Received 2024-01-25
Received in revised from 2024-03-16
Accepted 2024-07-01
Available online 2024-07-03

Implementation of Integrated Farming System Technology Towards Sustainable Agriculture in the Kemiren Tourist Village, Banyuwangi

Rita Parmawati[123]*, Indah Yanti[4], Ayu Winna Ramadhani[5], Wuwun Risvita[2], Muhaimin Zulhair Achsin[6], Nadhea Oktaviantina Rahmawati[1], Fahdynia Karnira Gunawan[1], Fadhil Muhamad Ashari[1]

[1]Postgraduate School, Universitas Brawijaya, Malang, Indonesia
[2]Study Program of Agribusiness (Off – Main Campus), Universitas Brawijaya, Kediri, Indonesia
[3]Department of Socioeconomics, Faculty of Agriculture, Universitas Brawijaya, Malang, Indonesia
[4]Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya, Malang, Indonesia
[5]Study Program of Aquaculture (Off – Main Campus), Universitas Brawijaya, Kediri, Indonesia
[6]Government Science Study Program, Faculty of Social and Political Science, Universitas Brawijaya, Malang, Indonesia

Abstract

Kemiren Village, Glagah District, Banyuwangi Regency is a tourist village where the majority of people work as farmers. Several problems arise starting from the narrowness of agricultural land which has been converted into lodging buildings and places to eat. The lack of farmers' knowledge of agricultural technology to process plants is a factor in reducing the production capacity of rice plants. The purpose of implementing this community service activity is to increase motivation to create healthy and sustainable agriculture and provide knowledge and skills in processing local resources into a system and product that has high economic value. The results obtained are an integrated farming system as well as products from IFS such as chicken eggs, rice, vegetables, and catfish which are healthy and of good quality because they use organic ingredients. There is an increase in the level of knowledge of farming and non-farming communities and a map of identification of existing problems and potentials has been formed after socialization regarding the application of Integrated Farming System Technology Towards Sustainable Agriculture, making IFS prototype framework, the level of knowledge of farmers in making IFS agricultural systems with quality product categories and so that the product has competitiveness in the market.

Keywords: *Integrated Farming System, Tourism Village, Banyuwangi*

INTRODUCTION

The Indonesian government states that Indonesia's current food reserves are only around 21 days (sindonews.com, 2022). Furthermore, competition in land use for food production, housing, and industry also threatens food security, considering that Indonesia is the country with the 4th largest population in the world (Sukarja, 2015). Therefore, innovative strategies are needed to help improve food security.

Food security can be realized through the availability of access to food. Food access is highly dependent on a healthy and sustainable food system. With current technology, the integration of agriculture-livestock-fisheries systems has been widely developed, even in urban areas where land is relatively small. According to (Wardah & Niswah, 2021) The combination of three economic activities, namely agriculture-livestock-fisheries with limited land conditions, is known as the integrated urban farming system. This integrated urban farming system is effective in increasing land productivity and increasing resource efficiency compared to conventional methods. The benefits of implementing an integrated urban farming system include: helping to reduce land dependence, water consumption, growth of unwanted plants (weeds), and cultivation costs (Sadali, 2018).

The agriculture, livestock, and fisheries sectors are the highest contributors to GRDP. Harvest area and agricultural production in East Java in recent years has continued to decline. Seeing these facts, it is very possible to develop an integrated farming system in Kemiren Village. This system has the

Correspondence address:
Rita Parmawati
Email : *rita_parmawati@ub.ac.id*
Address : Postgraduate School, Universitas Brawijaya, Malang, Indonesia

potential to be developed because farmers will get several benefits at once. Currently, not many farmers in Kemiren Village have adopted the Integrated Farming System. Researchers are trying to implement an Integrated Farming System in the Kemiren Tourism Village to help with the problems of an increasingly narrow agricultural sector and low farmer incomes due to the increasing development of the tourism sector.

Integrated Farming System technology is a combination of several agricultural activities. The development of an integrated agricultural system can be carried out using several approaches and strategies that focus on harmony between natural resources, both organic and intensive agriculture, with human resources and the environment (Syafruddin, 2019). An integrated agricultural system carried out using several approaches and strategies also focuses on the benefits of maintaining environmental sustainability that is oriented towards a zero waste system, meeting human food needs, and increasing the income of farmers and breeders.

