain areas cluster closely around the center point, indicating that the social aspect sustainability status among these regions does not differ significantly and their distribution is relatively balanced. The Monte Carlo analysis further confirms the stability of these results, as there is no substantial deviation in the ordination pattern. Based on the results of the social aspect leverage analysis (Figure 8), the attributes that have high sensitivity values in social aspect sustainability are (1) coordination between institutions (2.99), (2) the existence of exporter associations (2.61), and (3) the availability of field extension workers. The attributes with the lowest sensitivity values were monitoring and supervision (0.14).

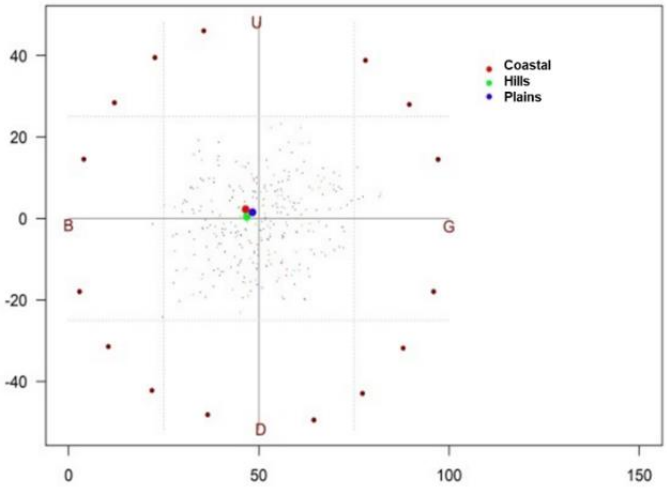

Figure 7. Sustainability ordination and Monte Carlo analysis of attribute distributions in social aspect.

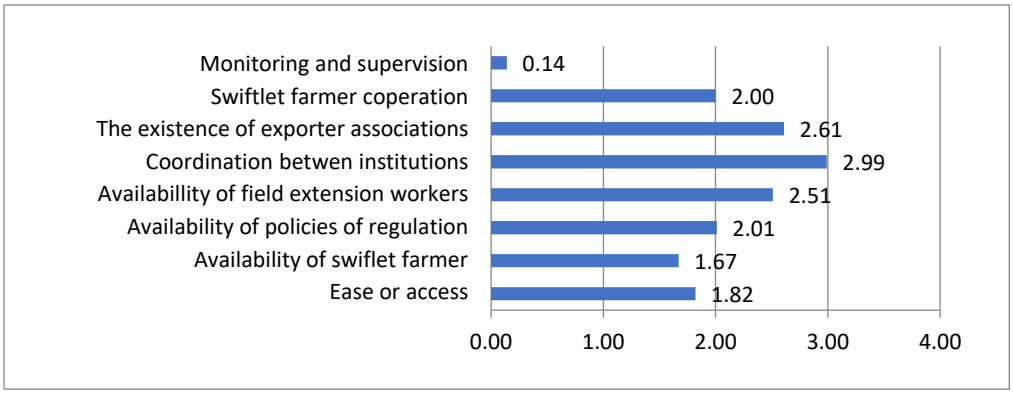

Figure 8. The social aspect leverage analysis illustrates the sensitivity level of each attribute to the sustainability of switftlet houses.

Multidimensional Scaling (MDS)

The multi-aspect analysis shows that the sustainability level of swiftlet house agribusiness varies significantly among regions. The results obtained for the coastal, hilly, and plain ecological areas were 53.16%, 55.44%, and 56.94%, respectively. The sustainability status of the coastal, hilly, and plain ecological areas describes the contribution of swiftlet houses to sustainable development (Table 1). The index net diagram (Figure 9) illustrates a multi-aspect sustainability analysis by mapping the contribution of swiftlet house operations from ecological, economic, and social perspectives with different geographical characteristics. Multidimensional assessment is based on a combination of the three aspects, where the highest value is on the coast, hills, and plains, indicating that, overall, the plains area is the most ideal area for sustainable swiftlet house agribusiness based on the analysis of various aspects. The results of the multi-aspect analysis

diagram, which is assessed from the ecological, economic, and social aspects, show that the ecological and economic aspects have the highest sustainability value in the plains' geographical location. The ecological and economic sustainability values for geography were 64.24% and 59.80%, respectively. Meanwhile, the highest value based on social aspects was in the hills (48.32 %).

