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Integrating Endemic Bird Conservation and Aquatic-Based Livelihoods: Income-Generating Activities for Sustainable Development in Masakambing Island, Indonesia

Ihsannudin[1*], Fuad Hasan[2], Ernoiz Antriyandarti [3], Lenny Luthfiyah[4], Ebban Bagus Kuntadi[5]

[1,4] Agricultural Extension Department, University of Jember, Jember, Indonesia
[2] Agribusiness Department, University of Trunojoyo Madura, Bangkalan, Indonesia
[3] Agribusiness Department, Universitas Sebelas Maret, Surakarta, Indonesia
[5] Agribusiness Department, University of Jember, Jember, Indonesia
[*]**Corresponding Author: ihsannudin@unej.ac.id**

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ABSTRACT

Small islands are known for their remoteness, which affects their vulnerability, including the economic sector of their people. On the other hand, small islands have huge marine biodiversity and rely on fisheries. Therefore, an issue that can raise the popularity of small islands is needed, one of which is the issue of endemic animals. The yellow-crested cockatoo is an endemic animal on Masakambing Island that lives in an area owned by the community. This condition makes it necessary to apply the community-based conservation (CBC) approach. Local communities need to receive economic benefits in the form of income generating activities (IGAs) so that motivation and participation arise in realizing CBC. This study aimed to find out the assets and variety of activities of the community to determine the introduction of IGAs. This study also explored aquatic-based IGAs, such as sustainable fisheries and marine ecotourism, to promote conservation-driven economic development. A mixed-method analysis was used with a sequential explanatory design. The results show that natural assets are extremely abundant, but they lack management. Meanwhile, community activities are dominated by crop cultivation and fisheries. The introduction of IGAs prioritizes livestock development, crop cultivation, fisheries, trade and goods and services industry. The introduction of IGAs that need to be developed urgently is ecotourism for special interest based on the conservation of the yellow-crested cockatoo.

INTRODUCTION

Small islands are known for their remote character, which affects limited access, information, and economy. This condition has certainly an impact on the livelihood activities of the community. The poverty condition of small island communities is also a main issue in the Small Island Development States (SIDS) solution forum in Bangkok **(Sharp & Andrew, 2021)**. On the other hand, small islands also have extraordinary

biodiversity. Small islands are known not only as migration routes but also as habitats for endemic animals **(Nugroho *et al.*, 2021)**.

As is known, small islands will never be separated from the marine ecosystem that surrounds them. Although the existence of the sea poses challenges and limitations, it can also be a source of income **(Teniwut *et al.*, 2023)**. Indeed, fisheries always show essential resources in economic activities **(Calado *et al.*, 2014)**. On the other hand, small islands are also often habitats for biodiversity that require conservation. This condition is similar to what occurs on the Caribbean island of Grenada, which is the habitat of the Grenada bird **(De Ruyck & Koper, 2024)**. These conservation efforts will not only impact ecological interests but also serve as an economic lever for local small island communities. **Ando and Langpap (2018)** revealed that conservation activities are often a lever for infrastructure development, local community economic empowerment programs, and ecotourism. Therefore, an appropriate approach and strategy are needed to handle it. Previously, **Belmar *et al.* (2016)** proposed an adaptive management concept to overcome the complexity of governance on small islands. Hence, one strategy is to analyze livelihood activities through income generating activities (IGAs).

One of the small islands is Masakambing Island in Sumenep Regency, East Java, which is the habitat of the endemic animal, the yellow-crested cockatoo (*Cacatua sulphurea abbotti*). In the international scope, since 2004, the yellow-crested cockatoo has been listed in CITES Appendix 1 **(Cahill *et al.*, 2006)**. In the implementation, the Indonesian government has designated this animal as a priority animal whose population needs to be increased based on the Decree of the Directorate of Forest Protection and Natural Conservation No. 200 / IV / KKH / 2015.