MATERIAL AND METHOD

Target implementation methods in two groups:

1. Kemiren Village Farmers: Introduction to IFS, dividing the tasks of each farmer to take part in activities:
   a. Agricultural sector: training, monitoring and evaluation of organic farming
   b. Livestock sector: training, monitoring and evaluation of organic farming using maggot.
   c. Fisheries sector: training, monitoring and evaluation of organic fisheries.
2. Kemiren community other than farmers: help make the program a success:
   a. Marketing of agricultural, livestock and fishery products
   b. Provider of raw materials for implementing IFS

The partner approach method is carried out in several stages, described in Table 1.

Table 1. *Implementation Stages*

No	Method	Achievement Indicators
1	**Method**: observation process and FGD **Output**: knowing the problems and the potential of Kemiren village	Availability of problem and potential data that can be optimized in Kemiren Village
2	**Method**: observation and interviews providing tools and supporting materials **Output**: availability of places providing raw materials for implementing the Integrated Farming System to strategic marketing places	Looking for a place to provide suppliers of equipment and materials that will be used as partners in Kemiren Village or areas adjacent to Kemiren Village, if not yet available then an alternative is given to look for suppliers from outside the area
3	**Method**: counseling using presentation and discussion methods **Output**: availability of individuals who are responsible for each manufacturing process	Formation of individuals who are responsible in every field of animal husbandry, agriculture and fisheries
4	**Method**: training and practice outcomes of implementing IFS **Output**: ISSBN training module	Each individual who has been assigned their respective duties understands their duties and responsibilities
5	**Method**: evaluation **Output**: program improvement	Activities carried out well

Partner Participation in Program Implementation:

1. Financing activities
2. Provide data on the potential of the Kemiren Village area
3. Place of program implementation

Steps to Evaluate Program Implementation:

1. Focus Group Discussion (FGD) between the community who have been divided into tasks such as fish cultivation, chicken cultivation, rice and vegetable cultivation and suppliers providing tools and materials
2. Socialize the products made and create networking to expand the market

How the Zero Waste Integrated Farming System Works

1. Preparation of Fish Ponds and Aquaponics Installations:
   - Prepare a tilapia pond
   - Assemble the water pump installation and water lines that flow to the aquaponics system.
2. Aquaponics System:
   - Flow water from the fish pond into the aquaponics system.
   - The aquaponics system contains pak choy vegetable plants.

- The water that flows into the aquaponics system contains nutrients from fish waste in the pond.
- Vegetable plants utilize these nutrients for their growth.

3. Diffusion and Growth Process:
   - During the diffusion process, plant roots absorb nutrients dissolved in aquaponic water.
   - These nutrients are useful for the growth of vegetable plants grown in an aquaponic system.
   - In this process, the water becomes cleaner as the nutrients are absorbed by the plants, reducing the nutrient density in the water that returns to the fish pond.
4. Cultivating Chickens and Maggots:
   - Laying hens are kept in cages.
   - The chicken manure produced is collected and directed to the maggot cultivation area.
   - Maggots consume chicken droppings and break down the organic material.
5. Benefits of Maggots:
   - The maggots produced can be reused as a mixture of fish feed.
   - Maggots contain high nutrients and are a good source of protein for fish growth in ponds.
6. ZWIFS System Waste Integration:
   - In the ZWIFS system, all waste generated from the chicken, maggot and aquaponic cultivation processes can be utilized in an integrated manner.
   - The nutrients contained in chicken droppings are utilized by maggots, and the maggot larvae are then used as a fish food mixture.
   - By utilizing all waste in this system, no waste is produced, thereby achieving the concept of zero waste.

