



Strategies for Developing Competent Youths in Integrated Agriculture Through Local Wisdom

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Abstract

Integrated agricultural system is a management system (business) that combines agricultural components, such as plants, animals and fish in a unified whole. In addition to meeting the criteria for sustainable agricultural development, this system has a significant positive impact because it is organically based and developed/directed based on local potential (local resources). Warmadewa University offered a solution to the concept of integrated agricultural conservation starting from livestock and fisheries activities to post-harvest processing and encourage an entrepreneurial spirit in the younger generation. The engineering provided was an efficient technology resulting from research from professional agricultural experts that has been published in various journals. Among them are the development of organic cultivation and diversification using the SNT (System Nutrient Tank) method for exclusive vegetables, super local breed chicken farming in accordance with national poultry standards, fisheries with the concept of aquaponics (hydroponic system and poly culture system) and post-harvest processing of agricultural, livestock and fishery products, with the concept of food processing supporting local wisdom, all of which were integrated and with the concept of zero waste. The method used in this activity were delivering material, training, practice and mentoring to young people who are members of the partner, DUDI Tamiang Bali Mandiri Foundation in the Agro Learning Center (ALC) group. These youth were given integrated agricultural knowledge as well as fisheries and animal husbandry and the processing of agricultural products with the concept of "zero waste" based on Tri Hita Karana (Balinese local wisdom). There were 5 activities in this program. The output of Unwar's Matching Fund activities with the Industrial World was a young generation who are competent and have competency certificates from the Professional Certification Institute through the National Professional Certification Agency (BNSP) for 8 people, and integrated agricultural training certificates for 25 people, so they are ready to be independent or work competent in agriculture. Other outputs were Activity Books and Standard Operation Procedure Books, IPRs, Modules, Product Launches, News in the Bali Post Newspaper, Product Exhibitions, Video activities, each targeted at one achievement target.

Keywords: Integrated Agriculture, Tri Hita Karana, Zero Waste

1. Introduction

The vision of Warmadewa University (UNWAR) is to become a quality university with an ecotourism perspective, and to be globally competitive in 2034. With this vision, all activities carried out by academic community of Unwar were ecotourism-oriented. One of the pillars of ecotourism is conservation. Therefore, engineering activities are prioritized for green economy conservation. One of the goals of conservation is to protect the wealth of natural ecosystems and maintain ecological processes and ecosystem balance in a sustainable manner.

One of the problems that arise during the era of the industrial revolution 4.0 is that the younger generation are more attracted to technology than the agricultural industry. Referring to this situation, encouraging young people to get involved in the agricultural sector is urgent. It is not for the current time, but for the next five or ten years. The young generation is the key, and modern agriculture is the solution to attract the younger generation to be involved in the agricultural business. Digital agriculture itself is a technology that can facilitate practical and useful decision-making,

so that risk management in agriculture becomes easier and it also helps to increase potential profits in a sustainable manner (Abioye et al., 2022).

The younger generation in this era is known as those who want everything to be instant, fast and easy. Indonesia urgently needs farmer regeneration in the coming years. To become a successful young farmer, patience and perseverance are certainly necessary. Apart from having prominent skills, the ability to be patient in achieving achievements needs to go hand in hand. In the modern era of globalization, human needs for basic needs are getting bigger. Therefore, humans use various ways to meet their needs. However, the ways that humans do are not all done in a proper way and seem to damage the environment. Some of the ways in which humans destroy the environment are illegal logging, forest fires, poaching, especially for endangered species, and others (Novianti et al., 2022).

The direct impact that can be felt by humans for the destruction of nature is global warming, climate change, pollution, the emergence of various diseases and others (Agache et al., 2022). From this it can be understood that if we treat nature carelessly, then nature will repay humans. This arbitrary behavior with nature and the environment has an impact on two parties, humans themselves and other living things. Therefore, humans must maintain the concept of *Tri Hita Karana* (Balinese Wisdom), especially in terms of human relations with nature itself (Sumantri et al., 2022).

In Balinese culture, in order to preserve other living things, humans must carry out the *Tumpek Kandang* ceremony which is addressed to animals and *Tumpek Wariga* which is addressed to vegetation. Through this ceremony, humans can express their gratitude to the environment, especially the living things in it, namely animals and plants. By carrying out all these things, humans can have a good relationship with the environment.