The inventory result of **Nandika *et al* (2020)** stated that there are 22 yellow-crested cockatoos. The population decline due to natural and human factors but human activities become significant factor such as hunting and reduction of carrying capacity of environment **(iucnredlist.org, 2017)**. This is reasonable because humans have an interest in accessing natural resources for livelihood. Conflicts of interest in accessing the natural resources, both on land and in water areas, are common on small islands **(Polman *et al.*, 2016)**.

The habitat of the yellow-crested cockatoo is in the area with community ownership. Therefore, conservation efforts in conservation area with state ownership have many dimensions and problems, even less in the area with community ownership. Conservation activities would deal with conflict of interest due to the usage of same resources for different purposes. A platform is needed to facilitate various interests **(Rist *et al.*, 2007)**. However, conservation efforts in the area with community ownership are still possible. This focus is particularly important when considering species that have native habitats in the area. Conservation initiatives in protected areas are often preferred due to the protective advantages they offer. **Capano *et al.* (2019)** said that conservation in the area of private or community ownership has the potential benefits as follows: (a)

increasing the protection area; (b) increasing the number of stakeholder engagement; (c) increasing ecological and socio-economic connectivity, and (d) reducing social conflict.

The yellow-crested cockatoo need trees for nesting, feeding and sleeping. According to **Nandika *et al.* (2012)**, this animal uses several types of trees for feeding and nesting such as kapok, coconut, breadfruit, tamarind and mangrove *(Avicennia* sp.). Recently, there are 9 active nesting trees; 1 is located in the mangrove area and 8 trees are located in plantation and settlement area that concentrated in the Ketapang sub-village **(Ihsannudin *et al*., 2019)**.

Basically, the conservation activity approach based on technical-biological has been abandoned and switched to the green approach that offers socio-cultural and political solutions **(Ife & Tesoriero, 2006)**. Furthermore, conservation activity must be institutionalized **(Game *et al.*, 2015)**. In detail, conservation activities are conducted through protection activities, species/habitat management, education, regulation/policy, economy (utilization) and development of community capacity **(Capano *et al*., 2019)**. Then, how to formulate an appropriate introduction of conservation activities is questionable. It would be no choice, conservation activities must apply Community-Based Conservation (CBC). In the long term, community involvement in the development, implementation and monitoring of conservation activities will help distribution of ideas and practices **(Leslie, 2005; Armitage *et al.*, 2009; Ostrom, 2009; Dong *et al.*, 2024)**.

Conservation activity with CBC approach would guarantee success, moreover the habitat is adjoining with the community. It is considered that livestock grazing, predators, fires and clearing of native vegetation cause habitat degradation and threatening to the conservation activity **(Smith *et al.*, 1994)**. If the management is not integrated, it will disserve conservation activity **(Saunders, 1994)**.

In the conservation activities, all processes, tasks, practices and visions need to be directed at community empowerment through collective responsibility for prosperity by adopting self-help principles **(Kenny, 2006)**. It means, the activities should implement community-based. This is in accordance with the success story of conservation activity in Fiji who adopted a community involvement approach **(Thaman *et al.*, 2016)**.

Community involvement in the conservation activity correlate the presence of economic effects **(Meyer & Börner, 2022; Manaf *et al.*, 2025)**. After the Earth Summit at Rio in 1992, attention to the community in conservation activities is more improved, then, the conservations are accompanied by the development and sustainability which is implied sustainable livelihood **(Brown, 1998)**. Conservation activity as a form of natural resources management has economic values both direct and indirect **(Liu *et al.*, 2025)**. **Nilsson *et al.* (2016)** encouraged that conservations should have economic value, provide new benefits (emerging of processing businesses) and management authority.

Laursen *et al*. (2025) added that CBC creates accountability and foster a sense of belonging trough community empowerment. The community will have more trust and

responsibility **(Ruitenbeek & Cartier, 2001; Berkes, 2004)**. Community involvement in conservation will lead to an increase in biodiversity and livelihoods because the community has experience, environmental knowledge, cultural values, networks and institutions, and initiatives **(Sazzad *et al.*, 2024)**. **Lee (2018)** also mentioned that the use of CBC approach led to an increase in the population of giraffes in Tanzania.

