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Implementation Of Integrated Farming System (IFS) And Digitization Of Gurgur Tourism Park To Improve Circular Economy In Toba Regency, North Sumatra

Doni Sahat Tua Manalu[1]*, Widya Hasian Situmeang[2], Agief Julio Pratama[3], Melewanto Patabang[4], Chintya Eka Putri[5]

[1.5]Agribusiness Management Study Program, College of Vocational Studies, IPB University
[2.3] Production Technology and Agricultural Community Development Study Program, College of Vocational Studies, IPB University
[3]Ecotourism Study Program, College of Vocational Studies, IPB University
Corresponding Author: Doni Sahat Tua Manalu. E-mail: donisahat@apps.ipb.ac.id

Abstract: Agriculture and tourism are two sectors that play a significant role in economic development, especially in rural areas. Sustainable development of rural areas demands constructive collaboration between efficient agricultural practices, resource conservation, and the inclusive utilization of local tourism potential. The purpose of this study is to analyze the perception of the people of Toba Regency in the implementation of the Integrated Farming System (IFS) and digitalization in order to improve the circular economy. The method of selecting the research location was carried out deliberately (purposive). The results obtained from this study are that the community has a perception of agricultural integration and understands that the circular economy principle is useful in improving resource efficiency and ecosystem sustainability. Tourism digitalization has been proven to strengthen the promotion of tourism and local products. Furthermore, 100% of respondents stated that the integrated farming system and digitalization are able to increase income and realize a circular economy.
Keywords: Digitalization, circular economy, integrated agricultural system, Gurgur Tourism Park

INTRODUCTION

Agriculture and tourism are two sectors that play a significant role in economic development, especially in rural areas. The combination of these two sectors has the potential to create synergies between the provision of livelihoods and the preservation of local natural resources. However, agricultural practices that are still often linear and locally managed tourism are manually managed tend to result in low resource efficiency and waste streams that have not been optimally utilized, thereby reducing the potential for local added value (Nababan & Regina, 2021).

Sustainable development of rural areas demands constructive collaboration between efficient agricultural practices, resource conservation, and the inclusive utilization of local tourism potential. *Integrated Farming System* (IFS) is a holistic approach that combines various components of production, both crops, livestock, fisheries, and horticulture, in one integrated ecosystem to increase productivity, input utilization efficiency, and food security of farmer families. The application of IFS can increase production per unit area, reduce waste through the cycle of using *output* as inputs, and support environmental sustainability on a small and medium-scale agriculture scale (Bhagat *et al*., 2024).

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In line with the IFS concept, there is a *circular economy* approach that emphasizes the reuse of resources and minimization of waste by making it a raw material with economic value. The implementation of a circular economy in an integrated agricultural system allows for waste reduction, increased added value of by-products, and diversification of agricultural household income. Thus, the circular economy model can transform a linear production system into a more environmentally friendly and inclusive cyclical system. The implementation of the circular economy in the agricultural sector shows that *the zero-waste model* and the utilization of leftover production increases food security and opens local business opportunities, noting that technical capacity building and local institutional support are needed (Sudrajat *et al*., 2025).

In addition to the agricultural sector, strengthening the tourism sector is also an important strategy in improving the welfare of rural communities. Currently, digitalization has become a fundamental need in the management of tourist destinations, including tourist villages. The use of digital technology, such as online reservation systems, e-marketing, and application-based financial record-keeping, can increase the number of tourist visits while expanding market access (Widyanaputri *et al*., 2024). Toba Regency in North Sumatra is one of the areas with enormous potential in the agricultural sector as well as tourism. The area has the Gurgur Tourist Park, a destination designed not only for recreation, but also designed for agricultural, livestock, and fishing activities. On the other hand, Gurgur Tourism Park also has strategic value because it is related to the Toba Caldera Geopark area, which is recognized by UNESCO as part of the world heritage and demands sustainable management based on nature, cultural and educational conservation. The potential of the area is truly relevant to be developed through the implementation of IFS combined with *circular economy* practices. In addition, strengthening the digitalization of park services will help position Gurgur Tourism Park as a more competitive ecotourism/edutourism destination because of the added economic value created and sustainable for the local community, as well as supporting environmental and cultural values.