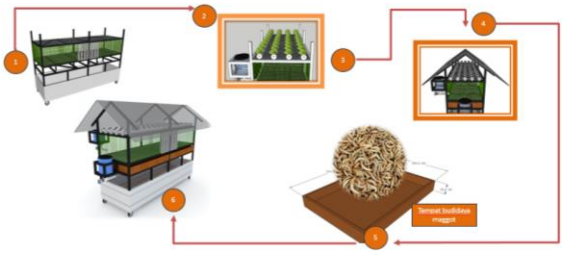

Figure 1. How the Integrated Farming System Works

Table 2. *Team Structure and Division of Tasks*

No	Name	Role	Description
1	Dr. Rita Parmawati, S.P., M.E	Research lecturer	1. Make details of the main concept of service along with a timeline 2. Dividing portions of team tasks Directing and supervising all stages of activities 3. Providing education about sustainable agriculture 4. Provide training on IFS concepts
2	Wuwun Risvita, S.P., M.P	Research lecturer	1. Provide IFS counseling 2. Marketing of IFS products
3	Indah Yanti, S.Si., M.Si	Research lecturer	1. Assist in the development and implementation of IFS 2. Design an aquaponics system that can be applied to the IFS model
4	Ayu Winna Ramadhani, S.Pi., M.Si	Research lecturer	1. Journal Publication 2. Process research data
5	Muhaimin Zulhair A, S.IP., MA	Research lecturer	1. Journal Publication 2. Process research data
6	Fahdynia Karnira Gunawan, S.T	Research student	Assist with research administration
7	Nadhea Oktaviantina Rahmawati, S.Pi	Research student	Assist with research administration
8	Fadhil Muhammad Ashari, S.Pi	Research student	Help analyze and process research data

RESULT AND DISCUSSION

The agricultural sector is a leading sector that contributes to the food and nutritional needs of the world's population, where this population is increasing every year. According to (Zuhdi, 2021) the more population in the world, the greater the need. In the midst of land scarcity and unpredictable weather, the Zero Waste Integrated Farming System is considered a solution for farmers to manage their land productively. Integrated farming uses multiple cultivation initiatives in the same area to produce more sustainable agriculture.

This system combines agriculture, animal husbandry, fishing and other activities using the same land allowing farmers to earn additional income rather than relying on one type of crop (Somasundaram et al., 2021). The concept of the Zero Waste Integrated Farming System can be defined as a "middle way concept", which takes advantage of both types of agricultural sectors, namely the organic agricultural sector and the conventional agricultural sector. According to (Meghwal, 2021) the Zero Waste Integrated Farming System has revolutionized conventional agriculture by providing opportunities for adaptation and integration of several other sectors such as livestock, fisheries, and others. Integration that can occur can be in the form of plant-fish integration, livestock integration, plant-fish-livestock integration or a combination of plants, livestock, fish and business.

The sustainable agricultural method that is expected to be the solution is an integrated farming system. An integrated farming system was developed as a response to the failure of conventional agriculture in achieving agricultural sector development goals (Bunga and Meringgi, 2020). The principle of an integrated farming system applies sustainable land use management by integrating agriculture-forestry-plantations-livestock-fisheries simultaneously. In an integrated agricultural system, there are three elements that must be fulfilled, namely: (1) land use management with various combinations of cultivation between agriculture-forestry-plantations-animal husbandry-fisheries; (2) integration to increase production and reduce the risk of crop failure; and (3) sustainability, namely the ability to produce sustainably over a long period of time.

The agricultural system in Kemiren Village still uses conventional farming systems. Several problems faced by the agricultural sector have resulted in reduced income. If left unchecked, people will leave the farming profession because they feel they are unable to meet the needs of farmers. Based on the results of interviews and initial field observations, data was obtained that the majority of the people of Kemiren Village have a profession as farmers with low income levels. Seeing the potential that Kemiren Village has, namely that it is a tourist village, human resources in the form of many farmers, natural resources in the form of agricultural land and favorable weather. With this doctoral service program, it can provide benefits to various parties, especially the Kemiren village community. The solution offered is the creation of Integrated Farming System technology. Integrated Farming System technology has several advantages, including farmers being able to harvest several agricultural, fisheries and livestock products on one land, creating healthy agriculture, minimizing the use of chemical fertilizers and becoming a new vehicle for visitors to the Kemiren tourist village. Integrated Farming System is an integrated system in which agriculture, animal husbandry and fisheries are in a rotating cycle with waste utilization. IFS integrates several commodities including; agriculture (aquaponics), namely the presence of rice or vegetable crops, animal husbandry, namely the cultivation of chickens and maggots, and fisheries, namely the presence of catfish. The rotating cycle starts from the use of organic waste (you can use household organic waste) as maggot feed, then maggots as side feed for chickens, dried chicken manure is used as side feed for catfish, and catfish pond water can be used as aquaponic growing media. Furthermore, chickens and catfish can generate profits that can be reused in system development. So you can minimize the waste produced.