There are some community-based conservation activity frameworks related to the other sector. The most sophisticated and comprehensive frameworks is Sustainable Livelihood Framework (SLF) which was strengthened in 1992 during the Earth Summit in Rio de Jeneiro. Unfortunately, SLF does not cover all aspects comprehensively. **Wiesmeth** (2018) criticized that SLF does not accommodate the role of the actors, strategies and the impact of action, change and innovation. Likewise, **Sakdapolrak**, **(2014)** assessed that the SLF is still lame in linking actors and institutions, shallow understanding of assets and weak examining on the space and time aspects.

Furthermore, various models were implemented to correct and complete the SLF, then, to optimize non-agricultural activities such as ecotourism, small industries, and others as subsidiary jobs **(Jing *et al.*, 2024)**. **Barrett and Reardon (2000)** formulated a dual activity by examining the assets that determine activity, community dynamics and the diversification linkages of assets-activities or known as Income Generating Activities (IGAs).

The Masakambing Island community, as a small island community, has a lot of limitations. The existence of endemic animals can be used as an issue in efforts to develop the community's economy. **Sitanggang and Sitanggang (2025)** stated that obtaining economic benefits plays an important role in fostering community participation in conservation. The availability of natural resources in an area, including Masakambing Island, constitutes natural capital that can be utilized to generate income through various activities. This study aimed to identify the assets and variety of community activities to determine the introduction of IGAs. It also explored aquatic-based IGAs, such as sustainable fisheries and marine ecotourism, to promote conservation-driven economic development.

MATERIALS AND METHODS

The location of study was chosen purposively in Masakambing Island, Masalembu District, Sumenep Regency, East Java Province, Indonesia. The study area is an endemic habitat for the yellow-crested cockatoo that needs conservation urgently. The island with an area of 7.79 km2 is divided into two sub-village namely Ketapang and Tanjung. The population is 1,365 persons consisting of Madura, Bugis and Mandar ethnicity.

The data consisted of both quantitative and qualitative data, including primary and secondary sources. Primary data were obtained through field observation, interviews (both closed-ended and open-ended), and focus group discussions (FGDs). Observation

was conducted to collect data on community assets and livelihood activities, as well as to verify the introduction of IGAs. Closed interviews (questionnaires) were administered to 160 respondents, determined by proportionate random sampling (53% = 83 respondents from Tanjung sub-village and 48% = 77 respondents from Ketapang sub-village). This sample size was sufficient, as it exceeded the provisions of **Gay *et al.* (2011)**, who recommended a minimum of 10% of the population (1,365).

Open interviews were conducted with key informants, including representatives of local communities (traditional leaders, educators, religious figures, women, and conservationists); government representatives (the head of Masakambing Island Village and the Natural Resources Conservation Agency of East Java Province, NRCA); and NGO representatives (the Indonesian Cockatoo Conservation – Indonesian Parrot Project, KKI-IPP, and PA Kawali, a conservation volunteer group from Masalembu Senior High School). FGDs were conducted to collect information, align perceptions, and reach agreement on the introduction of IGAs related to community-based conservation for the yellow-crested cockatoo.

This study applies quantitative methods with a non-experimental design, describing variables (assets, activities, and their relationships) without manipulating participant conditions **(Clark & Creswell, 2014)**. Quantitative data analysis was conducted using frequency descriptive analysis, while qualitative analysis followed an interactive model by examining and interpreting non-numerical observational data to identify meaning and patterns of relationships **(Babbie, 2014)**. The construction of the introduction of IGAs employed a rational–comprehensive approach to explain possible livelihood alternatives based on the assets and activities of the Masakambing Island community.