Despite the good and enormous potential, there are also some real obstacles encountered in the field, namely the capacity of local communities to manage agricultural, livestock, and fisheries commodities is still limited. Then there is a tourism management system, ranging from tickets, promotions, to financial recording which is still done manually so that it is less efficient. The use of agricultural and livestock waste has also not been maximized, so it has the potential to cause environmental problems. This situation emphasizes the need to understand how the public perceives the implementation of IFS, the application *of circular economy principles*, and the digitalization of tourism management. The implementation *of the Integrated Farming System* (IFS) and the Digitalization of Gurgur Tourism Park to Improve *the Circular Economy* in Toba Regency, North Sumatra" is a strategic step that not only supports increasing community productivity and income but also maintains environmental sustainability and strengthens tourist attractions. This program is expected to be able to become an integrative model of integrated agriculture-based tourism destination management that can be replicated in other areas with similar characteristics.

Based on this description, the purpose of this study is to analyze public perception in the Implementation of *the Integrated Farming System* (IFS) and Digitization of Gurgur Tourism Park to Improve *the Circular Economy* in Toba Regency, North Sumatra.

METHOD

The community service program activity of IPB University Lecturers was carried out in Tampahan Village, Toba Regency, North Sumatra, which was attended by 50 participants. The selection of the location of the service was carried out deliberately (*purposive*) as a concept of the birthplace of the IPB University Lecturer so that the surrounding community could feel the impact of the activity. With material that was tailored and presented by each speaker, especially material on *Integrated Farming System* (IFS) innovation, *circular economy*, and digitalization, especially for the development of village tourism areas. The target group is PKK cadres who are also accompanied by the Village Head, the Gurgur Tourism Park Coordinator, and the Agriculture Office. The IPB University Homecoming Lecturer activity will be held in August 2025.

The types of data carried out are quantitative and qualitative data, quantitative data is obtained using questionnaires in the form of pre-test and post-test questions, then descriptive analysis is carried out with the aim of explaining the overview of the implementation of research activities. Descriptive analysis is expected to provide a description of the conditions and implementation of the research.

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The research is carried out through several main stages as follows:

- **Focus Group Discussion (FGD) dengan Mitra**

The activity began with an FGD between a team of lecturers, the Gracia Toba Raya Foundation, and the manager of the Gurgur Tourism Park. The goal is to agree on the implementation mechanism, activity time, and role division. Mitra conveyed the main needs of the community, namely capacity building in integrated agriculture, tourism management, and digital marketing.

- **Integrated Farming System (IFS) Training**

Provide materials related to the implementation of an integrated agricultural system that is environmentally friendly and oriented towards increasing productivity. Participants were trained on diversification of farming businesses, the use of organic waste, and sustainable farming patterns. It is hoped that the community will be able to reduce dependence on external inputs and increase income through the optimization of local resources.

- **Tourism Management Training**

Focus on increasing the capacity of Gurgur Tourism Park managers. The material includes strategies for developing tourist attractions, managing facilities, and improving the quality of tourist services. The approach is carried out practically by modeling a management model based on local wisdom and environmental sustainability.

- **Digital Marketing Training**

Intended for tourism managers and the surrounding business community. The material includes the use of social media, digital content creation, and the use of online platforms for product promotion and tourist destinations. With digitalization, it is hoped that the promotional reach will be wider to increase the attractiveness of tourism and the marketing of local products.

- **Innovation Dissemination**

The results of the activities and innovations implemented are disseminated through publications in online media. The goal is to make information on activities accessible to the wider community and encourage the replication of similar activities in other areas. This dissemination is also a form of academic accountability to the public.

- **Evaluation and Follow-up**

After the series of activities is completed, an evaluation is carried out with the community and partners. The evaluation includes the level of understanding of the participants, the suitability of the material with the needs, and the commitment to implementation in the field. The results of the evaluation showed an increase in participants' understanding, but further assistance was still needed to ensure the sustainability of the program.

RESULTS AND DISCUSSION

The research will be carried out in August 2025. The results showed that the participants' understanding after receiving the material and training with 50 respondents, consisting of 37 men (74%) and 12 women (26%). This composition shows an unbalanced involvement between men and women in activities with men being more dominant. This is relevant to the condition of the people of Toba Regency, where the role of men is still quite large in agricultural activities and land management, while women tend to play a role in household activities and processing agricultural products. Women's almost equal participation is also an important potential, as it supports the realization of a more inclusive community empowerment.

