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Coffee Supply Chain Management: A Case Study In Ciamis, West Java, Indonesia

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ABSTRACT

Ciamis Regency is a potentially developed coffee-producing area in West Java with Arabica and Robusta coffee types. However, in the current marketing process, it is still faced with various obstacles that make the supply chain flow non-optimal. Therefore, in optimizing the Ciamis coffee supply chain management, it is necessary to conduct further research related to supply chain flow, performance, and farmer's share. This study aims to determine the flow, performance, and farmer's share of the coffee supply chain in Ciamis Regency. This research uses the descriptive, SCOR, and farmer's share methods. The results showed that the supply chain flow consisted of material flow in the form of green beans that flowed from upstream to downstream, the flow of information in the form of information (quantity, price, and quality of green beans) that flowed from upstream to downstream and from downstream to upstream, and financial flows in the form of cash payment transactions that flow from downstream to upstream. The performance of coffee supply chain management in Ciamis Regency has an average category with a value of 56.91. The most significant farmer's share value is found in the distribution channel from farmers to inter-regency traders, ending with outside-regency traders.

Keywords: coffee; farmer's share; SCOR; supply chain flow; supply chain performance

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1. Introduction

Coffee is one of the plantation products with high economic value and is one of the mainstay export commodities. Indonesia is one of the largest coffee producers globally and is included in the top 5 coffee producers in the world (FAO, 2015; USDA, 2022; Purnomo et al., 2019; Purnomo et al., 2021). This is supported by the coffee growing area in Indonesia which reaches 1.26 million ha.

The most problem of sustaining coffee production is an unequal in supply chain management that laid farmers as not benefited parties (Purnomo, 2018; Purnomo et al., 2019; Guido eta al., 2020). Coffee grown in Indonesia is spread over several areas. To asses such problem, we use one of the coffee-producing areas in

Indonesia is Ciamis Regency, West Java. Coffee production in Ciamis reaches 725.61 tons with a coffee plant area of 1,851.61 ha in robusta and 290.30 ha in arabica (Ciamis Regency Agriculture and Food Security Office, 2018).

This production potential began to be widely developed with the number of coffee shops starting and the marketing of Ciamis-speciality coffee products. However, in the current marketing process, it is still faced with various obstacles such as non-optimal supply chain flow. For example, the unutilized information on the quality and specifications of coffee is expected by buyers, so the distributed coffee beans are often not in line with consumer expectations. In addition, most of the coffee beans are distributed to the outside Regency and not utilized by local roasters which have been widely spread in Ciamis Regency.

A study conducted by Mauladi et al. (2022), the coffee beans produced by farmers are frequently conventionally marketed which flows

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to collectors outside the city with modest quality, so they get a low price. In line with what was stated by Umaran et al. (2022), the complexity of coffee supply chain flow could reduce farmer profits. But the other hand cutting the supply chain can create new problems. Therefore, it is necessary to carry out further supply chain analysis to find out the causes of the non-optimization of the existing supply chain.

The non-optimal flow of the supply chain can affect the performance of the supply chain and can reduce the actors potential profit, especially for coffee farmers who are the most important actors who provide raw coffee beans. Therefore, in optimizing the Ciamis coffee supply chain management, it is necessary to conduct further research related to supply chain flow, performance, and farmer's share.

2.   Theoreticalcal Underpinning

Based on the research of Mauladi et al. (2022), The local coffee beans in Ciamis Regency were marketed conventionally. Green beans that are produced by farmers are sold as simply as possible to collectors and then resold to industrial consumers and exporters. Apart from conventional marketing methods, the quality of green beans produced by farmers is often not considered, so farmers as coffee producers only get a small profit from the coffee bean trade.

Based on data from Ciamis Regency Agriculture and Food Security Office (2022), Ciamis Regency has more than 60 coffee shops spread across various locations. This should be used by local farmers to increase profits. This is in line with the research of Borrella et al. (2015) which states that direct trade cooperation between farmers and roasters can benefit both parties. Farmers get higher prices than before, and roasters get a supply of quality coffee beans with a relatively closer. According to Neilson et al. (2018), the development of coffee shops provides opportunities for coffee farmers to become coffee supply agents and develop the coffee supply chain back to developing rural communities as local coffee producers. So, this research was conducted to find out how the local coffee supply chain in Ciamis Regency can be appropriately utilized by each actor, especially farmers.

Yunita et al. (2019) state that in the coffee supply chain, there are coffee beans, financial, and information flows that flowing from farmers to consumers. The flow of coffee beans consists of various coffee distribution schemes according to

the agreement between actors. Financial flows relate to supply chain costs that match the coffee distribution scheme. Meanwhile, the flow of information is a stream that needs to be paid more attention to by farmers because it relates to information on coffee specifications desired by consumers as well as market price information. It is also necessary to find out how the performance of the coffee supply chain in Ciamis Regency is.

Prasetya et al. (2017) stated that in measuring the performance of the coffee supply chain, several attributes can be measured, namely reliability, responsiveness, cost, agility, and asset management. In addition, Yunita et al. (2019) state that a proportional profit margin for farmers can also be used as a reference to whether the existing performance provides benefits for farmers or not. In the study, it was found that the shortest distribution channel provides better supply chain performance and provides a greater farmer's share value than the longest distribution channel. In line with what was conveyed by Borrella et al. (2015), the simpler local coffee bean marketing distribution channels can provide benefits for both parties who transact.

3.   Research Methods

This research was conducted from January 2021 – February 2021. The research location was carried out in Rajadesa District, Ciamis Regency. The location was chosen purposively by considering its potential as a center for coffee producers in Ciamis Regency with a production yield of 98.66 tons/year, the largest planted area in Ciamis Regency (384.40 ha), and as a district with the majority of coffee farmers (Ciamis Regency Agriculture and Food Security Office, 2018).

3.1.   Sampling Method

The sample consists of 30 members of active farmer groups, selected by the stratified proportional sampling method. The following sample is a sample of collectors and inter-regency traders determined by the snowball sampling method, by following the flow of coffee from the producer point (coffee farmer) to the final coffee trader in Ciamis Regency.

3.2.   Data Analysis Method

In this study, the data obtained were analyzed by analyzing the supply chain flow descriptively, supply chain performance analysis using the SCOR method, and supply chain efficiency analysis using the farmer's shares analysis.

3.2.1. Supply Chain Flow Analysis

Supply chain flow is analyzed using a descriptive method by analyzing the flow of coffee beans delivery from farmers to final traders as the final flow. The analyzed supply chain flow consists of coffee bean flow (quantity), information flow, and financial flow.

3.2.2. Supply Chain Performance Analysis

Supply chain performance was analyzed using the Supply Chain Operations Reference (SCOR) method. This method carves performance by providing an assessment and weighting of each supply chain performance attribute including the attributes of reliability, responsiveness, agility, cost, and asset management (SCC, 2012). Performance measurement is carried out using a level matrix consisting of 2 levels. Matrix level 1 contains an assessment of the final performance results. The level 2 matrix presents the initial calculation of indicators on each performance attribute (Paul, 2014). The range of weighting and initial assessment of the supply chain can be seen in Table 1. and Table 2.

Table 1. Range of Weights of Ciamis Coffee Supply Chain Performance.

Level of Importance Weight	Description
0.81 – 1.0	Very Important
0.61 – 0.8	Important
0.41 – 0.6	Neutral
0.21 – 0.4	Unimportant
0.2	Very Unimportant

Table 2. Range of Initial Assessment of Ciamis Coffee Supply Chain Performance.

Score	Description
81 – 100	Very Good
61 – 80	Good
41 – 60	Adequate
21 – 40	Bad
20	Very Bad

Weights and ratings are given by each supply chain actor based on a Likert scale with five levels. After obtaining the initial weights and assessments on the level 2 matrix, the final assessment is given to the level 1 matrix. The final performance assessment is divided into five categories based on the values obtained, namely poor (<40), marginal (40 - <50), average (50 - <70), good (70 - <90), and excellent (90) (Trienekens & Hvolby, 2000). This category describes the coffee supply chain performance in Ciamis Regency.

3.2.3. Farmer's share

Farmer share is used to determine supply chain efficiency by looking at the percentage of the comparison of prices received by farmers compared to prices for the last actor. Farmer's share is calculated using the following formula:

$$FS = \frac{\text{Price at farm (Rp/Kg)}}{\text{Final price at the final seller (Rp/Kg)}} \times 100\%$$

4. Results and discussion

4.1. Coffee Supply Chain Flow
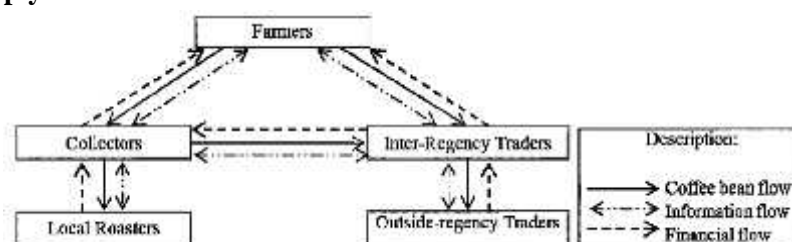
Figure 1. Coffee Supply Chain Flow Scheme in Ciamis Regency.

Based on Figure 1., the flow of the coffee supply chain in Ciamis Regency consists of the flow of coffee beans (green beans) from robusta coffee, the flow of information in the form of price, quality, and quantity information produced by the supply chain actors, and financial flows in the form of cash payment transactions. The three types of supply chain flows are divided into three distribution schemes, namely:

a. Farmers   Collectors   Local Roasters
b. Farmers   Collectors   Inter-regency Traders   Outside-regency Traders
c. Farmers   Inter-regency Traders   Outside-regency Traders

The main coffee supply chain flows through three business groups, namely producers (Farmers), distributors (Collectors, Inter-regency Traders, and Outside-regency Traders), and

downstream industries (Local Roasters). The flow consisted of the flow of coffee beans, specification, and payment transactions (Hakim et al., 2020).

4.1.1. Coffee Bean Flow (Green Bean)

Some farmers choose to sell their coffee beans to collectors, because the location of the collectors is closer to where the farmers live. Besides that, the farmers get various other conveniences such as collectors who come directly to farmers so that farmers do not have to pay the transportation cost. The various advantages provided by collectors are often more considered than the higher prices from other buyers. However, this sales pattern can also threaten farmers because of the lack of incentives or the share of the price that farmers receive (Gelaw et al., 2016). While some other farmers, sell coffee beans directly to inter-regency traders because the location of where the farmers live is close to inter-regency traders, and there are no collectors in areas close to the farmers live. The flow description can be seen in Table 3.

Table 3. Green Bean Flow in Ciamis Coffee Supply Chain.