Table 1. Analysis results of the swiftlet house agribusiness sustainability level based on the ecological area.

Aspect	Coast	Hills	Plains
Ecology	58.06%	60.11%	64.24%
Economy	54.93%	57.90%	59.80%
Social	46.49%	48.32%	46.79%
Multidimension (MDS)	53.16%	55.44%	56.94%

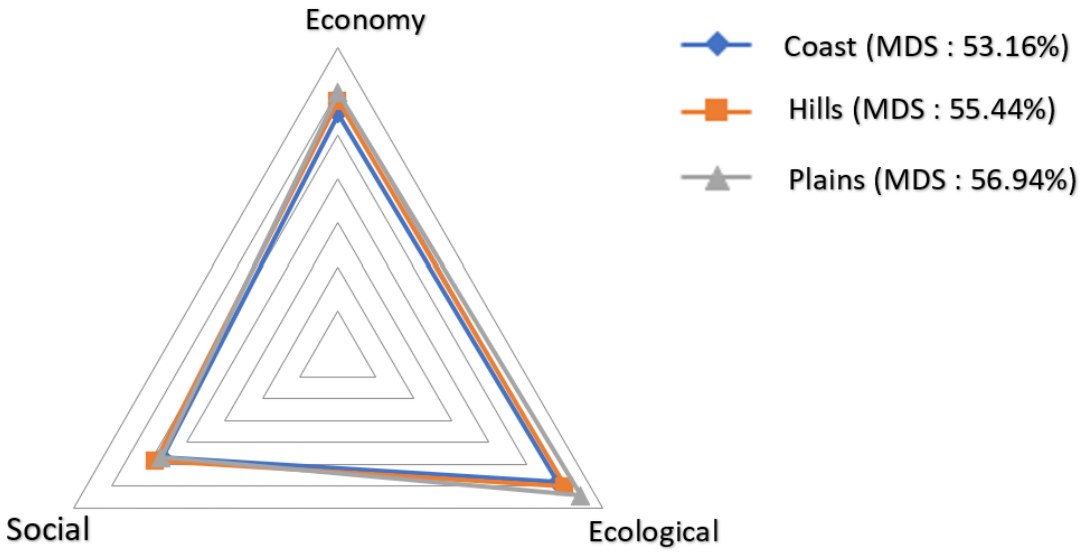

Figure 9. Sustainability index radar diagram of swiftlet house operations in coastal, hilly, and plain areas across ecological, economic, and social dimensions.

Discussion

Ecological Aspect Analysis

Several factors significantly influenced the success of swiftlet-bird nest production. The highest value affects the success of swiftlet nests from an ecological perspective. The presence of predators and pests can create disturbances that decrease production and even cause swiftlet mortality. The main predators that can threaten swiftlet breeding activities are reptiles (snakes and monitor lizards) and mammals (rats, bats, and monkeys). The pests most often found in swiftlet farming environments are owls, bats, rats, ants, and cockroaches that can destroy swiftlet nests [19].

Wild food availability is an aspect of ecological analysis that plays a significant role in the sustainability of swiftlet nest management. Swiftlets generally leave their nests in the morning to search for food and then return to the colony at night. Birds move between colonies based on food availability in natural forests around the swiftlet house. Natural forests are the most popular locations for swiftlets to find food [20]. Swiftlets can search for food more than 30 km away [19]. Natural food sources for swiftlets include flying insects such as mosquitoes, flies, and moths. Ideal environmental conditions with high insect diversity provide a good source of food for swiftlets. Good environmental management can support food availability through habitat conservation and sustainable agriculture, such as using natural pesticides and agroforestry systems that combine agriculture and forest conservation to increase insect diversity and provide food sources for swiftlets.

The presence of cave swiftlets (*Collocalia linchi*) was the largest species in swiftlet nest cultivation, ranking as the third highest threat after predators, pests, and food availability in the wild. Cave swiftlets and swiftlets