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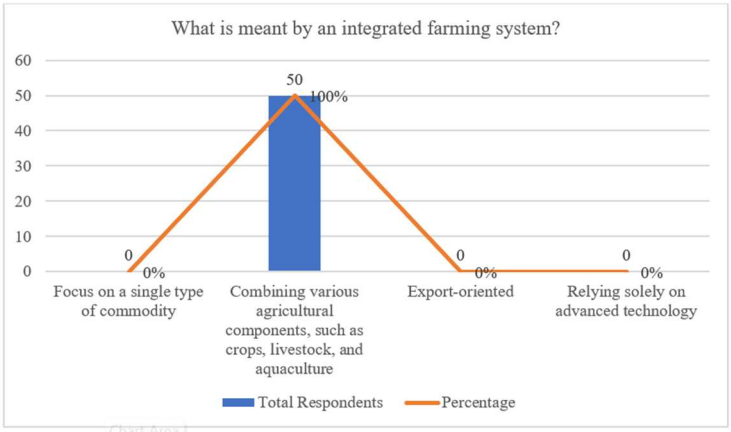

Figure 3.1 Knowledge of *the meaning of Integrated Farming System*

The results of the data processing in Figure 3.1 show that all respondents (100% or 50 people) gave the correct answer, namely that the integrated agricultural system is a combination of various agricultural components, such as crops, livestock, and fisheries. These findings show that the level of respondents' understanding of the basic concept of IFS is in the very good category. The uniformity of the answers shown that the socialization and training provided succeeded in transferring the core knowledge related to the definition of IFS. In other words, respondents are able to understand that the strength of IFS lies in the integration between subsectors so that waste from one component can be used as input for other components.

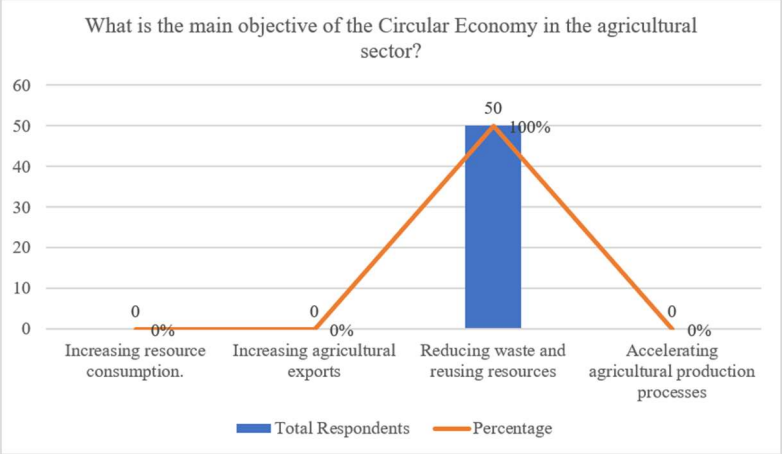

Figure 3.2 Knowledge of the main objectives *of the circular economy*

The results of the analysis in Figure 3.2 show that all respondents (100% or 50 people) answered correctly, namely reducing waste and increasing resource reuse. This shows that respondents' understanding of the concept of circular economy in the context of agriculture is in the very good category. Respondents realized that the essence of the circular economy is not just to increase production, but how to minimize waste and improve the use of available resources. This shows the success of the training in transferring the basic concept of the circular economy to the community.

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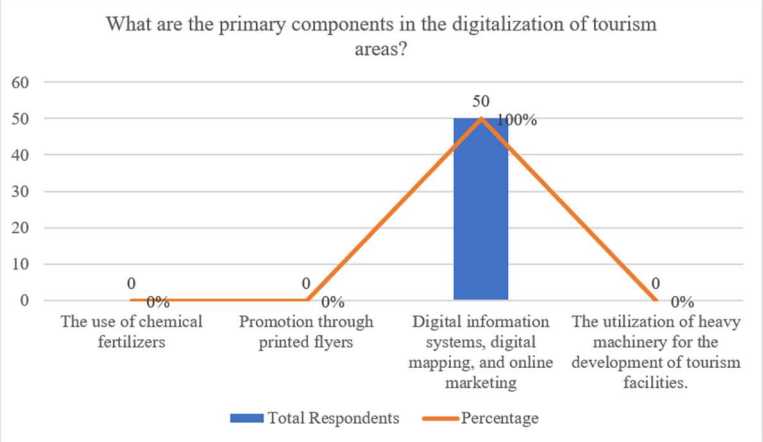

