The contribution of integrated farming to fulfill the food consumption of Payung Island community's

Nurmalinda[1,*], and *Chery* Soraya Ammatillah[2]

[1] Research Center for Behavioral and Circular Economics, Nasional Research and Innovation Agency. Jl. Gatot Subroto no. 10, South Jakarta, Indonesia
[2] Jakarta Assesment Institute of Agriculture Technology, Jl. Ragunan 30, Pasar Minggu, South Jakarta, Indonesia

Abstract. The Payung Island's peoples depend on food supplies from outside, so they are very vulnerable to food shortages. One of the efforts to provide food sources for islanders is integrated farming. This study aimed to analyze the contribution of integrated farming to meet the needs of fruit and vegetable consumption of the Payung Island residents. The study was conducted from September 2018 - September 2019 in Payung Island, Thousand Island, by involving 38 respondents. Contribution analysis was used to analyze the contribution of integrated farming to the fulfillment of the Payung Island community's food consumption. The results showed that the current average food consumption of the Payung Island residents was lower than the residents of mainland Jakarta. The contribution of integrated farming to fulfill the vegetable and fruit needs of the Payung Island residents ranged from 47% to more than 100%.

1 Introduction

Payung Island is one of the areas in Tidung Island Village, South Kepulauan Seribu District, Kepulauan Seribu Administrative District. The main characteristic of sandy soil in Payung Island is low holding water and nutrients capacity, leaching occurs before the nutrients are absorbed by the roots, which means it is not good for use as agricultural land. Based on [1] and [2]. The sandy soils have a weak structure, high water infiltration, and poor water retention. [3] said that the quality of soil is directly connected to food quality and quantity. Besides that, the soil is the resource of essential nutrients, water, oxygen, and root sustenance for producing of plants. Because of the limitation of sandy soil in Payung Island, almost all the main food sources such as rice, vegetables and fruits are supplied from the mainland of the island of Java, such as the cities of Jakarta, Tangerang, and Bekasi.

To support the islander efforts to meet the food needs, it is necessary to conduct an agricultural business. Agricultural practices in small islands will have an impact on food security, economic welfare and environmental sustainability [4] and it has the added benefit of promoting economic development for women and employment for young people [5]. In

* Corresponding author: lindaguno@yahoo.com

Solomon island, the role of women in the archipelago is very important in helping the family economic [6]. However, marginal land has various limitations for agricultural use, including sandy land conditions, low soil fertility, limited availability of fresh water, and minimal availability of fertilizers, less of agricultural human resources. [7] was described the limitations of agricultural practices in small islands, including vulnerability to global warming, limited carrying capacity and land area for agriculture, sensitive to natural disasters, isolated and far from main markets, very sensitive to market shocks, distribution chain and marketing are geographically constrained and vulnerable to long-term control, have limited agricultural infrastructure, and limited education and skills of communities. In the Maluku island, the potential of agricultural land was less supportive in equalizing production, so that some farmers turn to the trade sector which causes the contribution of the agricultural sector to regional income decline [8]. The limited agricultural resources in the islands require particular strategies to handle them. The use of technology can be done in order to accomplish an adequate agricultural ecosystem. To deal with all the limitations of existing agricultural resources on Payung Island, an integrated agricultural technology was introduced. Integrated agricultural practices in Payung Island comprise vegetables and fruit crops, as well as goat farming. Besides to improve food self-sufficiently in Payung Island, the goal of integrated agriculture in Payung Island was to become a supplier of fresh food to the surrounding islands in Kepuluan Seribu Administrative District.

Despite the integrated agriculture has been implemented in Payung island, but it was not known how much the contribution of integrated agriculture to the fulfillment of community food consumption, especially vegetables and fruits. Therefore, the aim of this study was analyzing the contribution of integrated agriculture to the fulfillment of fruit and vegetable consumption by the people of Payung Island, Kepulauan Seribu Regency.

2 Research methods

The purpose of this research was to measure the contribution of integrated agriculture to vegetable, fruit crops and goats' production (milk). The production measured was the production for one year. The existing food consumption of the Payung Island community analyzed, apart from vegetables and fruit, as well as other family foods, namely: groups of rice, animal food, milk, oil, and sugar, were calculated in the last one week at the time of the interview. To compare the average food consumption of Payung Island residents either with Jakarta or Indonesia residents, the conversion of food consumption per capita per day per gram was carried out. Meanwhile, to measure the contribution, the existing consumption data was converted into consumption data per year.

The study was conducted within September 2018 - September 2019, in Payung Island, Tidung Island Village, South Kepulauan Seribu District, Kepulauan Seribu Regency, Special Capital Region of Jakarta Special Capital Region of Jakarta Province. The selection research locations was carried out purposively with the consideration that Payung Island was the island in the Kepulauan Seribu Regency which was the first island on integrated farming system implementation.