No.	Location	Green Bean Flow			
1.	Rajadesa Village	Farmers	Inter-regency Traders	Outside-regency Traders	
2.	Andapraja Village	Farmers	Collectors	Inter-regency Traders	Outside-regency Traders
		Farmers	Inter-regency Traders	Outside-regency Traders	
3.	PurwarajaVillage	Farmers	Inter-regency Traders	Outside-regency Traders	
4.	TigaherangVillage	Farmers	Collectors	Inter-regency Traders	Outside-regency Traders
		Farmers	Collectors	Local Roasters	
5.	SukajayaVillage	Farmers	Collectors	Inter-regency Traders	Outside-regency Traders
6.	SukaharjaVillage	Farmers	Collectors	Inter-regency Traders	Outside-regency Traders

4.1.2. Information Flow

The flow of information consists of information on the quantity of available green beans and information on the price and quality of coffee beans expected. Green bean quantity information is related to how many green beans are sold by one actor to the next tier actors. The price information is obtained by asking directly to the next-tier actors. Besides that, price information is also obtained by farmers from other farmers who have previously transacted coffee buying and selling. Pricing per kilogram of green beans was carried out by following market prices and measuring the quality of green beans. Quality information relates to the moisture content and cleanliness expected by the buyer. All actors, especially farmers, should be able to follow information related to coffee beans' moisture content and cleanliness. Because the inability of actors to take advantage of this information can make buyers switch to other sellers (Hakim et al., 2020). The description of the flow of information along with the directions can be seen in Table 4.

Table 4. Information flow of the Ciamis Coffee Supply Chain.

Location	Actors and Types of Information Flow
1 Rajadesa Village	Farmers(green beans quantity) Inter-regency Traders(green beans quantity) Outside-regency Traders
	Farmers (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders
2 Andapraja Village	Farmers (green beans quantity) Collectors (green beans quantity) Inter-regency Traders (green beans quantity) Outside-regency Traders
	Farmers (price and expected quality) Collectors (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders
	Farmers (green beans quantity) Inter-regency Traders (green beans quantity) Outside-regency Traders
	Farmers (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders
3 Purwaraja Village	Farmers (green beans quantity) Inter-regency Traders (green beans quantity) Outside-regency Traders

Location	Actors and Types of Information Flow
	Farmers (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders
4 Tigaherang Village	Farmers (green beans quantity) Collectors (green beans quantity) Inter-regency Traders (green beans quantity) Outside-regency Traders Farmers (price and expected quality) Collectors (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders
	Farmers (green beans quantity) Collectors (green beans quantity) Local Roasters Farmers (price and expected quality) Collectors (price and expected quality) Local Roasters
5 Sukajaya Village	Farmers (green beans quantity) Collectors (green beans quantity) Inter-regency Traders (green beans quantity) Outside-regency Traders Farmers (price and expected quality) Collectors (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders
6 Sukaharja Village	Farmers (green beans quantity) Collectors (green beans quantity) Inter-regency Traders (green beans quantity) Outside-regency Traders Farmers (price and expected quality) Collectors (price and expected quality) Inter-regency Traders (price and expected quality) Outside-regency Traders

4.1.3. Financial Flow

Financial flow is the flow of financial transactions that flows from downstream to upstream. All green bean sales transactions between all supply chain actors are carried out in cash, so there is no delayed product payment process. Coffee sellers, especially farmers, want payments as soon as possible to get clear payment certainty. Because farmers are used to the ijon (not fully formed fruit trading) trading system which causes a lot of losses, so they don't want any more losses in the sale and purchase of coffee (Magfirahti et al., 2021). The description of financial flows can be seen in Table 5.

Table 5. Financial Flows in the Ciamis Coffee Supply Chain.

Location	Actors and Types of Financial Flow
1 Rajadesa Village	Farmers (cash payment according to the quantity and quality received) Inter-regency Traders (cash payment according to the quantity and quality received) Outside-regency Traders
2 Andapraja Village	Farmers (cash payment according to the quantity and quality received) Collectors (cash payment according to the quantity and quality received) Inter-regency Traders (cash payment according to the quantity and quality received) Outside-regency Traders Farmers (cash payment according to the quantity and quality received) Inter-regency Traders (cash payment according to the quantity and quality received) Outside-regency Traders
3 Purwaraja Village	Farmers (cash payment according to the quantity and quality received) Inter-regency Traders (cash payment according to the quantity and quality received) Outside-regency Traders
4 Tigaherang Village	Farmers (cash payment according to the quantity and quality received) Collectors (cash payment according to the quantity and quality received) Inter-regency Traders (cash payment according to the quantity and quality received) Outside-regency Traders Farmers (cash payment according to the quantity and quality received) Collectors (cash payment according to the quantity and quality received) Local Roasters
5 Sukajaya Village	Farmers (cash payment according to the quantity and quality received) Collectors (cash payment according to the quantity and quality received) Inter-regency Traders (cash payment according to the quantity and quality received) Outside-regency Traders
6 Sukaharja Village	Farmers (cash payment according to the quantity and quality received) Collectors (cash payment according to the quantity and quality received) Inter-regency Traders

Location	Actors and Types of Financial Flow
	(cash payment according to the quantity and quality received) Outside-regency Traders

4.2. Coffee Supply Chain Performance

4.2.1. Supply Chain Reliability

The reliability performance of the coffee supply chain in Ciamis Regency has an average category with a value of 68.03. This value has an average category because it is in the 50-70 value range. Respondents gave a very important weight (0.81 - 1.0) on the attributes of the percentage of orders sent without complaint, perfect condition, and accuracy of documentation because all supply chain actors are trying to make the green beans sold can be priced at market prices without any discount. Meanwhile, the delivery time performance attribute is given a neutral weight

(0.41 – 0.6) because in the coffee supply chain in Ciamis Regency, all supply chain actors are not given a target time or demand for green bean delivery time. In line with what was stated by (Groth, 2013), the more important thing in assessing coffee reliability is the quality and origin of the coffee beans. However, Thiruchelvam et al. (2018) stated that the time aspect in the supply chain is also significant because it relates to the efficiency and effectiveness of product delivery. The imperfect time aspect indicates that there is non-optimal supply chain management. The results of the coffee supply chain reliability performance analysis in the Ciamis Regency can be seen in Table 6.

Table 6. Calculation of Supply Chain Reliability Performance of Ciamis Coffee Supply Chain.

Matrix Level 2	Initial value	Matrix Level 2 Value	Matrix Level 1	Matrix Level 1 Value
% Orders Sent Without Complaints (**0.85**)	87.14	74.59	Perfect order fulfillment	68.03 (Average)
Perfect condition (**0.89**)	81.57	72.89		
Delivery time performance (**0.56**)	81.29	45.80		
Documentation Accuracy (**0.88**)	89.71	78.82		

4.2.2. Supply Chain Responsiveness

The order fulfillment cycle time for coffee commodities in Ciamis Regency reaches 23.06 days. There are 12 farmers (40% of all farmers), three collectors (75% of all collectors), and one inter-regency trader (100% of all inter-regency traders) who fulfill the cycle time performance of coffee order fulfillment in Ciamis Regency. So the percentage of actors who can reach the cycle time of fulfilling coffee orders in Ciamis Regency is 72% (good).

Source cycle time, especially for farmer actors, is an aspect that needs to be considered in supply chain management, because it is the aspect that requires the most time. This aspect relates to the process of harvesting and post-harvesting coffee. The more optimal the production process can optimize the order fulfillment cycle time (Gomez et al., 2020). Details of Order Fulfilment Cycle Time of Coffee Supply Chain in Ciamis Regency can be seen in Table 7.

Table 7. Order Fulfilment Cycle Time of Coffee Supply Chain Actors.

Supply Chain Actors	Source Cycle Time (hour)	Make Cycle Time (hour)	Delivery Cycle Time (hour)	Order Fulfilment Cycle Time (hour)	(day)
1 Farmers	500	2	0.63	502.63	20.94
2 Collectors	8.75	2	2	12.75	0.53
3 Inter-regency Traders	10	4	24	38.00	1.58
Total				553.38	23.06

4.2.3. Supply Chain Cost

The coffee supply chain cost performance in Ciamis Regency has a good category with a value of 75.25. Inter-regency traders are actors who have the highest supply chain costs because

of the significant financial capital owned by inter-regency traders. Meanwhile, farmers, who are the most important actors in the coffee supply chain, have the lowest supply chain cost-performance value because on average they have low financial

capital, so financing performance is not optimal. As was the case in the study of Nguyen et al. (2021), farmers are actors who require the highest costs in the procurement of raw materials and storage. Meanwhile, with various limitations, farmers are unable to meet the costs of doubling raw materials and optimal storage. In line with what was stated by Arifin (2013), Most farmers have limited financial capital so the cultivation and post-harvest processes are carried out at a minimum without any effort to improve the quality of their products. The coffee supply chain cost performance analysis in the Ciamis Regency can be seen in Table 8.

Table 8. Calculation of Supply Chain Cost Performance of the Ciamis Coffee Supply Chain.

Matrix Level 2	Initial value	Matrix Level 2 Value	Matrix Level 1	Matrix Level 1 Value
Farmers Supply Chain Cost (**0.86**)	83.70	72.16	Total Supply Chain Cost	75.25 (Good)
Collectors Supply Chain Cost (**0.88**)	85.83	75.82		
Inter-regency Traders Supply Chain Cost (**0.83**)	93.33	77.78		

4.2.4. Supply Chain Agility

The performance of the coffee supply chain agility in Ciamis Regency has a poor category with a value of 38.68. This value means that supply chain actors do not have good readiness to face dynamic market changes. Whereas every actor in the coffee supply chain must be prepared to face ever-evolving consumer demand (Hakim et al., 2020). Some supply chain actors already have the readiness to manage their resources when there is an unplanned change in consumer demand, such as the availability of sufficient green bean storage space when there is a planned return or demand. However, some other supply chain actors, especially farmers, do not carry out storing raw material stocks. Coffee farmers generally do not have coffee storage, because they have financial limitations in procuring an ideal coffee bean storage space (Nguyen et al., 2021). Whereas the existence of an optimal storage process can increase the effectiveness of the coffee supply chain (Palomino et al., 2017). The result of the coffee supply chain agility performance analysis in the Ciamis Regency can be seen in Table 9.

Table 9. Calculation of Supply Chain Agility Performance of the Ciamis Coffee Supply Chain.