Based on interviews with farmers in Kemiren Village before the socialization regarding the Implementation of Integrated Farming System Technology Towards Sustainable Agriculture, it can be seen that the level of community understanding regarding this method is still low. This can be seen in the results of the distribution of pre-test answers in Figure 2. Based on the distribution of answers, it can be seen that the average score of the farming community's answers to the questions presented regarding the Integrated Farming System is 1.3, which means that people do not understand. Then the researchers conducted outreach to the farming community regarding the Application of Integrated Farming System Technology towards Sustainable Agriculture to introduce this method while increasing the understanding of the farming community regarding sustainable integrated agriculture. The results of the distribution of answers after socialization had increased, namely with an average post test score of 2.7.

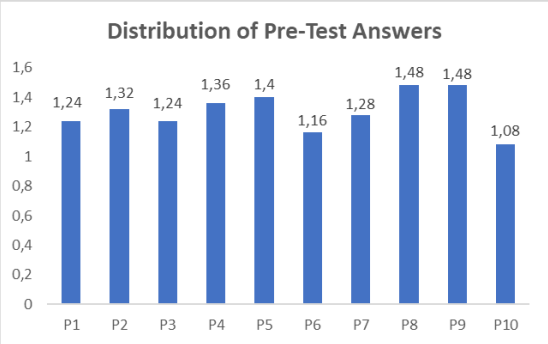

Figure 2. *Pre-Test Answer Distribution Graph*

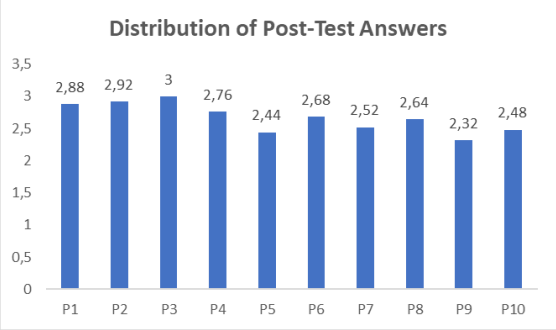

Figure 3. *Post-Test Answer Distribution Graph*

The results of the distribution of answers are supported by supporting data such as age, highest level of education, non-formal education attended and the average income of the farming community. Below is a diagram of the latest educational data for farming communities.