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RESULTS

1. The valuation of assets

The assessment of assets is carried out to map the possibility of assets owned by the community. Asset identification consists of human, natural, social, physical, financial, credit, and other assets (remittance). Human assets refer to the skills, knowledge, and level of health that enable the community to secure a livelihood **(Xu *et al.*, 2023)**. Natural assets are natural resources in the physical environment that enable humans to earn a livelihood **(Guerry *et al.*, 2015)**. According to **Coleman (1988)**, social assets refer to trust, cooperation, and social relations. Physical assets are essential infrastructure that supports the goods and services industry **(Rajab-Kalantarzadeh & Savari, 2025)**. Financial assets are tools for people to earn income, maintain livelihoods, make investments, increase assets, and reduce livelihood vulnerability **(Ibrahim *et al.*, 2017)**. Credit assets are sources of microloans to finance livelihood sustainability **(Desalegn *et al.*, 2024)**. Finally, the other asset is remittance, which refers to the number of community members who receive remittances from working outside the island **(Saha *et al.*, 2025)**.

Human assets are derived from knowledge, as reflected in education, which represents intellectual capacity **(Li & Wan, 2025)**. The level of education in the community is very low, with 20.4% of the population not completing elementary school. Meanwhile, community skills (demonstrated through activities) are dominated by crop cultivation, fisheries, and livestock. There are 132 households engaged in food and horticulture cultivation, such as corn, banana, cashew nuts, mango, and other fruits. About 130 households are involved in plantation activities (coconut, cloves, and medicinal chilies). Fishing activities are practiced by 132 households. In general, the community has two primary professions: farming and fishing. In addition, some community members also have diving skills to catch sea cucumbers. Livestock activities (cattle, goats, sheep, and poultry) are carried out by 71 households.

In terms of gender, women make up 51.51% of the population. Age distribution is dominated by the elderly (over 60 years), who account for 10.36%, followed by those aged 30–34 years (10.9%). Notably, there have never been any serious public health issues reported.

The natural assets of Masakambing Island cover 779 ha of land, consisting of 754.5 ha of agricultural area and 24.5 ha of non-agricultural land. The proportion of agricultural land is 84.6% plantation, 14.12% community forest, and 0.3% settlement. Crop cultivation depends on rainwater and wells, as irrigation facilities are not available. There is also the yellow-crested cockatoo conservation area called "Beka Park." The land was developed by KKI-IPP and includes a yellow-crested cockatoo monument, guesthouse, camping ground, and various plants to support the cockatoo's habitat. Masakambing Island also has abundant natural scenery, beautiful forests, and socio-cultural diversity, with Bugis, Mandar, and Madura ethnic groups present.

The biodiversity of flora on the mainland and in the coastal waters of Masakambing Island is abundant and even includes protected categories **(Nandika *et al.*, 2012)**. Flora biodiversity is divided into coastal areas (more than 23 species) and mainland areas (more than 32 species). The biodiversity of mainland fauna includes insects (more than 5 species), reptiles (more than 3 species), mammals (more than 2 species), and birds (more than 10 species), with some species classified as protected.

Masakambing Island is surrounded by mangroves, most of which are in good condition, with scenic beach spots. There is also an atoll called "Karang Pote" with beautiful coral reef views. The biodiversity of fauna in the coastal waters is diverse, including pelagic, demersal, invertebrate–mollusk, and reptile species. Demersal fish species provide significant economic value, especially sea cucumbers, which are a popular commodity. The biodiversity of fauna in Masakambing's coastal waters includes pelagic fish (more than 10 species), demersal fish (more than 11 species), invertebrates and mollusks (more than 6 species), and reptiles (turtles).

Social assets relate to community trust, social networks, and social capital, which bridge relationships between individuals and groups across different social strata (social

bridging) **(Heysham & Elkadi, 2025)**. Social trust is assessed based on relationships among community members, religious leaders, community leaders, ethnic leaders, the village government, activists, and conservation institutions for the yellow-crested cockatoo (KKI-IPP and NRCA of East Java).

Table 1. Trust of Masakambing Island community

Level	Quantity	Percentage (%)
Very low	13	8,1
Low	25	15,6
Middle	70	43,8
High	26	16,3
Very high	26	16,3
Total	160	100

(Source: Analysis of Primary data. 2024).

Community trust is at a moderate level (43.8%). The community shows moderate trust toward fellow community members, religious leaders, community leaders, traditional leaders, the village government, and the NRCA of East Java. Regarding ethnic figures, the community does not consider ethnic origin significant. Trust among local people is reflected in the sense of security in the region: the houses of Masakambing Island are never locked, either during the day or at night. Likewise, livestock pens are placed far from the houses without concern.