Matrix Level 2	Initial Value	Matrix Level 2 Value	Matrix Level 1	Matrix Level 1 Value
Flexibility to procurement enhancement (**0.54**)	78.29	42.94	40.67	38.68 (poor)
Flexibility to production enhancement (**0.5**)	78	39		
Flexibility to delivery enhancement (**0.57**)	67	39.61		
Flexibility to consumer return enhancement (**0.51**)	71.94	37.34		
Adaptability to procurement enhancement (**0.51**)	76.71	39.19	38.11	
Adaptability to production enhancement (**0.5**)	78	39		
Adaptability to delivery enhancement (**0.54**)	65.86	36.33		
Adaptability to consumer return enhancement (**0.51**)	70.86	36.69		
Adaptability to decreased capacity (**0.53**)	69.86	37.26	37.26	

4.2.5. Supply Chain Asset Management

The performance of the coffee supply chain in Ciamis Regency has a poor category with a value of 30.59. This value indicates that the management of the coffee supply chain assets in the Ciamis Regency is still not efficient. This is because the products sold through inter-regency traders are priced cheaper at Rp. 19,000/kg compared to selling directly to small-medium industries (IKM) in the downstream sector in Ciamis Regency which is valued at Rp. 30,000/kg. Meanwhile, the investment or working capital and the value of the coffee supply chain assets are quite large, so a better quality product is needed to make the rate of the asset more efficient. In improving product quality, in addition to making improvements to the harvest and post-harvest processes, can be done by rejuvenating coffee plants also (Pineda et al., 2019; Rueda & Lambin, 2013). In addition, Othuon et al. (2021) in their research stated that the value of return on assets can also be increased by rejuvenating the equipment used. The coffee supply chain asset management analysis in the Ciamis Regency can be seen in Table 10.

Table 10. Calculation of Supply Chain Asset Management Performance of Ciamis Coffee Supply Chain.

Matrix Level 2	Initial value	Matrix Level 2 Value	Matrix Level 1	Matrix Level 1 Value
Farmer's cash-to-cash cycle time	52.20	Cash-to-cash cycle time	57.10	30.59 (Poor)
Collectors' cash-to-cash cycle time	59.04			
Inter-regency traders' cash-to-cash cycle time	60.06			
Farmers' rate of return on assets	10.43	Rate of return on fixed assets	4.07	
Collectors' rate of return on assets	1.52			
Inter-regency traders' rate of return on assets	0.26			

Based on the analysis of the supply chain performance attributes of the supply chain (reliability, supply chain responsiveness, supply chain cost, supply chain agility, and supply chain asset management) the average value of the coffee supply chain performance in Ciamis Regency is 56.91 in the average category. The performance of the coffee supply chain in Ciamis Regency still needs to be improved, especially regarding readiness to face dynamic market changes and inefficient asset management (Hakim et al., 2020). Green bean inventory management and the availability of green bean storage warehouse facilities and infrastructure need to be owned by all actors, especially farmers. Good coffee bean storage management can provide benefits, especially during the harvest season, when coffee beans are abundant and need a lot of storage space (Georgise & Mindaye, 2020).

4.3. Coffee Farmer's Share

Table 11. The Value of Coffee Farmer's Share Comparison.

Supply Chain Distribution Line / Supply Chain actors	Line 1 Farmers – Collectors – Local roasters	Line 2 Farmers – Collectors – Inter-regency traders – Outside-regency traders	Line 3 Farmers – Inter-regency traders – Outside-regency traders
Farmers			
Selling price /kg	Rp17,100.00	Rp17,100.00	Rp19,000.00
Cost /kg (fertilization, care, harvesting, post-harvest, transportation)	Rp3,316.26	Rp3,316.26	Rp3,316.26
Profit /kg	Rp13,783.74	Rp13,783.74	Rp15,683.74
Collectors			
Selling price /kg	Rp30,000.00	Rp19,000.00	
Cost /kg (purchase of green beans, storage, packaging, transportation)	Rp18,194.17	Rp18,194.17	
Profit /kg	Rp11,805.83	Rp805.83	
Inter-regency traders			
Selling price /kg		Rp25,000.00	Rp25,000.00
Cost /kg (purchase of green beans, storage, packaging, transportation)		Rp23,861.26	Rp23,861.26
Profit /kg		Rp1,138.74	Rp1,138.74
Farmer's share	57%	68%	76%

Based on Table 11. it can be seen that the highest value of Farmer's share is in the third line with a 76% value. The existence of collector actors makes the farmer's share lower with a value of 68% due to longer distribution channels (Justiceawan et al., 2020). The result is not the same as the first distribution channel, the value of the Farmer's share is the lowest because the enormous profits from the final value in the first line are only felt by the collector actors and not felt by the farmers. Thus, although the first line is classified as a short distribution channel, the farmer's share is the lowest because the share

received by farmer actors is lower than the price received by collector actors.

The collectors in the first channel perform a more ideal post-harvest process than the collectors in the second channel. This collector can process coffee beans following the wishes of local roasters. As is the case in the research of Jaya et al. (2020), the highest profit is obtained by actors who can process coffee beans according to what consumers want.

The collector on the second channel only performs simple green beans post-harvest drying process. The process of buying and selling green beans on the second and third channels was accepted entirely or there are no green beans returned. Determination of the quality standard of green bean water content in the second and third channels only determines the final price of green beans and does not determine whether or not green beans pass in coffee trading. In contrast to the first channel, local roasters who are buyers from collectors determine the quality standard of water content as a standard for passing green beans that are traded. Therefore, the post-harvest collector process in the first channel is carried out more seriously, such as green beans that are traded and must be 100% clean and have a moisture content of 12-13%.

The main problem with the first distribution line is the imperfect flow of information related to market demand because farmers do not have direct access to information on market demand (Yunita et al., 2019). Whereas the standard information on the level of cleanliness and water content quality from local roasters should be able to be used by farmers in determining the harvest and post-harvest processes. Farmers are expected to be able to sell green beans directly to local roasters according to the specifications desired by local roasters so that farmer's shares can increase. It is essential to build a coffee supply chain information system so that the flow of information can flow more effectively.

5. Conclusions

The flow of the coffee supply chain in Ciamis Regency consists of the flow of material in the form of green beans that flow from upstream to downstream, the flow of information in the form of quantity that flows from upstream to downstream, and in the form of price and expected quality that flowing from downstream to upstream, and the flow of financial in the form of cash payment transactions that flowing from downstream to upstream.

The performance of the coffee supply chain in Ciamis Regency still needs to be improved, especially regarding readiness to face dynamic market changes and inefficient asset management. Green bean inventory management and the availability of green bean storage warehouse facilities and infrastructure need to be owned by all actors, especially farmers.

The highest farmer's share value in the coffee supply chain in Ciamis Regency is not found in the shortest distribution line. Because the benefits of the high final price are only felt by the collectors, not the farmers.

In the end, optimal supply chain management is not only determined by the length of the flow, but also by the effectiveness and efficiency of utilizing information from each of the existing actors. In line with what was stated by Borrella et al. (2015), Coffee producers must be able to take advantage of existing information to be taken into consideration in producing coffee beans that are following consumer desires. Umaran et al. (2022) in their research also explain that cutting supply chain channels cannot be a solution because it can lead to new and more complicated problems.

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Energy Adequacy Rate and Desirable Dietary Pattern of Horticultural Farmer Household in Probolinggo Regency during COVID-19 Pandemic

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ABSTRACT

Household food security is an important concern for the government because it can describe food security in the smallest unit, namely household consumption. One of the government's policies regarding food security on the side of food absorption is through the Law of the Republic of Indonesia Number 18 of 2012 namely the fulfillment of diverse, nutritious, balanced, and safe food consumption patterns. The research objectives are (1) To analyze the food security of horticultural farmers' households in terms of the Energy Adequacy Rate (EAR) in Probolinggo Regency, (2) To analyze the food security of horticultural farmers' households as seen from the Desirable Dietary Pattern (DDP) in Probolinggo Regency, and (3) To analyze the factors that influence the Desirable Dietary Pattern (DDP) in Probolinggo Regency. The results showed that food security in terms of quantity and quality still did not meet the recommendations. The actual EAR of horticultural farmers in Probolinggo Regency is 1867.76 kcal/capita/day, which is still below the normative or recommended EAR of 2,100 kcal/capita/day. The actual DDP score is 74.15 which states that the actual DDP is still below the normative DDP of 100. Two parameters have a significant effect on the dependent variable, namely farm income (X1) and dummy nutrition knowledge of housewives (DX2), while dummy education head of household (X3) has no significant effect.

Keywords: farmer household food security; Energy Adequacy Rate (EAR); Desirable Dietary Pattern (DDP)

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1. Introduction

Food security from the consumption pillar is reflected in the ability of every citizen to consume sufficient food in nutritional quantity and quality, safe, diverse, and affordable (Christiansen, 2020; Amarita, 2022). So it is important to meet food security in the household so that energy needs for the diversity of food consumption are fulfilled.

Food diversification is intended not to completely replace rice, but to change and improve people's consumption patterns so that there are more diverse types of food with better nutritional quality (Umanailo, 2018). Therefore, to achieve food diversification, it can be done by improving the food consumption patterns of farmers' households.

Nutritious and varied foods help people to maintain their immune systems to stay healthy. Diets with low diversity can increase the risk of malnutrition, especially in vulnerable populations such as children, the elderly, and women (Nachvak et al., 2017). Although the intake is diverse, the variety of foods in the food groups does not vary in terms of nutritional needs in the body and only focuses on delicious foods that are cheaper and affordable (Bidari, 2012). An important thing that often happens in Indonesia is that there are many ready-to-eat foods that people are interested in but are not good for the body. If it is added to the current COVID-19 condition, the consumption of fruits and vegetables should be of more concern to be intensified.

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Household food security during the COVID-19 pandemic needs to be studied so that it can provide input to the government on the importance of nutrition for the Indonesian people today. The COVID-19 pandemic has become a major topic in all aspects of life, especially in community activities, especially economic activities throughout the country. Related research can be done through a survey of the other household food consumption of farmers.

A food consumption survey is needed to see the consumption of various types of food that reflects the quality of food consumption. The quality of food consumption is obtained from the calculation of the Energy Adequacy Rate (kcal/capita/day) to produce an Expected Food Pattern score. The energy consumption figure affects the decrease in the percentage of EAR, up to the food pattern score of the Probolinggo Regency. Probolinggo Regency's EAR is 2190 kcal/capita/day while the Probolinggo Regency's DDP (Dietary Diversity Pattern) Score from 2018 to 2020 has increased by 81.9 in 2018 and 84.5 in 2020 (Dinas Ketahanan Pangan dan Pertanian Probolinggo, 2021). Currently, Probolinggo Regency has an EAR score that has exceeded the recommended limit of 2,100 kcal/cap/day, while the DDP score has not yet reached the normative value of 100.