Tumpek Kandang dan *Tumpek Wariga* merupakan salah satu perwujudan dari filosofi *Tri Hita Karana*. Pada dasarnya hakikat ajaran *Tri Hita Karana* menekankan tiga hubungan manusia dalam kehidupan di dunia ini. Ketiga hubungan itu adalah hubungan manusia dengan Tuhan, hubungan manusia dengan lingkungan, dan hubungan manusia dengan sesama manusia (Sumantri et al., 2022). Konsep *Tumpek Kandang* dan *Tumpek Wariga* ini menekankan kepada konsep ajaran *Tri Hita Karana* yang merupakan bagian hubungan manusia dengan lingkungan, dalam hal ini merupakan suatu bentuk konservasi dalam mempertahankan kearifan lokal (Indriasari et al., 2022).

Through the Matching Fund program in 2022, UNWAR established collaborative activities to support the Agro Learning Center (ALC) program located in Denpasar. ALC is a center for training programs for young people engaged in agriculture in a broad sense. The activities carried out by ALC have not been integrated with the concept of "zero waste" ecosystems and ecology. Therefore, based on the essence of *Tri Hita Karana*'s local wisdom with the concepts of *Tumpek Kandang* and *Tumpek Wariga*, Unwar offered a solution to the concept of integrated agricultural conservation with livestock and fishery activities to post-harvest processing and encourage entrepreneurial spirit in the younger generation who are members of ALC.

The engineering provided by UNWAR was an efficient technology resulting from research from professional agricultural experts at Unwar and has been published in various journals. Among them are the development of organic cultivation and diversification using the SNT (System Nutrient Tank) method for exclusive vegetables (Iceberg, horensen, italian dandelion, basilicum, lolla rosa, lettuce, rocola), super local breed chicken farming in accordance with national poultry standards (SKKNI for poultry), Fisheries with the aquaponic concept (hydroponic system and poly culture system), and post-harvest processing of agricultural, livestock and fishery products, with the concept of food processing supporting local wisdom, all of which are integrated and with the zero waste concept.

2. Materials and Methods

To develop a competent generation in the field of integrated agriculture, the UNWAR Faculty of Agriculture Matching Fund (MF) program was administered by delivering material, training, practice and mentoring to the youth who are members of partners, the Tamiang Bali Mandiri Foundation Business World in the Agro Learning Center (ALC) group. They were given agricultural knowledge integrated with fisheries and animal husbandry as well as processing agricultural products with the concept of "zero waste" based on *Tri Hita Karana*.

There are 5 activities in this program, they are as follows:

1. The first activity was integrated farming training. It was conducted for partners, involving lecturers, students, experts and resource persons from the Professional Certification Institution. The training was carried out by delivering material, training, practice and mentoring by the Unwar Faculty of Agriculture.
2. The second activity was an integrated aquaponic activity between the tilapia aquaculture system, giant prawns and the hydroponic system. Fish feed given was in the form of pellets and natural feed in the form of fermented coconut dregs plus additional feed in the form of tape yeast, green vegetables, and Hong Kong caterpillars. This activity produced liquid waste and solid waste. Filtration were made to the liquid waste from the aquaculture system before entering the hydroponic system by means of aeration. Solid waste was used as raw material for solid fertilizer for ornamental plants and vegetables. The method for implementing tilapia aquaponic cultivation was by using a biofloc system which is used for hydroponic activities.
3. The third activity was rearing super local breed chickens. The implementation of livestock activities, especially super local breed chicken, was in accordance with the national poultry standard (SKKNI for poultry) and was also integrated with agriculture and fisheries cultivation in the utilization of livestock waste.
4. The fourth activity is agriculture. The planting of rhizomes, exclusive vegetable plants and hydroponics was carried out using the System Nutrient Tank (SNT). It is a way of planting that is done in certain containers

with media rich in nutrients. Containers can come from gutters, wooden tubs, polybags, planter bags or used styrofoam. Thus, it is possible to plant several times in a container until the media nutrients are minimal.