The collected data were secondary and primary data. Secondary data was obtained from Food Security Agency, the Ministry of Agriculture [18], while primary data was obtained by interview of 38 households in Payung Island. The household in question was a family that lives under the same roof with the same kitchen. Primary data collected in the form of data on household characteristics of the Payung Island community, family income per month, patterns and amounts of existing food consumption of the Payung Island community, as well as production data produced by integrated agricultural businesses.

The existing food consumption data of the Payung Island community was grouped based on food ingredients, namely rice, meat, milk, vegetables, fruit, oil and sugar. Food

consumption data was collected by recalling food consumption the previous week. Integrated agricultural production data was collected according to the type and amount of product produced at harvest, at a time period that was not far from consumption data collection. Data obtained through direct observation and interviewed by using a questionnaire. Consumption data were collected through interviews with all households in Payung Island, while production data collection was carried out through interviews with people who carry out integrated agricultural businesses.

To analyze the contribution of integrated agriculture in Payung Island to the fulfillment of food needs, the following formula was used:

$$X = \frac{s}{d} \quad (1)$$

Where X was the contribution of integrated agricultural production to the fulfillment of food consumption for the Payung Island residents (%), (supply (s) was the total production of each commodity produced (Kg/year) and demand (d) is the total consumption needs of the community for each commodity (Kg/year)

3 Results and discussion

3.1 Integrated farming in Payung Island

The Integrated agriculture is an agricultural system that combines several subsystems in one management with the principle of zero waste. The integrated farming system which implemented in Payung Island combines sequential cropping and intercropping (mixed cropping) cultivation systems. According to [7], integrated agriculture is using mixed cropping methods or polyculture in accordance with the characteristics of the archipelago. Mixed cropping systems provide greater economic benefits than monoculture systems [9,10].

The types of vegetable crops grown on integrated agriculture in Payung Island were kangkong, shallots, eggplant, and tomatoes. While the fruit plants planted were bananas, papayas, watermelons, and cucumbers. Apart from vegetables and fruit, goats are also developed with the aim to produce animal protein for the residents and produce organic fertilizer for plants. Goat livestock with the main products of meat and milk has the potential to be developed in Payung Island.

The limited availability of fertilizers as the main source of plant nutrients is circumvented by the manufacture of organic fertilizers sourced from plant waste. Meanwhile, the limited forage available on Payung Island was managed by utilizing plant remains as animal feed.

3.2 Payung Island community food consumption pattern

Like most Indonesians, the main source of food for the people of Pulau Payung is rice with fish as a main side dish. All types of food except fish are supplied from outside the island. Foods that are vulnerable of scarcity are fruits and vegetables. The vegetables and fruit scarcity in Payung Island affects the frequency and amount of people's consumption of these two types of food. The average frequency of community vegetable consumption is three times a week, while the average frequency of fruit consumption is only once a week (Table 1). The frequency of consumption of these vegetables and fruits will be drastically reduced in bad weather conditions.

Table 1. The average food consumption frequency of Payung Island people in a week.

No.	Type of food	Frequency (times/week)
1.	Rice	7
2.	Vegetables	3
3.	Fruits	1
4.	Red Meat	0.25
5.	Fish	7

Table 2. Food consumption per capita of Payung Island, Special Capital Region of Jakarta and Indonesia (Gram/capita/day).

No.	Type of Food	Payung Island[1)]	Special Capital Region of Jakarta[2)]	Indonesia[3)]
1.	Carbohydrate source			
	a. Rice	254.42	260.00	221.89
	b. Instant noodle	4.96		6.75
2.	Animal source foods			
	a. Fish	259.87	65.90	22.80
	b. Poultry meat	22.93	31.10	17.72
	c. Read meat	6.83	21.10	1.29
	d. Egg	30.78	24.60	17.97
3.	Milk	14.77	17.40	1.03
4.	Vegetables			
	a. Spinach	1.97	12.00	9.39
	b.Kangkong	5.92		11.30
	c. Chinese cabbage	0.53		3.02
	d.Mustard green	1.41		4.09
	e. Cucumber	8.93		5.64
	f. Eggplant	3.29		7.62
	g.Pumpkin	4.46		5.02
	h.Young papaya	1.88		3.11
	i. Shallot	12.73	8.30	7.87
	j. Chili	11.04	13.67	10.32
5.	Fruits			
	a. Orange	9.87		9.45
	b. Apple	4.70		2.65
	c. Rambutan	7.99		15.55
	d. Banana	16.45	19.67	5.83
	e. Snake fruit	3.76		5.74
	f. Duku	1.88		15.59
	g. Papaya	6.71		7.84
6.	Oil			
	a. Palm oil	50.66	23.80	23.80
7.	Sugar			
	a. Sugar	13.39	14.80	19.10

Source:[18]

Archipelagic area also affects the patterns of food consumption based on animal source foods. Fish is much more consumed than other animal source foods. And so in Pacific Island fishing remains a major contributor to food security in PICTs, through subsistence production and income generation [5]. The average frequency of red meat consumption is once a month or 0.25 times a week, while the consumption of milk are very rare. The milk is usually only consumed by children under five years old (Table 1). Red meat is usually obtained from the assistance of the Special Capital Region of Jakarta Government through the Jakarta Smart

Card (JSC) program. Integrated farming is one of ways to encourage islanders to eat more diverse foods. But different with Payung island, especially in Suli village and Liang village (Central Maluku Regency), the main source of food for the people is grain (rice), tubers and animal food [11]. In East Nusa tenggara, rice and maize are main food in the first seasons harvest (January-Ápril) and cassava become a main food in the second (May-August) and third seasons (September-December) [12].