The main determinants of food diversity include household food production, knowledge, and awareness of agriculture and nutrition, access and use of information, household income, and time (Pasaribu et al., 2021). In addition, the supporting factor so that the nutrition obtained in a household is fulfilled, namely the knowledge of the head of the family, especially housewives. If the knowledge of housewives is low about the nutritional needs of family members who come from prepared food ingredients, then nutrition will not be fulfilled in the family.

During the COVID-19 pandemic, people are expected to increase their consumption of fruits and vegetables which can increase the income of horticultural farmers in the Probolinggo Regency. Therefore, this study aims to: (1) analyze the food security of horticultural farmers' households in terms of the Energy Adequacy Rate (EAR) in Probolinggo Regency, (2) analyze the food security of horticultural farmers' households as seen from the Dietary Diversity Pattern (DDP) in the Regency of Probolinggo, (3) Analyzing the factors that influence the Expected Food Pattern (DDP) in Probolinggo Regency.

Public awareness about food diversity still tends to be low, as seen by the high stunting rate in Probolinggo Regency, which is 54.75% in 2020 according to the 2021 FSVA (Food Security and Vulnerability Atlas), therefore, this study was conducted to see the condition of food security from in terms of quantity and quality as well as looking at the socio-economic factors that influence the Hope Food Pattern on Horticultural farmers in Probolinggo Regency. So that it can provide input to the government and the community in realizing food security.

2. Theoretical Underpinning

Pandemics, according to the Big Indonesian Dictionary (KBBI), are epidemics that occur simultaneously in large areas of geography. This pandemic has an impact not only on health, but on the socio-economic sector, especially on the provision of basic community needs in the form of food supply (Pasaribu et al., 2021).

The availability, access, and absorption of food are sub-systems that must be fulfilled as a whole, if one of these subsystems is not met so a country cannot be said to have good food security (Hanani, 2012). Although food is sufficiently available at the national and regional levels, if individual access to meet their food needs is uneven, then food security is still said to be fragile (Hanani, 2012). Some experts agree that food security contains at least two basic elements, namely "food availability" and "community accessibility" to these foodstuffs. One of the above elements is not fulfilled, so a country cannot be said to have good food security (Utami et al., 2019).

Research conducted by (Syakirotin et al., 2021), aims to see the differences in Food Security Before and During the Covid-19 Pandemic which found results that during the Pandemic there was a lot of disruption in all aspects as well as food security indicators, one of which was the economic aspect of the community and this was caused by restrictions on people's movements to reduce the spread of the Covid-19 virus so that there was a lot of unemployment immediately and reduced income.

Research conducted by (Annisahaq et al., 2014), states the importance of knowledge and awareness of the community, especially housewives and, this study analyzes the Dietary Diversity Pattern (DDP) through the energy adequacy figures of each household. Having high dietary diversity was associated with higher

education and large farm sizes. Improving community members' knowledge and awareness of nutritional benefits could improve the dietary diversity at household level (Minja et al., 2021). The household dietary diversity was collected through a 24-h dietary recall adapted from United Nations' Food and Agriculture Organization FAO (Minja et al., 2021).

3.   Research Methodology

The research location was carried out purposively with the consideration of the highest production of horticultural commodities in Probolinggo Regency, namely in Mranggon Lawang Village. Respondents were selected using cluster sampling with the consideration of meeting

the total land area of 100 m^2 BMU and selected evenly in each RT. The number of respondents was 61 shallot farmers obtained from calculations using Isaac and Michael's formula.

There are several procedures for calculating the expected food pattern after knowing household food consumption data using the 2 x 24 hour Food Recall method for respondents in Mranggon Lawang Village, Probolinggo Regency. Processing of household food consumption data using tools or applications that have often been used in this case, namely the Nutri Survey 2007. The steps in the analysis of food quality by calculating the expected food pattern are as follows (Food Security Agency, 2015), the first is to group food consumption according to divided into 9 groups as shown in table 1.

Tabel 1. Grouping food consumption by commodity

No	Food Groups	Commodities
1.	Grains	Rice and its preparations, corn and its preparations, wheat and its preparations
2.	Tubers	Cassava and its preparations, sweet potatoes, potatoes, taro, and sago (including starchy foods)
3.	Animal-derived food	Meat and its preparations, fish and its preparations, eggs, as well as milk and its preparations
4.	Oil and Fat	Coconut oil, palm oil, margarine, and animal fats
5.	Oily Fruit and Seeds	Coconut, pecan, and chocolate
6.	Nuts	Peanuts, soybeans, green beans, kidney beans, peas, cashews, arrears, other beans, tofu, tempeh, tauco, oncom, soybean essence, soy sauce
7.	Sugar	Granulated sugar, brown sugar, syrup, and bottled drink.
8.	Vegetable and Fruit	Fresh and processed vegetables, fresh and processed fruits.
9.	Etc	Various spices and beverage ingredients such as shrimp paste, cloves, coriander, pepper, nutmeg, tamarind, cooking spices, tea, and coffee

Food consumed by households is in various forms, and types with different units. Therefore, the unit of weight needs to be standardized by converting into the same (agreed) unit and type of commodity using a conversion factor so that the weights can be added up, preferably the food consumed is converted into raw weight.

3.1.   Calculation of energy adequacy rate (EAR)

The next step is to calculate the energy content of each type of food consumed with the help of the food composition list (DKBM). The energy column in the Food Security Agency - Ministry of Agriculture DKBM shows the energy content (kcal) per 100 grams of the edible part (BDD).

$$Ei = [\ Bi * KEi/\ 100 * (BDDi/\ 100)]\ /\ JRT \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\ (1)$$

Where:

Ei   : actual energy consumed from food stuffs i (kcal/cap/day)

Bi   : the weight of foodstuffs i (grams)

Kei   : energy content of foodstuffs i

BBDi   : Percentage of foodstuffs consumed (%BDD) of foodstuffs i

JRT   : number of household members (persons)

Furthermore, the amount of energy for each type of food is added up according to the food group.

Calculation of the actual Energy Adequacy Ratio (EAR):

$$T = \frac{Ei}{E} \times 100\% \dots\dots\dots\dots\dots\dots(2)$$

Where,

TKEp = Percentage of actual energy of each food group against the EAR

EAR   = 2100 kcal/cap/day

3.2. DDP Score Calculation

The actual DDP score is calculated by comparing the EAR score with the maximum score. The maximum score is the maximum score limit for each food group that meets the Ideal composition. Calculation of the DDP score for each food group with the following conditions:

A. If the EAR score is higher than the maximum score, then the maximum score is used.
B. If the EAR score is lower than the maximum score, then the EAR score is used.

The DDP score for each food group shows the composition of household food consumption of shallot farmers in Mranggon Lawang Village in 2021.

The total score of the Expected Food Pattern (DDP) which is known as the quality of food consumption is the sum of the scores of 9 food groups, namely the total of the grains group to the scores of other groups. This figure is called the food consumption DDP score, which shows the level of diversity in food consumption.

DDP Score = DDP scores for the grain group + tubers + … + Other group scores
……………………………………........ (3)

3.3. Socio-Economic Factors Analysis Method against DDP score

The method to analyze the factors that influence the DDP score uses Tobit regression with the consideration that the DDP score is included in the censored data. The mathematical model used for this method is a linear model as in equation 4.

$$Y = \beta_0 + \beta_1 X1 + \beta_2 D2 + \beta_3 D + \varepsilon \ldots (4)$$

Where,

Y	:	Total DDP score
β_0	:	Intecept
$\beta_{1,2,3,4}$	:	Coefficient Parameter
$X1$	:	Farm Income (Million Rupiah/ month)
DX2	:	Nutritional knowledge of housewives
DX2 = 1	:	High Nutritional knowledge of housewives
DX2 = 0	:	Low nutritional knowledge of housewives
DX3	:	education of the head of the family
DX3 = 1	:	education of the head of the family > Junior high school
DX3 = 0	:	education of the head of the family ≤ Junior high school

Testing the significance of the model and regression parameters was carried out to test the relationship between the independent variable and the dependent variable using the Tobit regression model (Syamsu Roidah et al., 2019). The Tobit Regression Model is used to analyze the factors that influence the Expected Food Pattern (DDP) of farmer households. This model uses a dependent variable that is censored or restricted or intentionally limited. Parameter values were estimated using the Maximum Likelihood Method. The use of this method overcomes the lack of multiple regression analysis tools by using the Ordinary Least Square (OLS) method which results in biased and inconsistent parameter estimates (Perwita Rahmanti et al., 2020).

There are a number of questions regarding nutritional knowledge possessed by farmer housewives, the total score produced from the 10 questions is divided into 3 with the consideration that the lowest score is 10 and the medium score is 20 then the high score is 30. So those who are included in mothers who have low of nutrition knowledge mothers who have a score of 1 to 20 while mothers who have high knowledge of nutrition are mothers who have a score of more than 20.

4. Results and Discussion

4.1. Food Security through Energy Adequacy Rate (food quantity)

Household food consumption patterns are an arrangement of types and quantities consumed by members of a household or a group of households at a certain time. The following is the energy contribution of each food group to the recommended EAR in Probolinggo Regency:

Table 2. The Energy Distribution Value of each Food Group against the EAR is recommended in Probolinggo Regency.

The Energy Contribution of Each Food Group to The Recommended EAR (2,100 kcal/capita/day)				
Food Groups	EAR actual kcal/capita/day	Percentage (%)	% EAR Normative	GAP (%)
Grains	1162,89	55	50	+5
Tubers	26,95	1	6	-5
Animal-derived food	156,71	7	12	-5
Oil and Fat	169,65	8	10	-2
Oily Fruit and Seeds	21,40	1	3	-2
Nuts	117,96	6	5	+1
Sugar	85,18	4	5	-1
Vegetable and Fruit	69,45	3	6	-3
Etc	57,55	3	3	0
Total	**1867,76**	**89**	**100**	**11**

Based on table 2, it is known that the average total energy consumption in horticultural farmer households in Probolinggo Regency is 186kcal/capita/ day, where the value is still below the Energy Adequacy Rate (EAR) recommended to the people of Indonesia, which is 2,100 kcal / capita / day. The insufficiency of energy consumption in farmer households is due to the lack of energy consumption in each food group. Household food consumption patterns are an arrangement of types and quantities consumed by members of a household or a group of households at a certain time. It can be known that food security based on food quality in horticultural farmers in Probolinggo Regency has not been fulfilled.

Based on table 2. It is known that the percentage of the grain and legume food group is a food group that has a positive difference which can be interpreted to mean that the food group has exceeded its normative EAR. The relationship between food group consumption in an area can be influenced by the availability and also food access in the area. According to Probolinggo Regency in 2021 figures, it is stated that the availability of rice and beans food is very high so that it can meet the needs of the people in the food group. The commodities in the grain group that have high production in Probolinggo Regency are rice and corn commodities while for the beans group are peanuts and soybeans. In line with the consumption of respondent farmers who prioritize rice, corn rice, tempeh and are main foods and mandatory in daily consumption.