are birds in great demand and have significant commercial value [21,22]. Cave swiftlets and swiftlets are distributed throughout Indonesia and contribute to biodiversity. Leverage analysis showed that three ecological factors had the highest sensitivity in influencing swiftlet nest cultivation: the presence of predators and pests, the availability of food in the wild, and the presence of cave swiftlets. Conducting noise levels and conditioning swiftlets are important in creating a comfortable environment, providing a sense of security, and creating an interest in nesting in that location [23]. In swiftlet house agribusiness, noise management generally involves using soundproofing materials and a good layout to ensure that external noises do not disturb the swiftlets. This can also be implemented through an efficient ventilation system to maintain the ideal temperature and humidity inside a swiftlet house by providing a good environment for the swiftlet house [24]. The sustainability of the swiftlet house agribusiness is highly dependent on managing ecological factors. In cases such as predators and pests, ensuring the availability of food and controlling the presence of cave swiftlets are important. Effective noise management and maintaining optimal environmental conditions inside swiftlet houses are also crucial for creating a conducive environment for swiftlets to thrive. All of these factors will significantly improve the sustainability and productivity of swiftlet house agribusiness, which will benefit the industry and the surrounding ecosystem.

Economic Aspect Analysis

The economic aspect of the leverage analysis results shows several crucial factors that need to be considered as they will have an impact on the economic success of swiftlet nest cultivation. The threat of losses due to pests and outbreaks is an economic factor with the highest value and is crucial. The presence of pests is closely associated with environmental factors. Pest infestations and disease outbreaks can cause swiftlet mass mortality, resulting in a significant decrease in swiftlet nest production. This has a major impact on income and economic profits. Efforts to control pests and prevent outbreaks through good sanitation, drug use, and strict biosecurity are paramount in minimizing the risk of economic loss. The threat of outbreaks in swiftlet nests can generally occur because of bacterial, viral, fungal, and parasitic diseases. Internal parasites that can interfere with the health of a swiftlet's nests generally affect the swiftlet's digestive system, which causes weight loss and compromises immunity.

The threat of outbreaks and diseases in swiftlet house agribusinesses is minimized through routine biosecurity and monitoring technology to detect infestations earlier to aid in taking action. This can help regulate the implementation of effective preventive and control strategies. This, in turn, helps to maintain the health of the swiftlets and bolsters the success of swiftlet house agribusinesses. Pest and disease control have an impact on economic profits. Another factor influencing the economic analysis is the quality of SBN products. The sustainability of SBN is influenced by the quality of SBN Production [20]. Good quality swiftlet nests sell at higher prices in the market [25]. High-quality SBN is generally shiny white, like rice, and has minimal defects. Poor conditions generally result in defective nests, a large amount of dirt/fecal matter, and irregular shapes.

Social Aspect Analysis

The results of the leverage analysis show that the social aspect that has the strongest impact on the sustainability of the swiftlet house business is the coordination between institutions. It has the highest sensitivity value of 2.99, which shows that synergy between various institutions plays a paramount role in supporting the SBN industry. Good coordination assists in formulating policies, implementing effective regulations, and integrating supervision. In addition, it can help overcome various obstacles in the field, such as administrative obstacles and bureaucracy between institutions, and can increase the efficiency of implementing policies supporting swiftlet breeders through community empowerment [26].

The next highest analysis result in the social aspect is the existence of an exporter association (2.61), whose role is to assist swiftlet farmers in navigating the international market in exporting swiftlet nest products, supplying market information to the farmers, and advocating the swiftlet farmers' interests in government and other stakeholders to improve their welfare. Exporter associations provide a way for swiftlet farmers to build knowledge platforms, improve product quality, and build awareness in compliance with international standards required for the export of swiftlet nests.

The availability of field extension in the leverage analysis shows the third highest value at 2.51 as field extension is an important factor in increasing swiftlet farmers' knowledge and skills. Extension activities deliver the latest information to farmers on good farming techniques, animal health management, and various other sustainable practices that can increase the productivity and quality of swiftlet nests [27].

Effective and consistent extensions provided to swiftlet farmers can help them adapt to market changes and constantly develop technology. This can help farmers improve their ability to face operational challenges.

Multidimensional Scaling (MDS)

The results of multidimensional scaling (MDS) show the level of sustainability of swiftlet houses. The geographical location of the plains has a higher sustainability value than other aspects in multiple dimensions, while the geographical location of the hills provides sustainability value in social aspects. Sustainability in the social aspect of the hill area has the highest value because residents in the hill area are more cohesive and subject to rules to comply with to support the sustainability of swiftlet houses. The condition in the hill area has good coordination with farmers' swiftlet, workers in swiftlet houses, and exporter associations.