In relation to the conservation of the yellow-crested cockatoo, the community has high trust in KKI-IPP, the first actor (since 2008), which has engaged in longer and more frequent interactions with the community. Trust within the local community is expected to serve as a bridge in various empowerment activities. Moreover, the community's ethnic diversity requires strong social bridging. According to **Qi *et al.* (2024)**, social bridging connects communities across different social strata, such as class and ethnic groups.

Masakambing Island is inhabited by multi-ethnic communities with the following composition: 60% Madura, 26.9% Bugis, 6.3% mixed Madura–Bugis/Mandar, and 3.1% Mandar. This ethnic mix has led to cultural acculturation, such as interethnic marriages and shared customs.

Social networks, as a form of social asset, are a precondition required in community systems. According to **Leonardi *et al.* (2001)**, social networks foster mutual trust among community members. Most social networks in the community are at a moderate level (42.5%).

Table 2. Social network of Masakambing Island community

Level	Quantity	Percentage (%)
Very low	13	8,1
Low	45	28,1
Middle	68	42,5
High	29	18,1
Very high	5	3,1
Total	160	100

(Source: Analysis of Primary Data, 2024).

The community has social networks among consanguine relatives, ethnic groups, different ethnicities, neighbors, willingness to cooperate with other parties, motivation, and efforts to maintain relationships with external actors. Despite distances and ethnic differences, the Masakambing community knows each other well, and ethnicity is not a barrier. The community has a strong social network with the village government and demonstrates a willingness to collaborate with other parties in the conservation of the yellow-crested cockatoo. The willingness to build networks for conservation shows a high level of commitment. However, the community hopes that conservation activities will not focus solely on the yellow-crested cockatoo but also on the community itself. This expectation is reasonable since the dominant habitat of the yellow-crested cockatoo is located on land owned by the community **(Ihsannudin *et al.*, 2019)**.

Physical assets in the region are still limited. Transportation relies on small boats with restricted schedules. A regular boat from Masalembu (the nearest island with port facilities) departs at 2:00 p.m., while the return trip from Masakambing to Masalembu leaves at 9:00 a.m., with a cost of approximately US$1.47 per person. Outside of regular hours, boats must be rented at a cost ranging from US$14.67 to US$22.00. Road infrastructure is limited, and transportation facilities consist of 136 motorcycles, 75 bicycles, 2 cargo cars, and 2 tricycles. Cellular signal coverage is very limited, with only one provider that does not cover the entire island. Internet access is unavailable. Electricity is supplied by privately managed generators. There are three operators who run generators from 5:30 to 10:00 p.m. at a cost of US$1.47 per lamp unit and US$3.67 per electronic device, such as a television. Energy sources for cooking are dominated by LPG, although some households still use firewood.

Religious facilities include two mosques and five mushollas. Educational facilities consist of one kindergarten, one Islamic elementary school, and one Islamic junior high school managed by the Islamic Education Foundation of DDI (Darud Da'wah wal Irsyad). The government provides only one elementary school, and no senior high school is available on Masakambing Island. Health infrastructure includes one Village Polyclinic (Polindes) and six Integrated Health Service (Posyandu) units. Government infrastructure is supported by one village hall building.

The financial assets of the community are reflected in the budgeting of the village government as regulated under Indonesia's village funding system. In 2018, the original local government revenue (PAD) of the village government was US$292.88, Village Funding (DD) was US$58,575.66, Village Funding Allocation (ADD) was US$21,965.87, and Financial Aid (BK) was US$7,321.96. These values are expected to increase along with the process of establishing Masakambing Island as an essential ecosystem area.

The community can access credit through the Village-Owned Enterprise Agency (BUMDES) of Masakambing. BUMDES provides productive capital loans with a

maximum nominal value of US$732.20, using livestock as collateral. For other loans, such as from banks, the community must travel to Masalembu Island.