The fifth activity was post-harvest processing of agricultural, livestock and fishery products with an integrated concept that was zero waste according to the local wisdom. In addition, marketing training and fostering entrepreneurial spirits were also included. Participants were given methods for implementing basic feasibility to improve the quality of food products to ensure product safety. It also includes checking up on whether or not the traditional processor has carried out the correct processing according to GMP (Good Manufacturing Practice) and if they have carried out hygiene sanitation according to its operational procedures (SSOP/Sanitation Standard Operating Procedures) to assess the level of hazard, risk estimation and determination of appropriate measures in supervision, with an emphasis on prevention and process control in the final product testing needs.

3. Results and Discussion

An integrated agricultural system is a management system (business) that combines agricultural components, such as plants, animals and fish in a unified whole (Afrahamiryano, 2015). This system has been proven to produce a significant positive impact and meet the criteria for sustainable agricultural development because it is organic based and is developed/directed based on local potential (local resources).

The purpose of implementing this system is to minimize input from outside (low input/input) so that the negative impacts as mentioned above can be avoided and sustainable as much as possible (Behera & France, 2016). To develop competent youths in the integrated agriculture, the Unwar Faculty of Agriculture Matching Fund (MF) program team implemented methods of delivering material, training, practice and mentoring to young people who are members of partners, DUDI Tamiang Bali Mandiri Foundation in the Agro Learning Center group (ALC). They were given integrated agricultural knowledge about fisheries and animal husbandry and processing of agricultural products with the concept of "zero waste" based on Tri Hita Karana.

The first activity took place at the partner's location, involving 25 young people who are members of the ALC. This can be seen in Figure 1. The material and training provided were about understanding the concept of integrated agriculture which has several characteristics, as follows:

1. Agricultural management is carried out broadly and comprehensively
2. Agricultural activities are oriented towards productivity, efficiency, sustainability, are socially acceptable and are economically profitable
3. Integrated agriculture is an independent system with the Low External Input Sustainable Agriculture system or abbreviated as LEISA. The system is able to run properly without being dependent on intake from outside the system
4. The system can be measured and evaluated at each stage (De Bhowmick et al., 2019).



Figure 1: Implementation of Integrated Agricultural Training

To find out the initial ability of the partners on agriculture, before carrying out the activity, the MF team conducted a pre-test followed by a post-test within the next 5 months. The pre-test was given before counseling, according to Tan et al. (2022) and Gothankar, (2013) The post test is given after the training material is given with the aim of knowing the extent to which the participants understand the training material after the activity is carried out. These tests functioned to see the effectiveness of training.

The results of the pre-test showed that the trainees got various score. On the other hand, the post-test scores showed that they were undifferentiated. This showed that the trainees tended to have the same knowledge. From the results of the training and pre-test and post-test evaluation, partner members who had prominent abilities would be included in competency training conducted by the Professional Certification Institute.

The second activity was aquaponic activity, Aquaponics is an advanced farming method that combines aquaculture and hydroponic techniques. In the aquaculture section, the biofloc method is used so that the activity of microorganisms (heterotrophic bacteria, fungi, yeast, protozoa, algae, and phytoplankton) can process leftover feed and excretion results into flocks (biofloc). There are two functions of biofloc in aquaculture containers, namely to

improve water quality in containers by converting nitrogenous waste into flocculate and as a source of additional food for fish reared (Deswati et al., 2021).

In carrying out the second activity, aquaponics was integrated between tilapia aquaculture systems, giant prawns and hydroponic systems. The activity was carried out in several stages, starting from preparation which included workshops, material debriefing, training, practice, mentoring by 4 lecturers from the Faculty of Agriculture, Unwar Aquatic Resources Management Study Program, involving participants from partners and students. The implementation of tilapia aquaponic cultivation activities using the biofloc system used for hydroponic activities can be seen in the Figure 2.



Figure 2: Aquaponic Activity

In carrying out the second activity, fish feed was given in the form of pellets plus natural feed in the form of fermented coconut dregs. Another feed in the form of tape yeast, green vegetables, and Hong Kong caterpillars were also added. Giving a combination of feed had a very real effect on growth. If the feed given can be responded well by the fish and there is no leftover feed in the rearing medium, a balance and synergy is created between the combination of commercial feed and supplementary feed so as to provide the best growth for tilapia fry (Rostika et al., 2022).