The sustainability value of multiple aspects of geographical plains based on ecological aspects is supported by the existence of swiftlet houses in geographical plains and the availability of abundant energy sources, both in terms of food and water. The adequacy of food factors is higher on the mainland than in coastal and mountainous geographies. Swiftlet house operations in the plains and hills are located in forested areas close to the Badui tribal areas. This can affect the ecosystem in the swiftlet house ecology, and the sustainability of the swiftlet house business is supported by the vegetation conditions of natural forests, such as mangrove forests, cultural reserve forests, and conservation environments. The Badui community has a tradition of protecting the environment and natural resources through environmental preservation and conservation based on applicable customary regulations known as pikukuh [28].

Swiftlet house agribusiness benefits naturally from the Badui community, as they have long practiced an environmentally friendly way of life, managing forests, land, and the environment, especially the Badui Dalam community [29]. The Badui community has a deep understanding of the surrounding environment; it does not damage the environment by cutting down trees, using chemical fertilizers, or using chemical cleaning products such as soap and shampoo. The Badui community makes great use of natural facilities for their livelihoods in managing agricultural land, forests, and the environment, so that they do not contribute to environmental damage [30]. This condition benefits the swiftlet house business because the ecosystem is balanced.

Swiftlet house agribusiness has great potential to support sustainable development by addressing the ecological, economic, and social aspects of sustainable development goals (SDGs). The effect of the sustainable development concept is increasing concentration among various parties to encourage economic growth, increase environmental productivity, and improve ecological defense and biodiversity in the environment to fulfill sustainable economic and social aspirations in society [31]. Swiftlet house agribusiness not only supports significant economic opportunities for the community in the international market, but also plays an important role in ecosystem conservation and social welfare, which positively affect sustainability. SBN cultivation affects various social and economic aspects as farmers become swiftlet breeders and create new job opportunities [32].

The sustainability of ecological aspects according to development goals includes environmental management, marine ecosystems, and terrestrial ecosystems. This sustainability adapts to climate change management by maintaining the balance of local ecosystems, including vegetation, clean water sources, and proper environmental sanitation [33,18]. Swiftlet house agribusinesses are generally located in terrestrial ecosystems (SDG 15), while the habitat of swiftlets is in caves or buildings that imitate natural conditions, known as artificial habitats for swiftlets [34]. Swiftlet farms, often located in areas rich in natural vegetation, depend on local environmental balance. Efforts to protect swiftlet habitats from environmental degradation are crucial, and techniques such as sustainable harvesting ensure that swiftlet populations are preserved, contributing to long-term ecological health. In several areas of Indonesia, sustainable programs for swiftlet nest agribusinesses have been implemented, where farmers are only allowed to harvest swiftlet nests using hatching techniques to maintain the population [35]. This can help maintain the population of nesting swiftlets, which are economically profitable and ecologically sustainable.

The sustainability of Swiftlet house agribusiness is related to the Sustainable Development Goals (SDGs) of several economic aspects, including poverty alleviation, decent work opportunities, economic growth, and responsibility for both consumption and production (SDGs point 12). The economic aspect of a swiftlet house significantly impacts poverty alleviation, as it provides many job opportunities for the surrounding community. Business offers potential jobs to the community, which can be a significant source of income. Business products are of high economic value and can improve the community's standard of living. Farmers have shifted to swiftlet breeding by allocating sufficient capital to building houses [36]. The community made

this shift to reap more profit than farming. Swiftlet house agribusiness creates multiple-level jobs that support local economic growth by providing decent jobs. The economic aspect of swiftlet house agribusiness also encourages innovation in swiftlet house agribusiness technologies and SBN processing. The high market demand for SBN products encourages advanced innovation in production and distribution, particularly in infrastructure and processing facilities for local industrial development.

Swiftlet house agribusiness also produces sustainable products from natural resources that can be efficiently utilized. The socioeconomic and cultural benefits of swiftlet nests have great potential as a new type of profitable business [25]. The technical guidance program for swiftlet house agribusiness in Banten provides training programs for swiftlet farmers on sustainable cultivation practices that can increase their income. This also helps to maintain the swiftlet population, which has a sustainable impact and supports the welfare of local communities. The social aspect of sustainable development can impact poverty alleviation, healthy living, the improvement of education, prosperity, peace, justice, and strong institutions. Social changes can also occur in the lifestyle of swiftlet farmers, giving rise to the phenomenon of the *nouveau riche* swiftlet farmers who have a consumptive lifestyle [36].