The food consumption per capita of Payung Island residents was described in Table 2. The results of the analysis showed that the existing average food consumption of Payung Island residents was lower than the average food consumption of Special Capital Region of Jakarta residents except fish, eggs, shallots, and oil. However, when compared to the average food consumption of the Indonesian population, the food consumption of Payung Island residents was higher, except for the vegetable consumption. Food type's consumption per capita can be used as a basis for determining the food adequacy of a society but can also be used as a basis for selecting commodities in carrying out agricultural business. The table 2 showed that the most commonly consumed vegetable was shallot, while the frequently consumed fruit was banana. Therefore, kangkong and banana were potential to develop in the integrated farming system in Payung Island.

It can be seen in the Table 2 that rice was still a staple food source for the people of Payung Island. To ensure food self-sufficiency, islanders need to pay attention to local wisdom. Breadfruit plants that were widely available on the island can be considered as a food substitution. Utilizing local food sources was one solution to ensure the availability of food for the community in small islands. In Selaru island community, to ensure family food security, there is important values inherited as local wisdom through planting certain commodities and utilize marine resources in a suitable way [13]. At Binongko Island, to ensure communities food security in a sustainable system have done through a system of agriculture production, distribution and comsumtion of food [14] Preservation of existing genetic resources and revitalization of agricultural activities will increase food security in small islands [15].

3.3 The Contribution of Integrated Agriculture to the Fulfillment of Vegetable and Fruit Needs for the Payung Island Communities and tables

The results showed that integrated farming had contributed to the fulfillment of food needs; almost all of the commodities planted have highly contributed to the food needs of the people of Payung Island. In Pacific Island, the farmers planted different crops both for food and for sale and They had growed local foods to support food security and expanding domestic asset creation to promote economic development [6]. In Payung island, kangkong gave the largest contribution to vegetable crops which reach to 564.90%. The fruit commodity that has the largest contribution was papaya fruit which includes young and ripe papaya, which is equal to 671.87% and the contribution of banana was reached 67.51%. The goats gave contribution as much as 219.71% for milk and was estimated contribute as much as 71.22% for meat (Table 3).

The extra production of some commodities was sold outside the Payung Island. The target market was the islands nearby Payung Island, such as Tidung Island and Pramuka Island. Sales of products outside the island had contributed to enhance the additional income of the Payung Island community. The implementation of integrated agriculture has a significant impact on farm household incomes [16].

Integrated agricultural cultivation utilizes all available resources, which lead to self-sufficiency farming and purposed to create food self-sufficiency for the Payung Island communities. Neo-traditional approaches to agriculture were the key strategies to reached food security of island communities through soil conservation, promoted local food crops,

organic farming, and developed synergies between agriculture and the burgeoned tourism sector [17].

Table 3. Contribution of integrated agriculture to the fulfillment of food consumption of the people of Payung Island

No.	Type of Food	Consumption per year (Kg)	Production per Year (Kg)	Contribution (%)
1.	Kangkong	328.55	1,856.00	564.90
2.	Eggplant	182.50	753.00	412.60
3.	Shallot	706.54	693.00	98.08
4.	Tomato	148.61	70.00	47.10
5.	Papaya	476.29	3,200.00	671.87
6.	Watermelon	190.00	234.00	123.16
7.	Suri cucumber (*Cucumis sativus*)	114.00	286.00	250.88
8	Banana	912.50	616.00	67.51
9.	Red meat	379.12	270.00	71.22
10.	Milk	819.27 l	1,800.00	219.71

4 Conclusion

From the research results, it could be concluded that almost all commodities cultivated through integrated agriculture had contributed to the food consumption of the Payung Island community. Commodities that contributed more than 100 percent were kangkong, eggplant, watermelon, papaya and *suri* cucumber (Cucumis sativus) from vegetables and milk from goats, while commodities that contributed less than 100 percent were shallot and tomatoes. Extra production that was not consumed within the island was sold outside the Payung Island.

The efforts of the Payung Island community to meet their food needs independently through integrated agriculture need the support of all parties. The cooperation between the Ministry of Agriculture and the Regional Government of Kepulauan Seribu Regency in particular and the Provincial Government were essential. In general, local government of Jakarta was needed to support the agricultural sustainability in Payung Island. The developing of integrated agricultural business is required internal synergies in the agricultural sector, external synergies with other sectors such as tourism, environment and education. Good synergy of integrated agriculture will combine the production, recreation, and education in one area.

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