Other assets include remittances from relatives working outside the island or abroad, which are important to the local economy. About 600 people from Masakambing work outside the island, particularly in Malaysia. Reflecting on the study of **Nahar and Arshad (2017)**, a migrant working in Malaysia earns around RM1,000 per month and typically remits RM500 (≈ US$118.67) to their families.

2. Variety of activities

The variety of activities is based on livelihood strategies such as crop cultivation, livestock/fisheries, trade, and the goods and services industry **(Hajdu *et al.*, 2011; FAO, 2019)**. Crop cultivation activities within income-generating activities (IGAs) may include vegetable production and other crops **(Pervez *et al.*, 2018)**. Livestock and fishery activities are vital livelihood strategies in rural communities **(Huisman, 2001)**. In the introduction of IGAs, trade activities can be promoted to overcome limitations **(Roger Federer Foundation, 2018)**. The goods and services industry also serves as an alternative IGA, as shown in the People's Oriented Program Implementation (POPI) program in Bangladesh.

The variety of activities in Masakambing Island is derived from the community's occupations. Crop cultivation is predominant (39.3%), reflecting the importance of natural assets. Corn production reaches 1,943.42 tons per year, bananas amount to 4,800 bunches per year, and cashew nut production is 1 ton per year. Plantation commodities include coconut, cloves, and chili herbs. This activity produces 204,000 coconuts per year, 3 tons of cloves per year, and 1.5 tons of medicinal chilies per year. Some farmers own their land, while 19% are tenant farmers.

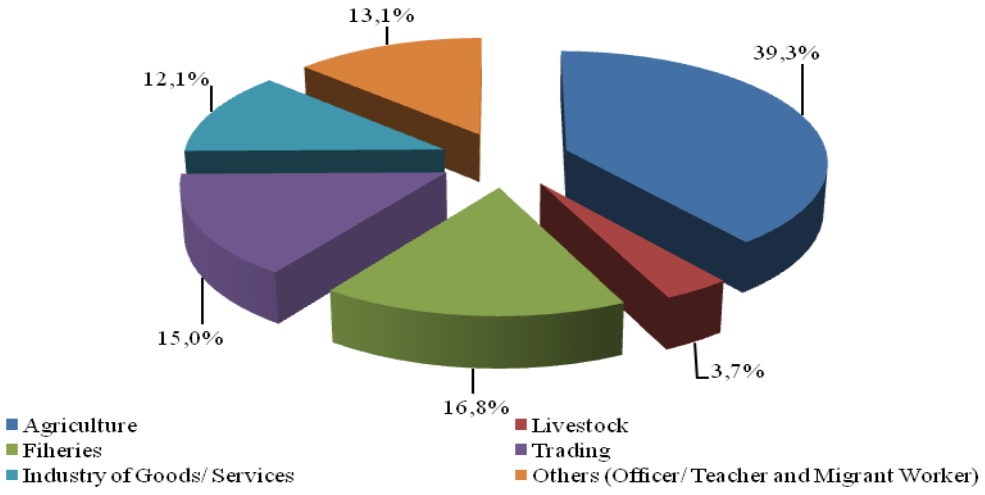

Fig. 1. Distribution of livelihood types

The community is also familiar with livestock activities (3.7%), which are dominated by cattle (75%). There are 363 cattle, 177 goats, and 64 sheep. Poultry consists of 335 birds, including 69 chickens and 52 ducks. Livestock practices remain traditional, with cattle tied in pinfolds located far from homes. Feed is provided through grazing once or twice a day. Consequently, this activity has not contributed significantly to household income. This contrasts with findings in Kenya, where livestock activities serve as stabilizers of household economies, particularly in supporting conservation efforts **(Chiteva *et al.*, 2016)**.

As a small island surrounded by water, the community is closely tied to fishing activities (16.8%). Fish are caught using personal boats or by working as crew members. In addition, the community also harvests crabs and sea cucumbers. Fishing is often considered a subsidiary occupation alongside farming. During peak seasons, marine fisheries production can reach up to 2 tons per day. This differs from wetland communities in Bangladesh, where 43% of households have abandoned fishing **(Rahman & Begum, 2011)**.