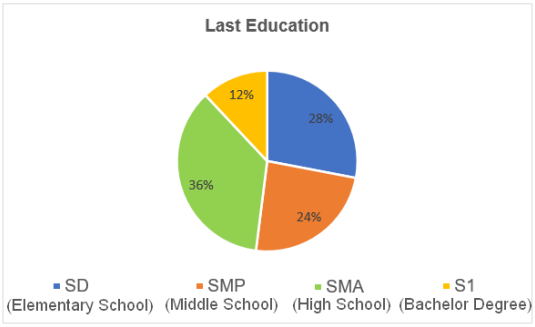

Figure 4. *Last Education*

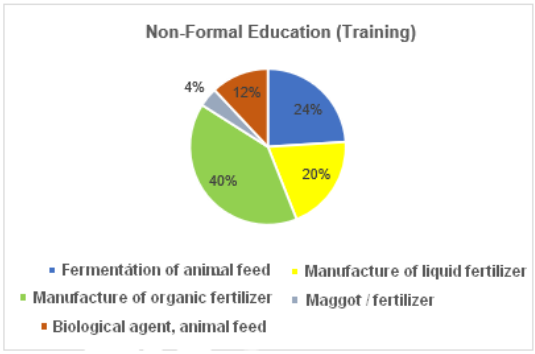

Figure 5. *Non-formal Education*

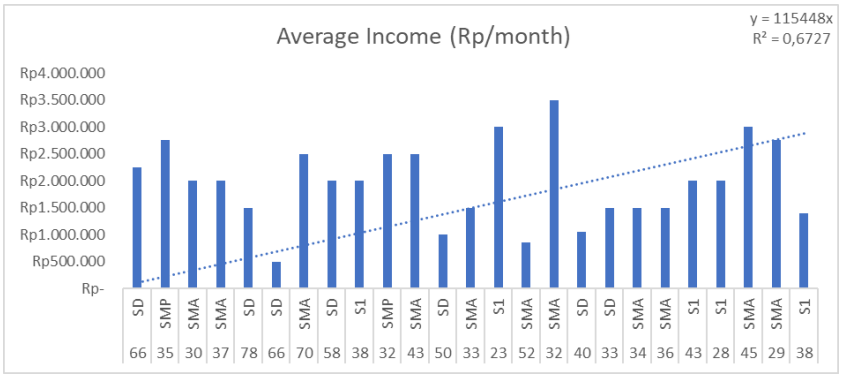

Figure 6. *Average Income (Rupiah/month)*

Based on Figure 5, it can be seen that the majority of the farming community's final education in Kemiren Village is high school at 36%, then the non-formal education or training that the majority of the community has attended is making organic fertilizer at 40%. Below is a graph of the average income in terms of age and recent educational history of the 25 respondents:

Based on figure 6, it can be seen that the R^2 value in linear regression analysis is 0.67. Based on these results, it can be seen that the high average income of farming communities has a relatively strong relationship with age and level of education. The figure shows that the highest average farmer income of IDR 3,500,000.00 was obtained by respondents of productive age, namely 32 years with a high school education level. This is supported by more farmers' skills and knowledge obtained from formal and non-formal education.

Based on these results, it can be concluded that assistance related to new sustainable farming system methods, in this case the Application of Integrated Farming System Technology Towards

Sustainable Agriculture in Kemiren Tourism Village, Glagah District, Banyuwangi, is very important to improve farmers' skills to overcome problems related to the agricultural sector faced such as reduced income due to unstable production or decreasing agricultural land. The impact of implementing Integrated Farming System technology towards Sustainable Agriculture in the Kemiren Tourism Village also opens up opportunities for non-farming communities to be able to produce agricultural, fisheries and livestock products even though the land they own is not large.

Implementation of IFS is carried out by: 1) counseling and training on processing chicken manure as *bokhasi* (organic fertilizer) 2) building integrated cages with the cultivation of catfish, rice and vegetables 3) contribution from the people of Kemiren Village apart from farmers by making collections and packaging of cultivated commodity products in IFS system with safe, informative and attractive packaging. Marketing plans, namely online and offline. Online marketing is marketed through Instagram, Facebook and other e-commerce media, while offline marketing is through sales at souvenir centers, left at local community kiosks, and sold to tourist attractions in Kemiren village or the surrounding area.

Figure 7. *Integrated Farming System Prototype Framework in Kemiren Village*

Based on the results of the service carried out in Kemiren Village, Glagah District, Banyuwangi, things that have been realized are the creation of an Integrated Farming System prototype framework, publication of local news and videos. Apart from that, modules and posters for appropriate technology products have been distributed to serve as a reference for managing the Integrated Farming System in Kemiren Village.

Figure 8. *Outcomes of Integrated Farming System Service in Kemiren Village*

IMPACT OF ACTIVITIES

So, with ZWIFS, the people of Osing can establish integrated farming without waste in managing household waste and meeting the kitchen needs of their home stay guests, without requiring a large area of land. With the existence of ZWIFS, there will be economic turnover on a small scale, namely households.

CONCLUSION

The conclusion section contains the achievements of community service activities in relation to the objectives. Based on the community service activities that have been carried out in Kemiren Village, Glagah District, Banyuwangi, the following conclusions can be given:

1. Increasing the level of knowledge of farming and non-farming communities and forming an identification map of existing problems and potential after conducting socialization regarding the Application of Integrated Farming System Technology Towards Sustainable Agriculture.