Respondent farmers needed an increase in EAR in the tuber food group with a difference of 5%, Animal-derived food with a difference of 5%, vegetables and fruits with a difference of 3%, and oils and fats with a difference, of 2% and oily fruits with a difference of 2%. Food consumption patterns in Probolinggo Regency are still not good because the consumption of tubers and vegetables is still small, not even a few of the respondents who do not consume vegetables in their daily consumption. Knowledge of the quantity of food that must be fulfilled in kcal/capita/ day) must be disseminated in order to meet the recommended EAR and meet the normative EAR of each food group.

This is in accordance with Adha & Suseno, (2020), where food consumption patterns serve to direct optimal utilization of food in the body, where in realizing optimal household food patterns the need for knowledge and awareness of the importance of diverse and nutritious food that is balanced. Therefore, to find out the pattern of food consumption in shallot farmer households, it can be seen by knowing household food consumption in terms of quantity and quality of the roast.

4.2. Food Security through Desirable Dietary Pattern (Food Quality)

Diversification analysis can be seen based on the composition of food consumed by the community and DDP (Desirable Dietary Pattern) is used to measure food diversification in quantity and quality. The quantity of food diversification can be measured through the energy consumed through the calculation of percentage to the total Kcal. Meanwhile, in terms of quality, food diversification is measured through the DDP score, if the DDP score reaches 100, it can be said that diversification is effective, but if it is less than 100 then food diversification is still not effective (Asmara et al., 2009).

Tabel 3. Farmer Desirable Dietary Pattern Score in Mranggon Lawang Village

Food Groups	actual DDP score	DDP score of Probolinggo Regency 2020	DDP Normative score	Selisih
	Desirable Dietary Pattern Score			
Grains	25	25	25,0	0
Tubers	0,6	1,3	2,5	-1,9
Animal-derived food	14,9	19,3	24,0	-9,1
Oil and Fat	4,0	5	5,0	-1
Oily Fruit and Seeds	0,5	0,2	1,0	-0,5
Nuts	10	8,2	10.0	0
Sugar	2,5	2,3	2,5	0
Vegetable and Fruit	16,5	23,2	30,0	-13,5
Etc	0	0	0,0	0
Total	**74**	**84,5**	**100**	**26**

Based on table 3, it can be seen that in horticultural farmers, Probolinggo Regency, an Actual DDP Score of 74 is produced and this figure is smaller than the normative DDP of 100. The actual DDP in Probolinggo Regency in 2020 was 84.5 which stated that the DDP for horticultural farmers in Probolinggo Regency in 2021 was lower than the DDP in Probolinggo Regency in 2020 and had not reached the normative figure. The closer the normative DDP score is, the more food security farmers are based on the quality of their food. This means that the food patterns of horticultural farmers in Probolinggo Regency have not been diverse and have not met every recommendation in each food group.

The food diversity found in horticultural farmer households in Probolinggo Regency has not been maximized several food groups will do not meet the normative DDP score such as, vegetables and fruits, still donimal-derived food, tubers, oils and fats, as well as oily fruits and seeds. The big difference is in the consumption of vegetables (13.5) and Animal-derived food (9.1), these scores are still far from the normative DDP score.

The availability of vegetables and fruits that have not been able to meet the needs of respondent farmers can be the cause of the low DDP score of the vegetable and fruit food group. High vegetable production in Probolinggo Regency is cabbage which is often found in the consumption of farmer respondents in processed vegetable soup but the amount is very small and the respondent farmers'

food consumption of vegetable and fruit food groups tends to be low, which means that public awareness of vegetable and fruit consumption is also still low. Likewise with fruit, there are not many respondent farmers who consume fruit in their daily lives, while what is widely consumed is fruit whose a production is abundant and does not require high costs and even free is like manga fruit which is mostly grown in the yard of the respondent farmer's house. However, because manga fruit is a seasonal fruit, the intensity of consumption is only during the manga season, while for other fruits it is limited to fruit prices that tend to be high in Probolinggo Regency.

Animal-derived food is still below its normative DDP score. The Animal-derived food that is available and accessible to respondent farmers is mostly sea fish and chicken, but it is still not fulfilled because the ability of respondent farmers to buy Animal-derived food products such as beef is still low because the price of beef tends to be high in Probolinggo Regency.

4.3. Factors affecting Desirable Dietary Pattern (DDP)

By using the Tobit regression method to analyze socio-economic factors against the DDP score because the DDP score data is censored data, which has a limit from a score of 0 to 100. The following are the results from analyzing with Tobit regression in horticultural farmers in Probolinggo Regency:

Tabel 4. Tobit Regression Results

Variable	Regression Coefficient	P>t
Konstanta	62,73511	0,000
Farm Income	0,1045415	0,005*
Dummy Nutrition Knowledge housewives	10,56692	0,000*
Dummy Education Head of Household	10,654196	0,639
Dependent Variable		: DDP
Prob > chi2		: 0,0000
LR chi2 (5)		: 59,95
Degree of Significance		: 99%

Where,
* : Degree of significance 99%

The results of the Tobit regression above show that the prob value of the $chi^2 >$ is 0.000 which means that the dependent variable can explain its dependent variable in the equation simultaneously with a significance level of 1%. The resulting value of LR chi2 of 59.95 indicates that there is at least 1 independent variable that affects the dependent variable. To see the influence of dependent variables on independent variables, namely household food security for each independent variable, namely as follows:

A. Farm Income

Farm Income has a significant effect on the food pattern of household food expectations/ resilience. This is evidenced by a significance level of 0.005. Income has a positive effect on food patterns of household food expectations/resilience at a confidence level of 99%. This shows that any increase in income of 1 rupiah will cause the DDP score of the respondent farmer to approach 100, which means that it will be more food secure, thus income has a significant effect on the energy adequacy of farmer households.

This is because if a person's income increases, the opportunity to buy nutritious foodstuffs is also higher. In the opinion of Argandi, Lucyana, and Trisna (2019) explained that various efforts to improve nutrition are usually oriented towards the income level of the family. The more income increases, the more food adequacy can be met. Thus the level of family income has a major factor in the selection of quality foodstuffs.

B. Nutritional knowledge of housewives

The Dummy variable of nutritional knowledge has a significance value of 0.000, which means that nutritional knowledge has a noticeable effect on the confidence level of 99%.

Nutritional knowledge has a coefficient result of 10.57. This means that respondents with high nutritional knowledge score 10.57 times higher than respondents who are knowledgeable from low nutrition. The DDP score is higher, the food diversification is higher. In line with the research of Musta'in & Saputro, (2021), namely The higher the knowledge, the wider the knowledge of food will also be. This will influence decisions in choosing foodstuffs and managing food well.

C. Education of the Head of the Family

The Dummy variable the education of the head of the family did not have a significant influence on the value of the Hope Food Pattern score because the significant value reached 0.686. This indicates that the education of the head of the family does not affect the food patterns of horticultural farmers in the Probolinggo Regency. Education affects the knowledge of farmers but does not affect decision-making in the selection of food menus and their processing.

This is because 100% of the respondents in this study stated that every decision on the diet and processing menu is the task of housewives and daughters in the household so that the education of the head of the family does not affect the decision. In line with Abdillah's research (2013) that with a higher level of education, the head of household is more focused on improving the quality of his farming business compared to the food menu matters that have been arranged by housewives. The head of the household is more focused on his task of making a living and then the proceeds are used for daily purposes.

5. Conclusion

Household Food Security of horticultural farmers is still below the normative EAR figure of 2,100, which is 1867.75 kcal/capita/day in horticultural farmers in the Probolinggo Regency. The highest contributors to the actual EAR value

were in the grain and beans group and the smallest contributor was the tubers group, Animal-derived food, and also vegetables and fruits. Based on the quality aspect, the household food consumption of horticultural farmers is seen from the DDP score, where the DDP score in shallot farmer households is still below the normative DDP score (100), which is 74,152 for Mranggon Lawang Village.

The need to increase the value of EAR in household food consumption can be done by allocating food for the fulfillment of AKE in food groups of tubers to fruits and vegetables. The allocation of food consumption can be by considering the high availability of food in Probolinggo Regency such as bananas, Moringa leaf vegetables and other commodities that can be obtained easily and also have affordable prices.

The unfulfilled quality of food consumption of farmer households is because there are still many food groups that have not been able to meet the normative DDP score, meaning that the consumption of horticultural farmers has not varied due to the dominance of several food groups that exceed the recommended limits, namely the grain and legume food groups.

Two parameters have a significant effect on the bound variables, namely farm income (X1) and dummy knowledge of nutrition of housewives (DX2), while the variable of family education (X3) does not have a significant effect. For shallot farmers, it can be by reimbursing production input costs for chemical pesticides with natural pesticides that are more economical and environmentally friendly. The shallot processing industry is strongly advised to process agricultural products in order to increase income and reduce risks if the price of shallots is very low. Meanwhile, melon farmers can increase their income by improving the quality of melons in order to widen the market to export.

Based on the quantity and quality of food, it is necessary to increase the value of EAR in household food consumption, where to increase the value of EAR can be done by increasing consumption from food groups that still do not meet the recommended value and reducing consumption of food groups that have exceeded the recommended EAR value, such as the legume group and can be allocated for the fulfilment of EAR in the food group of tubers to fruits and vegetables. The allocation of food consumption can be by considering the high availability of food in Probolinggo Regency such as bananas, Moringa leaf vegetables, and other commodities that can be obtained easily and also have affordable prices.

Knowledge of the nutrition of housewives also plays an important role in the variety of food produced, so information and counseling on basic information such as groups of foods that are rich in carbohydrates, protein, fat, vitamins and minerals are needed, are needed so that they can choose and sort out more diverse foods. processing of nutritious, balanced and safe food ingredients for each household's body needs, such as utilizing agricultural counseling, PKK, posyandu programs, to community associations.

Related to the complexity of factors that affect the diversification of food consumption, it is necessary to add several variables that have not been listed in this study, including cultural characteristics to market access to make decisions about food consumed in the household.