A healthy and prosperous life in the context of swiftlet house agribusiness can be achieved through the food safety of SBN products that implement hygiene practices in harvesting, washing, and processing to avoid potential contamination by microbes and other hazardous materials. Assessment of SBN safety and quality is also an important social aspect as an integration of quality and authenticity with the originality and uniqueness of a product before being marketed. In addition to having an economic impact, the job opportunities offered by the SBN business also impact social development. The social aspects that arise with the existence of swiftlet house businesses include creating jobs, improving workforce skills, increasing income, and improving social welfare [32]. This positively impacts worker welfare, provides education and training to the community, and increases knowledge. In addition, social aspects can also be in the form of community empowerment towards social and community awareness. The surrounding community can cooperate in establishing cooperatives and swiftlet agribusiness associations, and cooperate with private partners to improve public services. This is one of the strategic steps to achieve sustainability from the economic and social aspects of the swiftlet house agribusiness [37].

The swiftlet house business receives institutional and public service inputs that help improve the ecological, economic, and social aspects. These three factors contribute to sustainable development. The institutions that contribute are both government and non-government. Governmental institutions consist of the Indonesian Quarantine Agency and the National Border Management Agency (*Badan Nasional Pengelola Perbatasan*/BNPP) in collaboration with the Ministry of Agriculture (Kementan), the Ministry of Industry (Kemenperin), and the Ministry of Trade (Kemendag). Non-governmental institutions include individual business actors and business association members. In addition, Banten community institutions, especially the Badui Tribe community, and community institutions in the economic sector, such as cooperatives and business associations, are involved. Input from governmental and non-governmental institutions plays their respective roles in the success of the swiftlet-house business.

The community, business world, and government are involved in public services. Public service actors do not stand alone, but are related to and support each other. Public services for swiftlet house businesses can potentially involve the collaboration of various institutions, thus playing a strategic role in encouraging business success. Members of the National Border Management Agency (BNPP) collaborate with the Ministry of Agriculture (Kementan), Ministry of Industry (Kemenperin), and Ministry of Trade (Kemendag) to encourage SBN exports to support the community. The Ministry of Agriculture has focused on maximizing SBN cultivation to achieve optimal productivity. The products are then processed by the Ministry of Industry, which is responsible for industrial processing, increasing the added value, and downstream development. The Ministry of Trade also plays an important role in regulating trade, including exports, by creating supportive regulations and marketplaces. Collaboration not only increases the economic value of SBN but also provides a positive social impact that can increase social mobility and improve the economy of swiftlet farmers [38].

Public services are an important reform pillar in achieving professional bureaucracy for the actors involved. Coordinated and comprehensive public services are paramount for the sustainable development of swiftlet-nest businesses. Public service input in swiftlet house businesses not only supports business facilities, but can also be a driver of economic growth. Public services can create a conducive business climate that allows swiftlet nest entrepreneurs to operate more efficiently and productively. Public services can be a form of empowerment that improves the quality and capacity of the community and increases income [39]. This

increases entrepreneurs' incomes and creates new jobs that encourage economic growth in the area. In addition, stable prices and the availability of SBN as a result of good public services can increase the competitiveness of Indonesian products in regional and international markets, thus potentially increasing the value of exports and foreign exchange. Therefore, optimal public services in this sector are crucial for sustainable economic development.

Conclusions

Based on the analysis of swiftlet house agribusiness sustainability, the ecological system analysis (coast, hill, and plains) showed that the ecological system plays an important role in the success and development of the region. The swiftlet house agribusiness sustainability level in its contribution to the development of the ecological system in Banten Province on the coast, hills, and plains was 53.16%, 55.44%, and 56.94%, respectively. The sustainability status of coastal, hilly, and plain ecological systems is sustainable. Leverage analysis identified attributes with higher RMS values, indicating a greater influence on the sustainability of agribusiness, providing insights for more optimal ecosystem management, and supporting sustainability based on policy development. This research contributes to recommendations for swiftlet agribusiness, considering the ecological and environmental aspects that positively impact economic value. Similar studies can be applied to agribusiness sectors in coastal areas, such as ecosystem-based tourism and sustainable agricultural development in lowland areas, using the same parameters to deepen the understanding of sustainability in other sectors.

Author Contributions

AKD: Conceptualization, Methodology, Investigation, Analysis, Writing - Review & Editing; **MSSA**: Coach & Review; **IMF**: Coach & Review; **SB**: Coach & Review.

Conflicts of Interest

There are no conflicts to declare.

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