This activity produced liquid waste and solid waste. The solid waste was used as raw material for solid fertilizer for ornamental plants and vegetables, whereas before entering the hydroponic system by means of aeration, the liquid waste from the aquaculture system was refined. The existence of aeration could maintain conditions of high dissolved oxygen (DO) content so as to meet the needs of microorganisms to break down ammonia into simpler elements; In addition, the high dissolved oxygen (DO) content is also easily absorbed by plants and released back into the air in the form of nitrites and nitrates through nitrification and denitrification processes (Zhang et al., 2010).

After the implementation of the training activities was completed, the activities continued with competency tests carried out by assessors from the BNSP PROFESSIONAL CERTIFICATION INSTITUTION-KP who collaborated with partners. It was hoped that later after participating in this program, fish cultivating partners would have the knowledge and skills to develop tilapia aquaponic cultivation in narrow land. They were also expected to become young entrepreneurs in the field of fish farming.

The third activity was rearing super native chickens. Super local breed chickens are chicken that comes from a cross between laying hens and local breed chicken (Astuti, 2020). Local breed chickens are the easiest livestock to find in many areas. In carrying out local breed chicken rearing activities, training for the younger generation of ALC was carried out by providing material that includes background or introduction to types of free-range chickens and their crosses, rearing systems, livestock production facilities, cultivation issues, rearing management, and harvesting. The stages of livestock activities, especially super local breed chickens, was carried out by adjusting the national poultry standards (SKKNI in the field of poultry) which were integrated with agricultural and fishery cultivation in the utilization of livestock waste. Utilization of livestock waste in the form of manure and leftover feed as fertilizer for vegetable planting activities made this activity a rotational farming activity that applied the zero waste concept. With this concept, soil fertility can be maintained by ensuring nutrients in the soil due to chicken farming waste in the form of manure and leftover feed (Nawabpet & Menon, 2022). The activities of raising local breed chickens can be seen in Figure 3.



Figure 3: Super Local Breed Chicken Farming Activities

The implementation of local breed chicken breeding activities did not use the concept of environmentally friendly poultry farming. Cases of residues of antibiotics, hormones, heavy metals and other chemical contaminants are a negative impact of unsafe and unhealthy aquaculture management. This means that environmentally friendly local chicken farming is important in efforts to provide healthy and safe animal food (Abd El-Hack et al, 2018).

Environmentally friendly cultivation patterns can be carried out through various approaches, one of which is the feed management approach. The feed management approach places more emphasis on efforts to utilize natural (organic) feed which has a positive effect on the appearance of chickens.

In the implementation of training, the utilization of root herbs as one of the natural feeds was generally able to provide economic and social benefits. The economic aspect in question was the reduction in production costs by reducing the use of expensive commercial feed ingredients or feed additives. The social benefits were more directed to the non-technical aspects of the farm itself. The use of traditional plants in chicken farming will at least guarantee the availability of safer animal food (Chodkowska et al., 2022). In addition to the use of traditional plants, local breed chickens were given fermented coconut dregs flour rations, and bread waste for feed so as to improve meat quality which is in accordance to what is stated by Ayuti et al. (2022) and Kardaya et al. (2022).

The fourth activity was agriculture. The fourth activity was the cultivation of root herbs, exclusive vegetable plants and hydroponics with the System Nutrient Tank (SNT). The Nutrien Tank System is a method of planting that was carried out in certain containers with nutrient-rich media.

The Activities the implementation of agricultural activities was designed as follows:

1. Exclusive Vegetable Cultivation Activities with the System Nutrient Tank (SNT) Method.

This activity was carried out by designing containers where plants grow. Utilization of the maintenance system used the water from the pond where the fish was kept. In this process the plant utilizes nutrients derived from fish waste. Decomposing bacteria will convert fish waste into nitrogen elements, then these elements will be used as a source of nutrition in plants (Nenciu et al., 2022), (Nazara et al., 2021).

2. Activities of utilizing livestock and fish waste to be used as organic fertilizer and liquid organic fertilizer.

Addition of plant nutrition through fertilizer by utilizing existing local resources such as agricultural product waste can be done using livestock and fish waste. The advantage of utilizing livestock waste is reducing the negative impact of waste contamination on the environment and the high nutrient content can be used as fertilizer. Providing plant cultivation is an excellent solution to improve physical and chemical properties, to increase the activity of soil microorganisms and more friendly to the environment. Organic fertilizers are divided into two, namely in the form of solids and liquids. Liquid organic fertilizer or POC is a solution brewed from the decomposition of organic materials such as plant residues, animal waste, and other organic materials, in water to extract microorganisms and compounds that are beneficial to plants into the solution. The process of making POC can be carried out in two conditions, namely aerobic and anaerobic (Study et al., 2021).