2. Increasing the level of knowledge of farmers in integrating existing resources to support the creation of IFS at the stage of selecting raw materials and making the IFS prototype framework
3. Increasing the level of knowledge of farmers in creating an IFS agricultural system with quality product categories and so that these products have competitiveness in the market

ACKNOWLEDGEMENT

We would like to thank Universitas Brawijaya through the funding of the doctoral grant, the village head and the Osing tribe community in Kemiren Village, Banyuwangi district.

REFERENCES

AAK. 1988. *Budidaya Tanaman Kopi*. Yogyakarta : Kanisius.

Aklimawati, L., & Mawardi, S. 2014. Characteristics of Quality Profile and Agribusiness of Robusta Coffee in Tambora Mountainside, Sumbawa.*Pelita Perkebunan (a Coffee and Cocoa Research Journal)*, *30*(2).

Alder J., Pitcher T.J., Preikshot D., Kaschner, & Feriss. 2000. How good is good? A rapid appraisal technique for evaluation of the sustainability status of fisheries of the North Atlantic. In Pauly and Pitcher (Eds.), *Methods for evaluation the impacts of fisheries on the North Atlantic ecosystem.* Fisheries Research Report, Vol. 8 No.2.

Álvarez, J.F., & Furio, V.J.. 2010. Colombian family farmers' adaptations to new conditions in the world coffee market. *Latin American Perspectives*, *37*(2), 93-110.

Arifien, Moch S., 2014. *Ketika Kopi Berbunga*. Surabaya: Dinas Perkebunan Provinsi Jawa Timur.

Badan Pusat Statistik Kabupaten Malang, 2021. *Kecamatan Wagir dalam Angka tahun 2021, BPS Kab. Malang, Malang.*

Barham, B.L., & Weber, J.G.. 2012. The Economic Sustainability of Certified Coffee: Recent Evidence from Mexico and Peru. *World Development*, *40*(6), 1269-1279

Budidarsono, S., & Wijaya, K. 2004. *Praktek Konservasi dalam Budidaya Kopi Robusta dan keuntungan Petani*. World Agroforestry Centre, Bogor

Bunga, N.I., & Meringgi, A.R. 2020. Prospek Pemanfaatan Limbah Pertanian Sebagai Pupuk Organik Dalam Mewujudkan Sistem Pertanian Berkelanjutan. https://doi.org/10.31219/osf.io/rc4kv

Camargo, M.B.P. 2010. The impact of climatic variability and climate change on arabica coffee crop in Brazil. *Bragantia Campinas*, 69, 239–247.

Cipta, Shinta, W., 2015. *Pengembangan Komoditas Unggulan di Wilayah Pengembangan Tumpang Kabupaten Malang*. Tesis Sekolah Pasca Sarjana, Institut Pertanian Bogor, Bogor.

Craparo, A.C.W., Van Asten, P.J.A., Läderach, P., Jassogne, L.T.P., & Grab, S.W.. 2015. Coffea arabica yields decline in Tanzania due to climate change: Global implications. *Agricultural and Forest Meteorology*, *207*, 1-10.

CSD (Commission on Sustainable Development) . 2001. *Report on the aggregation of indicators of sustainable development [paper]*. New York : Division for CSD United Nations.

Dianiar, U. 2015. *Bersahabat dengan Lingkungan melalui pertanian Berkelanjutan*. Melalui http://pertanian.pontianakkota.go.id/artikel/29 - bersahabat-dengan-lingkungan-melalui-pertanian-berkelanjutan.html [5/09/2017]

Direktorat jenderal perkebunan, 2013a. *Percepatan Pelaksanaan ProgramPeningkatan Produksi dan Produktivitas Perkebunan Berkelanjutan 2013*. Kementerian Pertanian. Jakarta.

Davis, A.P., Gole, T.W., Baena, S., & Moat, J. 2012. The impact of climate change on indigenous arabica coffee (Coffea arabica): predicting future trends and identifying priorities. *PLoS One*, *7*, 1–13.