Acknowledgments

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The Formulation of Strategic Management for Market Development and Competition of Ground Coffee Product in SMEs of East Manggarai Regency

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ABSTRACT

The business unit's development is determined by its ability to design a marketing strategy. This study was intended to determine the criteria and sub-criteria for marketing resources using the ANP model and formulate an alternative marketing strategy using the TOPSIS method in small and medium enterprises (SMEs) for the ground coffee product in East Manggarai Regency. The sampling method used in this research is proposive sampling. Data collected using a questionnaire from 36 respondents. Research method study used analytical network process (ANP) and techinique for order preference by similarity to an ideal solution (TOPSIS) for the method. The ANP was used to analyze the priority of the sub-criteria of marketing resources, while the TOPSIS was used to determine the highest preference value on alternative marketing strategies. This study revealed that the sub-criteria with the highest weight for formulating alternative marketing strategies was the sub-criteria for the process of developing effective new products and services with a weight of 0.118. The highest preference value for alternative marketing strategies is the differentiation strategy with a value of 1.00. Hence, it can be concluded that an appropriate strategy for marketing development and competition of ground coffee products in SMEs of East Manggarai Regency is a differentiation strategy supported by the selected sub-criteria of the process of developing effective new products and services.

Keywords: ANP; marketing strategy; sub-criteria; TOPSIS

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1. Introduction

Suyanto (2007) asserts that every company is required to use a strategy to grow its business. Strategic management is required not only by large companies but also by small and medium-sized ones. Novianto (2019) states that strategic management is a series of decisions formulated based on an analysis of the company's external and internal environment to achieve long-term goals. The long-term goal of a business includes competitive advantages to thrive in the face of increasingly harsh competition. Hence, strategic management involves long-term decision-making.

Strategic management is critical in today's fast-changing era with increasingly fierce competition. Because every organization is seeking to meet customer satisfaction, the level of competition has become tighter (Mardia et al., 2021). Therefore, the discussion of marketing strategy management is prominent in the development of business units or companies for them to develop and compete. A company that uses a strategic management approach is more profitable than one that does not (Agwu, 2018).

The development of Micro, Small and Medium Enterprises (MSMEs) in Indonesia is an important part of national economic development. MSMEs are categorized as small-scale businesses. The data on MSMEs and large enterprises from Indonesian cooperatives and

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SMEs in 2018–2019 shows that the number of small and medium enterprises (SMEs) in Indonesia is 15,547 units with a contribution to Gross Domestic Product (GDP) of IDR 85,085 billion. However, despite the development and increasing contribution of MSMEs to GDP, it turns out that they are still having challenges with their business management. Handini et al. (2019) explain that there are numerous issues with initiatives to develop MSMEs, especially in terms of management, production and marketing, as well as financing.

In various literature, marketing is often considered one of the critical obstacles to the development of SMEs. Competitive pressures are one part of the marketing problems that small and medium enterprises. This is due to MSMEs' proclivity to dominate a small market as a result of their limited ability to compete with large companies, as well as their inability to see market opportunities. This corroborates previous research conducted by Purwanti and Suyanto (2021) that the weaknesses of MSMEs in developing their business are the lack of business management skills, lack of human resources, limited access to marketing, and limited IT partnerships.

SMEs that are starting to develop in the East Manggarai Regency area is ground coffee-based SMEs. Since 2018, it has begun to grow. East Manggarai Regency has the highest land area and coffee production in East Nusa Tenggara Province, with an area of 26,951 Ha and production of 8,696/ton (BPS NTT, 2021). As the region with the biggest coffee production, this helps small and medium enterprises market coffee. As a result, the business potential in East Manggarai Regency is unquestionably strategic. However, as with SMEs in general in Indonesia, the development of ground coffee SMEs in East Manggarai Regency has been hampered by a variety of internal and external issues. The problems include business management, limited information since the location is in remote areas, far from information centers, low internet connection as well as communication and transportation networks. It is also difficult to develop due to a lack of transportation. Another problem is the dependence of SMEs on market demand. The production and marketing of ground coffee occur only when there is market demand. This makes it difficult for SMEs to develop. In addition, the facilities and infrastructure to produce ground coffee are still simple. Thus, the

formulation of strategic management is crucial as supporting regulation for implementation.

Several studies on strategic marketing management have been conducted by several researchers who used the same statistical tools but distinct analytical tools. They have provided good literature on strategic management and issues related to a strategic management issue. The topic of management strategy, as discussed in this study, was the focus of previous research. This study focuses on the formulation of strategic management for SME marketing development and competition using multi-criteria decision-making methods with analytical tools of Analytic Network Process (ANP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Given the problems related to strategic management in SMEs, it is necessary to formulate strategic management for business development. The formulation of strategic management is one of the best alternatives to help SMEs in East Manggarai Regency develop. This study seeks to determine the criteria and sub-criteria for marketing resources using the ANP model and formulate an alternative marketing strategy using the TOPSIS SMEs of ground coffee in East Manggarai Regency.

2.   Theoretical Underpinning

Formulating the most effective marketing strategy is a part of problem-solving issues based on the criteria and sub-criteria of marketing. Marketing strategy improves the awareness about the direction a company is going, maintains the business sustainability, and facilitates the delegation and process of effective leadership (Susanto, 2014). Cahyadi and Anna (2019) stated that marketing should be regarded as investment that can bring simultaneous improvements that support business sustainability and grow positive consumers' perceptions. Marketing strategies consist of differentiation strategy, overall cost leadership and segmentation to compete and gain a sustainable position. Strategic decision-making framework is very important for business actors in determining the most efficient marketing strategy. (Rajesh and Gowri, 2018; Purnomo, 2018). MCDM is considered a complex decision-making tool which regards both qualitative and quantitative factors (Sukru and Basar, 2015; Rajesh and Gorwri, 2018).

This study focuses on the formulation of strategic management for the development and marketing of ground coffee products in small and

medium enterprises (SMEs) in East Manggarai Regency based on multi-criteria decision-making method using ANP and TOPSIS as the analytical tools. At the present, the multi-criteria decision-making model has been widely used in various fields. However, Gowri and Rajesh (2018) employed ANP and TOPSIS in determining the proper marketing strategy of automotive companies. Wu, Lin, and Lee (2010) used ANP and TOPSIS to make decisions and determine the framework of marketing strategies in a private hotel. In addition, ANP and TOPSIS were used by Abdolmaleki and Aghei (2015) in marketing strategy selection and evaluation at Emdad Khodro's company. Meanwhile, Cahyadi and Anna (2019) used a multi-criteria model in determining the marketing strategies for the batik fashion industry in Indonesia. Another research on marketing strategy management was conducted by Agwu (2018) which focuses on analysing the impacts of strategic management on the performance of MSMEs in Nigeria. The results of prior studies have shown that ANP and TOPSIS are able to in measure the interrelationships between sub-criteria and calculate the value of the existing sub-criteria in order to formulate and determine the most proper marketing strategy.

2.1. Marketing Resources

Wu et al (2010) stated that marketing resources enable the improvement of competitive business advantages as it allows the development of excellent performance. However, not all kinds of resources and capabilities can be fully possessed or controlled by an organization. Cahyadi and Anna (2019) mentioned five dimensions of marketing resources that affect marketing performance consisting of the relationship with customers, innovation ability, managerial ability, HR management, and company reputation. Meanwhile, Wu, Lin and Lee (2010) referring to Hooley et al (2005) mentioned four criteria consisting of managerial ability, relationship with customers, reputation, and market innovation ability. Efendi, et al (2018) added competition criterion into the criteria proposed by Hooley et al (2005), namely the competition criteria.

In a journal article published by Cahyadi and Anna (2019), the relationship with customers in SMEs refers to the process of relationship development by SME managers to the customers. In fact, customer relationship that is engaging will lead to trusting relationships among business partners, including customers, suppliers, and relatives that is advantageous in many ways. Wu, et al (2010), defined managerial ability as the ability to manage financial resources, effective human resource management, good operational management and excellent service management that can be developed over time. Cahyadi and Anna (2019) explained SME reputation as an aspect that relates to other factors affecting SMEs in the past and future which is relevant, especially brand equity. SME reputation is measured by checking the company name or brand and credibility with customers.

Competition is related to the ability of business actors in facing market competition, new competitors and the emergence of substitute products (Efendi, et al 2018). Market innovation ability can be defined as an interrelated process that allows SMEs to make market innovation (Cahyadi and Anna, 2019). This ability is shown by the penetration of new products and services (Wu., et al 2010).

2.2. Business Strategy

Bahudin, et al (2020) explained that generic business strategy relies upon two aspects: strategic emphasis and market approach. Strategic emphasis relates to how a business unit focuses on either low costs or the implementation of unique business strategy (differentiation). Whilst, market approach refers to the preference of a company over penetrating wider markets or small markets. Porter (1980) introduced three generic strategies that are the differentiation strategy, cost leadership, and segmentation strategy to create a sustainable position and achieve competitive advantage. Differentiation strategy is implemented to highlight one special characteristic of a product to make it different from competitors' products in order to make the product more attractive. Market segmentation strategy is the activity of dividing the market into different groups of buyers based on variety of needs, characteristics, and behaviors that may require different goods or marketing needs. The cost leadership strategy is one of the common strategies that can be used to produce cheaper products or services than those of competitors.

3.   Research Method

Research method study was carried out in SMEs of ground coffee in East Manggarai Regency, East Nusa Tenggara Province. Based on data from the Department of Cooperatives,

Small and Medium Enterprises that focus on the marketing of ground coffee in East Manggarai Regency, currently, there are 12 business units of ground coffee in East Manggarai Regency.

The sampling selection used the purposive sampling method. In this study, the inclusion criteria are those who understand the marketing activities of SMEs of ground coffee in the East Manggarai Regency. The sample in this study was three respondents from each SME. They are the chairman, marketing manager, and financial manager of the SME. Thus, there were 36 respondents from 12 SMEs.

Data collection includes interview through questionnaires and literature study. There were 3 questionnaires used. The first questionnaire deals with the relationship between criteria. This questionnaire aims to determine the dependence between sub-criteria as a basic reference for making the ANP model. The second questionnaire is a pairwise comparison. This questionnaire was developed based on the dependence obtained from the first questionnaire. The third questionnaire is the judgment questionnaire of the TOPSIS method. This questionnaire serves to determine the suitability of the recommended alternatives with sub-criteria or marketing resources owned by SMEs.

The data analysis technique used in this study were the Analytic Network Process (ANP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

3.1. Analytic Network Process (ANP)

The steps of ANP analysis are as follows (Effendi, 2018; Kaluku, 2015; Saaty, 1999):
a. Build a model and determine the desired solution.
    This stage deals with making a dependency questionnaire between the sub-criteria. If in a block (line i to column j) the number of respondents who choose (vij) is more than or equal to (N/2   2.5), there is a relationship between the criteria.
b. Making pairwise comparison matrices.
    At this stage, a pairwise comparison questionnaire between the two sub-criteria with a rating scale of 1-9 was made. Where the value of 1 is equally important and 9 is very much more important.
c. Calculating the weights of pairwise comparison.
d. Calculating consistency index (CI)
    CI: $(\lambda \text{ maks-n})/(n-1)$ (1)

e. Calculating consistency ratio (CR).
    The CR value is less than 0.1. CR = CR/RI.
f. Supermatrix building
    The supermatrix consists of:
    1) Unweighted supermatrix
    2) Weighted Supermatrix
    3) Limit Supermatrix
g. Matrix normalization.