This training activity was expected to be able to integrate livestock activities into SNT cultivation so as to be able to provide reciprocity between waste as a waste material and waste as a resource that was utilized. The implementation of this agricultural activity can be seen in Figure 4.



Figure 4: Agricultural Activities

By carrying out agricultural activities, it was hoped that partners would be able to get results in the form of: 1). Productivity increase of horticultural crop farming, through the utilization of livestock and fish waste. 2). Quality, safety and competitiveness improvement of horticultural commodities through improving the process of plant cultivation techniques using the System Nutrient Tank (SNT) method. 3) increasing farmers' income with a diversification system and reducing pollution and environmental damage through the utilization of livestock and fishery waste into several value-added products such as solid organic fertilizer and liquid organic fertilizer (POC). 4) Assistance in making System Nutrient Tank (SNT) production facilities so that the cultivation process could run well, would be more time efficient and could increase the profits obtained. 5) Knowledge and practical skills of farmers in optimal management of livestock/fish waste integrated into farming.

The fifth activity was post-harvest processing of agricultural products. In this activity the implementation of training activities emphasized traditional food processing. The distinctive feature of traditional food processing is the type and quality of raw materials and auxiliary materials which vary widely, and environmental conditions that are difficult to control and depend more on natural factors which also involved treatment that is not measured quantitatively (Candra, 2018). The processing process has not implemented a hygiene sanitation program, so it is necessary to develop traditional processing with several improvement efforts by implementing basic feasibility in food processing.

In carrying out activities, Participants were given methods for implementing basic eligibility which were aimed to improve the quality of food products in ensuring product safety, by carrying out proper processing according to GMP (Good Manufacturing Practices) and sanitary hygiene according to operational procedures (SSOP/Sanitation Standard Operating Procedures). The provision of material and training was expected to provide additional knowledge so that participants were able to meet the predetermined requirements to produce quality products in accordance with consumer demands. Another goal was that partners were expected to be able to develop and to implement supervisory procedures, monitor, and maintain sanitation conditions and practices (Thaheer, 2008). The GMP system also ensures consistency of product quality standards which are used as minimum requirements for an industry to operate (World Health Organization, 2007). In this activity, the training participants were invited to process agricultural products such as root herbs, fish products into crispy baby fish, processing chicken *betutu* and grilled chicken with soft bones. The implementation of post-harvest processing activities for agricultural products can be seen in Figure 5.



Figure 5: Post-harvest processing activities of agricultural products

After the administration of the activities, training participants from partners will be tested for competence in terms of Food Safety and HACCP through the Professional Certification Institute through the National Professional Certification Agency (BNSP), so that they would be ready to be independent or work in the competent food sector. In addition to the five activities carried out by the training participants, assistance was provided regarding entrepreneurship. The participants were encouraged to be able to develop an entrepreneurial spirit to be able to encourage personal commitment to be independent, to achieve something they want, avoid dependence on other people, to be more productive, and to maximize their potential. This is in line with what was said by Setiawan & Suryono (2022) and Tjahjadi (2022).

4. Conclusion

Through the 2022 Matching Fund program, Warmadewa University initiated collaborative activities to support the Agro Learning Center (ALC) program. There were five activities carried out including integrated agricultural training activities, aquaponic activities, super local breed chicken rearing activities and post-harvest processing activities of agricultural products. The engineering provided was an efficient technology resulting from research from professional agricultural experts at Unwar and has been published in various journals. Among them were the development of organic cultivation and diversification using the SNT (System Nutrient Tank) method for exclusive vegetables, super local breed chicken farms in accordance with national standards for poultry (SKKNI in the field of poultry), fisheries with the concept of aquaponics (hydroponic systems and poly culture systems) and post-harvest processing of produce. agriculture, animal husbandry and fisheries, with the concept of food processing supporting local wisdom, all of which were integrated with the zero waste concept. The implementation of activities was carried out in an integrated manner between fishery, agriculture, animal husbandry, processing of agricultural products, fishery and animal husbandry, as well as activities to develop an entrepreneurial spirit.

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