Donovan, J., & Poole, N.. 2014. Changing asset endowments and smallholder participation in higher value markets: Evidence from certified coffee producers in Nicaragua. *Food Policy*, *44*, 1–13

FAO. 1989. *Sustainable Development and Natural Resources Management*. Twenty-Fifth Conference, Paper C 89/2 simp 2, food and Agriculture Organization, Rome.

Fadlina, I.M., & Supriyono, B., & Soeaidy, S. 2013 Perencanaan Pembangunan Pertanian Berkelanjutan (Kajian tentang Pengembangan Pertanian Organik di Kota Batu), Sustainable Development of Agrocultural (Studies on Organic Agricultural Development in Batu City). *J-PAL*, *4*(1).

Groenen P.J.F., & Velden. 2004. *Multidimensional scaling [Econometric Institue Report Rotterdam University]*. Diakses dari http://repub.eur.nl/res/pub/1274/ei200415.pdf [30/12/2017].

Ismayadi, C. 1998. Cita rasa Kopi Arabika Spesialti Indonesia. *Warta Pusat Penelitian Kopi dan Kakao Indonesia*, *14*, 165-172.

Jaya, R. 2014. *Rancang Bangun Rantai Pasok Kopi Gayo Berkelanjutan*. (Disertasi). Bogor (ID): Departemen Teknologi Industri Pertanian, Sekolah Pascasarjana IPB.

Kangas, J., Pesonen, M., Kurttila, M., & Kajanus, M. 2001. A'WOT: Integrating the Ahp with Swot Analysis. *Proceedings–6th ISAHP*, 189-198.

Kasumbogo,U. 1997. *Pertanian Organik Sebagai Alternatif Teknologi dalam Pembangunan Pertanian. Diskusi Panel Tentang Pertanian Organik*. DPD HKTI Jawa Barat, Lembang.

Kementrian Pertanian. (n.d.). *Permentan No. 49 tahun 2014 tentang Pedoman Teknis Budidaya Kopi yang baik (Good Agriculture Practices/GAP on Coffee) Jakarta.*

Kementrian Pertanian RI. (n.d.). *Permentan RI nomor 52 tahun 2012 tentang Pedoman Penanganan Pasca Panen Kopi. Jakarta*

Khasan, A. F., Hariyati, Y., & Hartadi, R. 2015. Indeks Keberlanjutan Dan Identifikasi Faktor Kunci Sistem. *Berkala Ilmiah pertanian*, *x*(x).

Kurttila, M., Pesonen, M., Kangas, J., & Kajanus M. 2000. Utilizing the analytic hierarchy process (AHP) in SWOT analysis- a hybrid method and itsapplication to a forest-certification case. *Forest Policy and Economics*, *1*, 41-52.

Liling, Y., Malamassam, D., Nurkin, B., & Putranto, B. 2016. Analysis of Private Forest Resource Management in Socio Cultural and Institutional Aspects: A Case Study of Tana Toraja and North Toraja Regencies, Indonesia. *International Jurnal Of Sciences: Basic and Applied Research (IJBAR)*, *25*(3), 349-358.

Madlener, R., Robledo, C., Muys, B., & Freja, A.T.B. 2006. A Sustainability Framework for Enhancing the Long-Term Success of Lulucf Projects. *Climatic Change*, *75*(1-2), 241 – 271.

Marimin. 2004. *Teknik dan Aplikasi: Pengambilan Keputusan Kriteria Majemuk*. Jakarta (ID): Penerbit Grasindo.

Meghwal, P.R. 2021. *Potential of horticultural crops in integrated farming system for higher income in Arid Zone*. https://doi.org/10.1201/9781003245810-2

Meylan, L., Gary, C., Allinne, C., Ortiz, J., Jackson, L., & Rapidel, B. 2017. Evaluating the effect of shade trees on provision of ecosystem services in intensively managed coffee plantations. *Agriculture, Ecosystems & Environment*, *245*, 32-42.

Nesper, M., Kueffer, C., Krishnan, S., Kushalappa, C.G., & Ghazoul, J. 2017. Shade tree diversity enhances coffee production and quality in agroforestry systems in the Western Ghats. *Agriculture, Ecosystems & Environment*, *247*, 172-181.