3.2. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

1. Determination of alternative marketing strategies
    In this study, there are three alternative marketing strategies used. They are differentiation strategy, segmentation strategy, and cost leadership strategy.
2. Judgment questionnaire development
    This questionnaire intends to determine the suitability of the alternatives that will be recommended with the sub-criteria of marketing resources.
3. Building a normalized decision matrix
$$r_i = \frac{x_i}{\sqrt{\sum_{i=1}^{m} x2_i}} \qquad (1)$$
4. Building a weighted normalized decision matrix.
$$v_i = w_i \times r_i ; \qquad (2)$$
    J=1..j;i=1,…,n.
5. Determine the positive-ideal solution matrix (A^+) and the negative-ideal solution matrix (A^-)
$$A^+ = (v_1^+, v_2^+ .... vn^+) \quad (3)$$
$$A^- = (v_1^-, v_2^- ....., v_n^-)$$
6. The distance to the ideal solution between the alternative A_j and the positive-ideal solution is as follows:
$$s_i^+ = \sqrt{\sum_{j=1}^{n}(v_i - A_j^+)^2} \qquad i=1,2…,j \quad (4)$$
    The distance between alternative A_i and the negative- ideal solution:
$$s_i^- = \sqrt{\sum_{j=1}^{n}(v_i - A_j^-)^2} \quad i=1,2…,j \quad (5)$$
7. Determine the preference value for each alternative.
$$C_i^+ = \frac{s_i^-}{s_i^- + s_i^+}; \qquad j = 1,2…, j \quad (6)$$

4. Results and Disccusion

4.1. Analysis of the relationship between sub-criteria

The relationship between the sub-criteria was obtained based on the results of the dependency questionnaire for each sub-criterion.

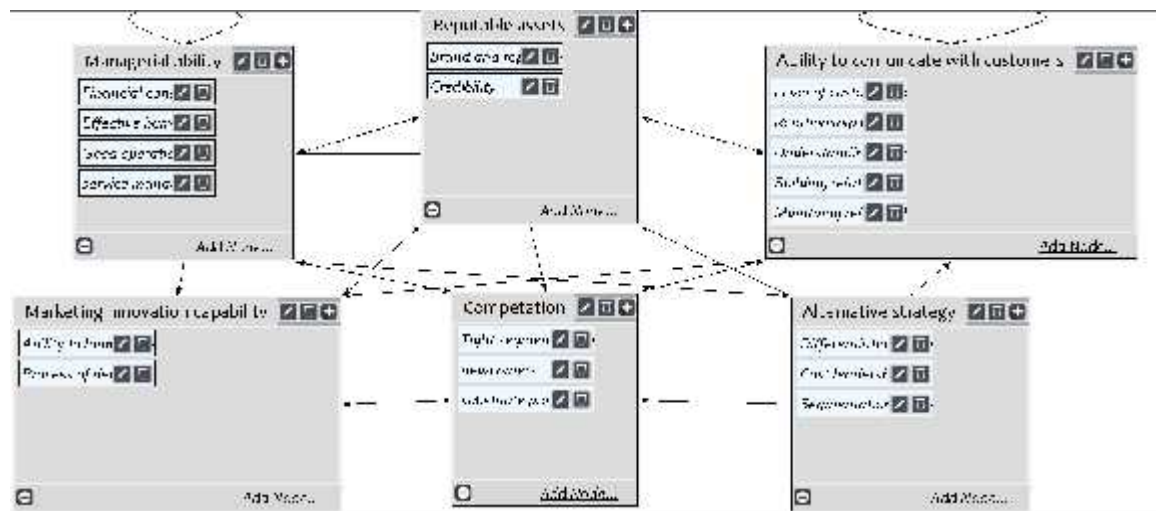The ANP model used in this study is presented in Figure 1.

Figure 1. The ANP Model

Figure 1 depicts two relationships, namely the inner dependence and outer dependence relations. Avrianto (2014) defines inner dependence as the relationship between elements in the same cluster so that this cluster will be connected to itself to form a loop relationship. Meanwhile, outer dependence is the relationship between elements in a different cluster making one cluster to be connected to another cluster. In this study, the sub-criteria with inner dependence relations are the sub-criteria of financial condition that has a relationship with the sub-criteria of human resource management, good operation management, and service management. These four sub-criteria are of the same criteria, namely the criteria for managerial ability. The two sub-criteria of the ability to communicate with customers with sub-criteria of the level of customer service has a relationship with the sub-criteria of relationship with the main target customers, understanding consumer needs, building relationships with consumers, and maintaining relationships with consumers.

Criteria and sub-criteria with an outer dependence relationship are where each sub-criteria have a relationship with each other. The criteria for managerial ability have a mutually influencing relationship with the criteria for the ability to communicate with customers, reputable assets, competition, and marketing innovation capabilities. Thus, the managerial ability of SMEs of ground coffee in implementing marketing strategies has a mutually influencing relationship with the ability of SMEs to recognize consumer needs making them be able to compete through their ability to innovate the market according to consumer needs. An alternative strategy has a relationship with the overall criteria because in implementing a marketing strategy, marketing resources will affect the marketing strategy used.

4.2. Calculation of the Consistency of the Criteria Matrix

Based on the data tabulation from 36 respondents, the calculation of the consistency ratio of each criterion is presented in Table 1.

Table 1. The Calculation of the Consistency Ratio (CR)

Criteria	N	CI	RI	CR	Description
Criteria	5	0.089	1.12	0.080	Consistent
Managerial Ability	4	0.061	0.90	0.068	Consistent
Ability to communicate with customers	5	0.015	1.12	0.013	Consistent
Reputable Assets	2	2.025	0.00	0.000	Consistent
Competition	3	0.000	0.58	0.000	Consistent
Marketing Innovation Capability	2	0.048	0.00	0.000	Consistent

Based on table 1, the consistency ratio of each criterion is < 0.1. Thus, from the respondents' assessment of the criteria through a distributed consistently pairwise comparison questionnaire, it can be stated that it can be used in analytical network process (ANP) analysis using Super Decision software.

4.3. Determination and analysis of sub-criteria weighting using the ANP method

The data from the questionnaire were analyzed by weighting the criteria and sub-criteria employing the Super Decision software. The results of the ANP analysis are presented in Table 2.

Table 2. The results of the weighting of the sub-criteria

Criteria	Sub-Criteria	Weight	Priority
Managerial Ability	Financial condition	0.061	5
	Effective human resource management	0.102	2
	Good operation management	0.047	7
	Service Management	0.089	4
Ability to communicate with customers	Level of customer services	0.057	6
	Relationship with main target customer	0.041	9
	Understanding consumer needs	0.044	8
	Building relationship with consumers	0.041	9
	Maintaining relationship with consumers	0.040	10
Reputable Assets	Brand and reputation	0.092	3
	Credibility	0.092	3
Competition	Tight segment competition	0.023	11
	Newcomers	0.047	7
	Substitute product	0.047	7
Marketing Innovation Capability	Ability to launch new products and services	0.059	5
	Process of developing effective new products and services	0.118	1

4.4. Analysis on managerial skill

The sub-criteria for effective human resource management weighs second in terms of importance value (0.102). It indicates the need for training and assistance to encourage capacity building and improve human resource quality in order to be able to keep up with the current business development. In the case of ground coffee SMEs in East Manggarai Regency, the entrepreneurs' knowledge about good business management was lacking. They focussed only on producing goods and marketing them without analysing the most proper marketing strategy for their business to grow. Efendi, et al (2018) stated that active and competent employees or human resources guarantee better product marketing.

Service management sub-criteria ranked fourth in priority (0.089), indicating that service management in ground coffee SMEs in East Manggarai Regency needs further improvement. The service management was found less effective as it took relatively long time to serve orders Due to the location of SMEs that is far from urban centers.

The financial condition sub-criteria appeared as the fifth priority (0.061). The financial condition of ground coffee SMEs in East Manggarai Regency is of particular concern due to limited working capital and financial reports that were manually written with inefficient organization. Limited capital inhibited entrepreneurs from improving their production, making it difficult for their business to develop. Arvianto, et al (2014) defined financial condition as the ability of a company or a business or business to manage its finance.

Good operational management appeared as the seventh priority sub-criteria with a value of (0.047). The operational management of the ground coffee SMEs in East Manggarai Regency needs to utilize advanced technology to simplify the production process. Currently, the production process was still traditional using simple production equipment. No structured or scheduled activities were determined in carrying

out their business. It was highlighted by Efendi, et al (2018) that a company or business requires a series of structured activity plans to direct the marketing activities to run as planned.

4.5. Analysis on ability to maintain good relationship with consumers.

Based on the pairwise comparison in the ANP, consumer service ranked sixth in its influence on the success of ground coffee SMEs marketing in East Manggarai Regency with a priority value of 0.057. The services has been something that consumers value in this business. The quality of service is also a factor that determines consumer satisfaction. It is necessary to provide faster and more efficient service to meet consumers' demand in order to improve customer satisfaction.

The sub-criteria that ranked eighth in priority is the understanding of consumer needs with a value of 0.044. To date, the ground coffee SMEs have never directly asked for consumers' feedback about their satisfaction with the services or products being offered. The feedbacks can be positive or negative which can provide fruitful insights to the improvement of products and services being offered.

The sub-criteria that ranked ninth in priority was the relationship with the main target consumers and building relationships with consumers (priority value of 0.041). In the context of the ground coffee SMEs, friendliness and good communication are important aspects to concern in order to make consumers satisfied. This way, good relationship can be maintained between consumers and business actors or their employees. Efendi, et al (2018) also mentioned that positive consumer-producer relationship makes consumers feel comfortable and appreciated.

The sub-criteria that obtained the tenth priority order was the relationship with consumers with a priority value of 0.040. It is necessary for the MSEs to create good relationships between producers or business actors and consumers. Business actors should provide services and products that can make consumers feel satisfied.

4.6. Analysis on asset and reputation.

As seen in Table 2, brand and reputation and credibility sub-criteria rank third in terms of priority. Right brand can help compete in the market. Products with high brand awareness are widely known by consumers. Ground coffee SMEs have branded their products in local language to make it different from other products. The use of local language also makes the product easy to remember and more familiar among consumers. Good branding can also improve product reputation, allowing the product to stick with consumers. It was explained by Cahyadi and Anna (2019) that company reputation is generally measured by brand name and credibility with customers.