Figure 3.3 Knowledge of the digitization components for tourist areas

The results of the analysis in Figure 3.3 show that all respondents (100% or 50 people) answered correctly, namely digital information systems, digital mapping, and marketing *Online*. These findings show that respondents' understanding of the digitalization of tourist areas is in the very good category after the implementation of socialization and training. Respondents understand that digitalization is not only related to physical facilities but includes the use of information technology for the management, promotion, and marketing of tourist destinations. This awareness is important because it is in line with global trends, where digital technology is a key factor in increasing the competitiveness of tourist destinations, expanding market reach, and facilitating interaction between managers and tourists

Discussion

The right understanding of IFS as a strategy for optimizing local resources through integration between agricultural subsystems is in line with Shanmugam's opinion *et al*. (2024) which states that IFS is able to increase the efficiency of resource utilization by utilizing waste from one commodity as an input for another, so that it can reduce production costs while maintaining the sustainability of the agricultural ecosystem. The implementation of IFS in the agricultural area of Toba Regency can contribute to strengthening *circular economy*, especially to minimize agricultural waste. Understanding of key objectives *circular economy* in the agricultural sector, it shows that partner communities already have an awareness of the importance of sustainability in agricultural management. This concept can also be known from Goyal *et al*. (2018) that *circular economy* aims to change linear production patterns to an implementation that focuses on harmonizing and managing the careful flow of resources by prioritizing reduction, recycling, and resource reuse.

Furthermore, the integration of *the circular economy* concept into the IFS system provides added value to research activities. The combination of crops, livestock, and fisheries allows for more efficient material flow, such as processing livestock manure into compost for plants or using water from fishponds to irrigate vegetable gardens as liquid organic fertilizer. This approach can be found in the results of Reddy *et al*. (2023) which shows that circular economy-based IFS is able to increase farmers' income while maintaining environmental sustainability.

In addition to strengthening the agricultural system, the aspect of tourism digitalization is also an important part of this activity. Partner communities who understand tourism digitalization can use it as a strategy in expanding market reach through information technology. This is in line with the results of research from Saputra (2023) which states that digitalization in the tourism sector is able to increase the attractiveness of destinations through real-time online promotions that are effective in reaching the global market. Gurgur Tourism Park with the implementation of digitalization can strengthen the promotion of nature-based destinations while supporting the marketing of local products produced by IFS. Through social media, digital platforms, and digital-based mapping, potential tourists can more easily access information about locations, attractions, and products offered. Thus, digitalization not only increases tourist visits but also expands the market for local agricultural products. This is supported by the findings of

Ningsih *et al*. (2024) that the application of digital marketing in the agriculture and tourism sectors has been proven to be able to increase the selling value of products while expanding the market on an international scale.

The overall results of the activity show that the partner community in Tampahan Village, Toba Regency has understood three main aspects of the program, namely *the Integrated Farming System* (IFS), *circular economy*, and tourism digitalization. This awareness is an important capital for the implementation of sustainable programs. However, continuous assistance is needed so that this knowledge can be implemented consistently in the field. Without continuous supervision, it is feared that the understanding that has been formed will not be actualized into real practice. Therefore, follow-up in the form of monitoring and further training is highly recommended to ensure the success of the program in the long term.

CONCLUSION

Public Perception of the Implementation of *the Integrated Farming System* (IFS) and Digitalization of Gurgur Tourism Park to Improve *the Circular Economy* in Toba Regency, North Sumatra obtained that respondents had the perception that the implementation was able to increase the knowledge of participants and felt that socialization, training and various activities to explain the Implementation of *the Integrated Farming System* (IFS) and Digitization of Gurgur Tourism Park to Improve *the Circular Economy* in Toba Regency, North Sumatra by 100%. These indicators are included in the high category, this shows that the material presented by the speakers is able to increase understanding, as well as in accordance with the potential and problems of the community, especially in managing the agricultural and tourism sectors in a more effective and efficient use of resources, so that the integration of the implementation *of the Integrated Farming System* (IFS) and *the circular economy*, as well as the use of digitalization can be an innovation effort that is beneficial for the welfare of farmers and environmental sustainability.

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