Trading activities play an important role in the local economy by diversifying markets and strengthening local purchasing power **(Hall, 2017)**. About 15% of the community engages in trade, ranging from petty trading to fulfilling household needs and selling local commodities such as fishery and agricultural products. **Fisher *et al.* (2017)** demonstrated that petty trading, by providing essential household items, positively impacts cash transfers and reduces the vulnerability of poor households.

Goods and services industry activities are also carried out by the community (12.1%). Agricultural processing industries include two units producing coconut oil, two units producing coconut sugar, and one unit producing copra. In addition, there are seven wood or bamboo furniture industries and four handicraft industries. Service industries include carpentry, party equipment rental, and transportation rental. These activities are significant because IGAs programs are generally implemented in communities engaged in goods and services industries, and they have been shown to be indicators of poverty reduction **(Neely *et al.*, 2004; Oxenham *et al.*, 2012)**.

Finally, some community members are employed as government staff, teachers, or migrant workers in other cities or abroad, particularly in Malaysia. Migration is a favored livelihood alternative when communities cannot access local resources. Migrant workers provide remittances, which constitute an important source of rural household income **(Pearce & Davis, 2000)**.

DISCUSSION

IGAs

After the assets and variety of activities are identified, the introduction of IGAs for the community—based on the conservation of the yellow-crested cockatoo—can be

determined. The database of existing assets and activities is crucial to ensure that the introduction of IGAs is genuinely bottom-up rather than top-down. **Thaman *et al.* (2016)** demonstrated that a bottom-up approach in Portugal led to high community involvement (88%), thereby making conservation activities more effective.

The introduction of IGAs for community-based conservation of the yellow-crested cockatoo in Masakambing Island was formulated through Focus Group Discussions (FGDs). Participants included representatives from the local community, government (village government, NRCA of East Java, Forestry Agency of East Java, and other relevant local agencies), NGOs (KKI-IPP and PA Kawali), as well as universities and the press. The FGD participants assessed the relationship between assets and livelihood activities of the Masakambing Island community using the following scale: 0 = impossible, 1 = low priority, 2 = medium priority, and 3 = high priority. The values were then summed, and the activities with the highest scores were designated as priority activities.

Table 3. Matrix of relationship between assets and activities

Assets / Activities	Crop Cultivation	Livestock	Fisheries	Trading	Goods and Services Industry
Human	3	3	3	2	2
Nature	3	3	3	2	1
Social	3	2	3	2	2
Physical	3	3	2	1	1
Financial	2	2	2	2	1
Credit	1	3	1	1	1
Others	3	3	3	1	1
Total	18	19	17	11	9

(Source: Analysis of Primary Data, 2024).

Cattle farming is the first priority for the introduction of IGAs on Masakambing Island, as it is still practiced only as a part-time and conventional business. Innovation is needed by adopting a silvopastoral system with ranching. Silvopastoral systems generate products such as meat and timber while also contributing to landscape improvement and ecosystem maintenance, including the conservation of the yellow-crested cockatoo **(Pezo *et al.*, 2018)**. This system is appropriate for Masakambing Island's natural conditions, which are dominated by coconut plantations. The security situation on the island is conducive, making this system feasible for implementation. According to **Alonso (2011)**, silvopastoral systems can increase cattle production and support sustainability.

Crop cultivation is the second priority in the introduction of IGAs. Although this is already the main livelihood activity, increasing productivity and integrating commodities that are conservation-friendly must be emphasized. The socialization of good cultivation techniques, provision of optimal and sustainable inputs, and access to capital are essential. The introduction of agricultural commodities should prioritize those that

support yellow-crested cockatoo conservation, such as coconuts, breadfruit, and a variety of fruit crops. Currently, clove is cultivated extensively and should therefore be controlled. This means that the focus of agricultural activities should not only be on high productivity but also on ecosystem sustainability **(Sepúlveda Vargas *et al.*, 2023)**. As a small island with high environmental vulnerability, Masakambing must adopt agricultural management and techniques that minimize environmental problems **(Odero, 2006)**.