Panggabean, E. 2011. *Buku Pintar Kopi*. Jakarta : PT. Agro Media Pustaka.

Parmawati, R., Putra, F., Sunaryo, & Wike, Hardyansah, R. 2021. *Sustainable livelihood approach: Mendorong pertanian yang ramah lingkungan dan berkelanjutan*. Malang: UB Press.

Parmawati, R., Wardana, F.C., Abidin, Z., Rahmawati, N.O., Gunawan, F.K., Purnomo, M., & Sui, J.M. 2022. *Optimization of the zero waste s concept in developing an Integrated Farming System model to realize sustainable agriculture*. Universitas Brawijaya

Perfecto, I., Vandermeer, J., Mas, A., & Pinto. L.S. 2005. Biodiversity, yield, and shade coffee

certification. *Ecological Economics*, *54*(4), 435-446.

Prasmatiwi Erry, F., Irham, Suryantini, A., & Jamhari. 2010. Analisis Keberlanjutan Usahatani Kopi di Kawasan Hutan Kabupaten Lampung Barat dengan Pendekatan Nilai Ekonomi Lingkungan. *Pelita Perkebunan*, *26*(1), 57-69.

Purnamasari, M., Hanani, N., & Huang, W.C. 2014. Analisis Daya Saing Ekspor Kopi Indonesia di Pasar Dunia. *Agricultural Socio-Economics Journal*, *14*(1), 58.

Purnomo, B.H. 2012. *Rancang Bangun Model Prediksi keberlanjutan agroindustri perikanan tangkap. Sekolah Pascasarjana*. Institut Pertanian Bogor.

Pusdatin (Pusat Data dan Informasi). 2016, *Outlook Kopi: Komoditas Pertanian Sub Sektor Perkebunan*. Sekretaris Jenderal kementrian pertanian, Jakarta.

Pujiyanto. 2007. Arah menuju Produksi Kopi Berkelanjutan. *Warta Pusat Penelitian Kopi dan kakao Indonesia*, *23*(1), 1-10.

Ruben, R., & Fort, R. 2012. The Impact of Fair Trade Certification for Coffee Farmers in Peru. *World Development*, *40*(3): 570-582.

Saaty, T.L. 2008. Decision Making With The Analytic Hierarchy Process. *International Journal Services Sciences*, *1*(1):83-98.

Salikin, K.A. 2003. *Sistem Pertanian Berkelanjutan*. Kanisius, Yogyakarta.

Sadali, M.I. 2018. *Ketahanan Pangan berkelanjutan di Kabupaten Sukoharjo*. https://doi.org/10.31227/osf.io/yuhw3

Sinukaban, N. 2007. *Membangun pertanian menjadi industri yang lestari dengan pertanian konservasi, dalam Konservasi Tanah dan Air Kunci Pembangunan Berkelanjutan*. Jakarta: Penerbit Direktorat Jenderal RLPS, Departemen Kehutanan.

Somasundaram, E., Nandhini, D.U., & Meyyapan, M. 2021. *Integrated Organic Farming System*. https://doi.org/10.1201/9781003260844-10

Sugiyono. 2009. Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: Alfabeta

Sumirat, U. 2013. *Pedoman Teknis Rekomendasi Praktik Budidaya Tanaman Kopi Robusta di Indonesia*. Pusat penelitian Kopi dan kakao Indonesia. Jember.

Syafruddin. 2019. *Pertanian Organik pertanian Andalan Masa Depan.* https://doi.org/10.52574/syiahkualauniversitypress.269

Triwahyuni, A. 2015. *Strategi Keberlanjutan Pemanfaatan Energi Alternatif Biogas di Desa (Menuju) Mandiri Energi Desa Argosari Jabung Kabupaten Malang.* Tesis Program Pasca Sarjana, Universitas Brawijaya, Malang.

Wulandari, P. 2016. *Status Keberlanjutan dan Arahan Pengembangan Wilayah Berbasis Industri di Pesisir Kab. Lampung Selatan*. Tesis Sekolah Pasca Sarjana, Institut Pertanian Bogor, Bogor.