Fisheries are the third priority of IGAs. The use of modern fishing boats is needed so that the community can access offshore fishing grounds. At present, fishing is supported by only five outboard motorboats and 21 motorboats. Sea cucumber harvesting still relies on traditional tools that disregard safety and health standards. Thus, the introduction of diving equipment that ensures safety and health is necessary. The transfer of knowledge and technology in aquaculture is also required. Revitalizing shrimp ponds will require skill development, financial assistance, adoption of modern technology, and institutional improvements to ensure livelihood sustainability for vulnerable groups **(Ibrahim *et al.*, 2017)**.

Trading is the fourth priority of IGAs. Currently, there are at least seven petty traders providing household goods. Strengthening capital and providing managerial training are needed to improve performance. The community also engages in trade by collecting and selling fish and agricultural products. Increasing added value is essential to raise household income. Drawing from the introduction of IGAs in Uganda, added-value training and collective marketing training should be implemented **(Krantz, 2001)**.

The final priority of IGAs is the development of the goods and services industry. The goods industry includes coconut oil, coconut sugar, and copra production. The creative industry covers furniture and handicrafts, while the services industry consists of carpentry, party equipment rentals, and transportation rentals. Strengthening capital and capacity-building training are necessary. Common problems in developing the goods and services industry, including in Masakambing, are limited marketing knowledge, insufficient creative skills, and minimal ability to respond to market opportunities. Solutions include exchange visits, skill development, organizational and managerial support, business planning, market assessments, networking opportunities, and engagement with stakeholders **(Sarma & Rahman, 2009; Teampanpong *et al.*, 2024)**.

A particularly urgent service industry to be introduced on Masakambing Island is ecotourism with special interests in yellow-crested cockatoo conservation. Birdwatching ecotourism has been shown to provide economic incentives for conservation **(Blanton *et al.*, 2024)**. However, such activities are often situated in remote areas with limited infrastructure. **Abdurakhmanova and Ahrorov (2025)** emphasized that ecotourism challenges are often linked to inadequate infrastructure.

This limitation can be addressed by targeting allocentric tourist segments—those with an interest in adventure and wildlife birdwatching. Masakambing Island has already attracted both local and foreign tourists due to its unique opportunity to observe yellow-

crested cockatoos in the wild. Visitors can explore "Beka Park," which offers feeding grounds, a camping area, and a monument dedicated to the yellow-crested cockatoo. Additional attractions include marine tourism showcasing coral reefs, beaches, and the Karang Pote atoll; jungle trekking through mangrove forests; and rich biodiversity. Cultural tourism also provides appeal, with exotic features such as community social life, traditional architecture, and local cuisine. Ecotourism is an ideal approach due to the mutual relationship it fosters between wildlife conservation and community livelihood sustainability **(Leslie, 2005; Tseng *et al.*, 2019)**.

As a small island ecosystem, Masakambing has significant potential to integrate endemic bird conservation with aquatic resource-based ecotourism. **Martins *et al.* (2025)** argue that marine ecotourism activities, such as fishing and snorkeling guided by environmentally friendly practices, not only contribute to the local economy but also foster conservation awareness. Masakambing's Karang Pote area, with its well-preserved waters, allows visitors to enjoy coral reefs and marine wildlife through snorkeling and sustainable fishing.

CONCLUSION

The natural assets of Masakambing Island is very prospective and promising, but it has not been utilized maximally. Productive economy activities in this island can be created by balancing the natural resources and maintaining the ecosystem. Crops cultivation and fisheries activity are still the main livelihood activity for the community. However, introduction of IGAs for the Masakambing Island community shows livestock activity becoming top priority. The most important introduction for IGAs that support the conservation of the yellow-crested cockatoos is ecotourism because Masakambing Island has abundant tourist attraction objects, both natural and cultural, and it has become ideal strategic to solve relation between livelihood and conservation. Endemic bird conservation efforts on Masakmbing Island need to prioritize community involvement. Therefore, conservationists need to prioritize community empowerment programs based on existing livelihoods to provide IGAs for the community to foster conservation participation.

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