4.7. Analysis on competition

New competitor and substitute products placed seventh in priority ranking with a value of 0.047. Product innovation should be carried out by providing a variety of flavors, sizes and packaging quality for their products to fit consumers' need, thereby customers will stay loyal. No substitute products have been produced in the SMEs, but the SMEs will focus on improving the main product.

The market segment competition ranked eleventh in terms of priority with a value of 0.023. The company will market its products in predetermined segments. In competitive market, SMEs need to increase the production to meet the market demand.

4.8. Analysis on market innovation ability

The ability to launch new products and services ranked the fifth with a value of 0.059. Ground coffee SMEs did not want to launch new products because the focus was still on the production using raw materials or basic ingredients that are available nearby. Business actors also apply offline and online marketing for larger marketing scope.

Based on the weighting of each sub-criteria, it is known that the sub-criteria of the process of developing effective new products and services have a higher importance weight of 0.118 among the sixteen sub-criteria (Table 2). This means that the greater the weighting of each sub-criteria, the more the priority of the sub-criteria. This shows that SMEs that produce ground coffee need to develop effective new products and services in marketing their ground coffee products because this will affect business development and product marketing competition. Thereby, this is expected to increase competitiveness and market share. Since this sub-criterion is the first priority, the business unit must innovate products and improve services to achieve customer satisfaction. Wu et al. (2010) confirm that a business must keep innovating and

create new products and services to meet customer needs since marketing innovation capability is measured by the ability of business units to launch effective new products and services.

4.9. Analysis and prioritization of selected marketing strategies using the TOPSIS method

After identifying the importance weight of each sub-criteria, the next step is to rank the priority of the selected alternative marketing strategies that are considered the most suitable for the SMEs of ground coffee. The method used to rank alternative marketing strategies is the TOPSIS method. This method has the basic principle that the chosen alternative marketing strategy must have the shortest distance from the positive-ideal solution and the farthest distance from the negative-ideal solution (Gowri & Rajesh, 2018). The first step was compiling the results of questionnaires which had been distributed to 36 respondents in order to calculate the average score of each sub-criteria. The average scores were then multiplied by the weight of each sub-criteria that was obtained from the results of ANP analysis (Table 2). After weighing the matrix of normalization decision, ideal positive and negative solutions were proposed for each sub-criteria in regards to the alternative strategies available. The gaps of the weighted scores of the ideal positive and ideal negative solution for each alternative had been measured in advance before ranking the alternative marketing strategies. The results of the calculation of TOPSIS are shown in Table 3.

Table 3. Results of Alternative Strategy

Marketing strategy	Preference Value	Preference
Differentiation Strategy	1.000	1
Cost Leadership Strategy	0.000	3
Segmentation Strategy	0.512	2

4.10. Differentation strategy

Based on Table 3, TOPSIS analysis reveals that an alternative marketing strategy with a higher preference value is a differentiation. The formulation of a differentiation strategy focuses on marketing innovation capabilities through the process of developing an effective new product

and service and managerial capabilities through effective human resource management. The differentiation strategy aims to provide different products and services from competitors. In another word, it is an act of developing and modifying a product to be more attractive without changing the physical specifications of the product (Kotler, 2001).

In the case of the SMEs of ground coffee, the products and services provided by each SME are still too simple in terms of packaging, production processes, and product and services. Thus, it is necessary to apply a differentiation strategy in marketing its products. This will make consumers interested in making a purchase. This will help SMEs grow and compete with other businesses. The competitors with whose same product category will encourage business actors to implement a differentiation strategy in running their business. In this way, the company will survive amid business competition by innovating and offering effective new services according to customer needs. Boyt and Harvey (1997) in Wu et al. (2010) stated that a differentiation strategy through offering superior services and product innovation is significant. Successful product and service differentiation can be achieved through innovation and improvement. Asty (2015) added that product and service differentiation is expected to create a competitive advantage.

4.11. Cost Leadership Strategy

The cost leadership strategy ranks third with a preference value of 0.00. In the case of small and medium enterprises (SMEs) in a state of financial condition experienced. Cost leadership strategy is not a priority for now for it aims to market products at lower prices than competitors without reducing profits which is not suitable for SMEs. It is difficult for SMES to reduce the selling price of the product because the target profit will not be achieved for their capital is limited. Likewise, Wu., et al (2010) also explained that cost strategy can be carried out if a business is in a superior position, making it possible to reduce the selling price.

4.12. Segmentation strategy

The segmentation strategy ranked second with a value of 0.512. This strategy can be employed after SMEs have implemented proper differentiation strategy. SMEs seemed to only sell and market their product without determining their target market. Segmentation strategy allows SMEs to market their products in ways that fit

consumers' purchase behaviour, needs and expectations. Consumers' needs and expectation can be identified by obtaining consumers' feedback towards the products being sold. This strategy also makes product marketing more focused to target consumer. In addition, market segmentation also raises consumers' awareness of the products.

In a research, Gowri and Rajesh (2018) identified that segmentation strategy was related to the process of dividing the market based on certain potentials and sub-groups of products with similar characteristics. Overall, segmentation strategy is mainly applied to gain higher value segment, i.e. for segments with the most profit and strong growth potential that should be watched carefully.

5. Conclusion

The results of this study imply that the development and marketing competition of ground coffee MSMEs in Manggarai Timur Regency require new effective product/service development as a major sub-criterion that allow owners to determine the most effective strategic marketing management. Topsis can be used to weigh the criteria that affect the strategic management. In this study, differentiation appeared as the most appropriate strategy to the enterprise since this enterprise was relatively new. This alternative strategy also supported the selected sub-criteria from the ANP analysis.

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The Effectiveness Interpersonal Communication Increasing Success of Pokdarwis Arumsari

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ABSTRACT

Organizing that involves the community is one of the factors that can determine the success of implementing tourism village activities. One of the tourism village managers whose organization involves the community is the Arumsari Tourism Awareness Group (Pokdarwis) in the Pandansari Tourism Village. To achieve the success of Pokdarwis Arumsari, it is necessary to have effective interpersonal communication between members, so, this study aims to analyze the effectiveness of interpersonal communication and its influence on the success of Pokdarwis Arumsari. The research location was conducted in Pandansari Village, Batang Regency, Central Java. The research method uses the case study method on all members of Pokdarwis Arumsari totaling 37 people as the respondents. Data collection techniques are closed interviews, observation, and literacy studies. Then analyzed by using Partial Least Square (PLS). The effectiveness of interpersonal communication and the success of Pokdarwis Arumsari are included in the high category with a percentage score of 81.2% and 79.2%, respectively. The value of the path coefficient is 0.859, the direction of the relationship between the effectiveness of interpersonal communication on the success of Pokdarwis Arumsari is positive, there is an effort to increase the effectiveness of interpersonal communication within the group, the success of Pokdarwis will increase. The results of the analysis show that the effectiveness of interpersonal communication can explain 73.9% of the success of Pokdarwis Arumsari. Pokdarwis Arumsari has a good and positive effect on interpersonal communication effectiveness so that success is realized in achieving the goals of Pokdarwis Arumsari.

Keywords: communication; effectiveness; interpersonal; partial least square; pokdarwis

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1. Introduction

Indonesia's tourism sector is a leading sector that has a big potential to be developed. Indonesia's tourism sector is one of the leading sectors that have the potential to be developed. One form of innovation in the development of the tourism sectors is village based tourism. Aini *et al., (2021)* stated that a tourism village is a form of integration of attractions, accommodation, and supporting facilities that are presented in a structure of community life that is integrated with applicable procedures and traditions. The development of the tourism sector through tourism village is expected to be able to attract tourist visits and increase the participation of local communities because organizing involving the community will bring benefits to the welfare of local communities.

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One of the tourism village managers whose organizing involves the community is the Tourism Awareness Group, *Kelompok Sadar Wisata* (Pokdarwis). According to Wijaya *et al.,* (2016) Pokdarwis is one component in society that has an essential role in tourism development, especially village-based tourism. The important role of Pokdarwis is to organize and plan activities related to the development of tourist villages, as a place to accommodate ideas from the community and increase village income (Apriliani *et al.,* 2021).

One of the tourism destinations in Batang Regency is the Pandansari Tourism Village which is located in the Warungasem District. Pandansari Tourism Village has been designated as a tourism village since 2012. The community manages Pandansari Tourism Village by creating the Arumsari Tourism Awareness Group (Pokdarwis). Pokdarwis Arumsari manages all tourism activities in Pandansari Tourism Village.

To achieve the success of Pokdarwis in carrying out its role as a tourism village manager, it is necessary to have effective interpersonal communication between members. As explained by *Prasetyo et al.,* (2019) the success of a group in carrying out its duties and functions depends on interpersonal communication between group members. Interpersonal communication is not only to raise awareness, provide information, influence behavior, but interpersonal communication also serves to listen, understand, explore deeper, and build consensus for change. Interpersonal communication by means of the process of transmitting information and joint understanding from one person to another is very essential for the success of any organization (Singh & Lalropuii, 2014), Furthermore, Singh stated that inside the organization; a communication must work as the flow of information, materials, perceptions and understandings among the numerous stakeholders of the organization, all the methods, media and means of the communication, all the networks, channels, systems of communication or organizational structure, all the person to person interchange or interpersonal communication. They includes all aspects of communication and make it comprehensive, because it advises that there is so plentiful things are going on in the organization.

Therefore, the main characteristic that distinguishes successful and unsuccessful Pokdarwis is the ability to interpersonal communicate effectively between Pokdarwis members. Effective interpersonal communication seen from a humanistic point of view requires an open attitude, empathy, supportive attitude, positive attitude, and an attitude of equality (Batlolona et al., 2020). Meanwhile, according to Singh & Lalropuii (2014) the key to effective interpersonal communication is how someone behaves and is skilled in conveying messages so that someone is able to receive the message conveyed.

Reviewing previously published articles, according to Suharsono (2020) if the coordination between members is carried out effectively and well, the quality of Pokdarwis services can be achieved. According to Wondirad & Ewnetu (2019), participatory communication has a basic concept namely how is the role of citizen groups as participants so that interactions occur in the interpersonal communication process. Subejo *et al.,* (2021) stated that relevant stakeholders have practiced interpersonal communication, and interaction in accordance with the interests of strengthening promotions. New media and several applications or platforms have begun to be used by the community in supporting the development of tourism villages. According to Yatmaja (2014), it is necessary to involve Pokdarwis members and the community in supporting tourism village activities and the activeness of members to be able to support the success of tourism villages. The ability to interpersonal communicate is an important aspect that will affect how effective a community is in responding to and imaging its organization (Lusiawati, 2019).

Based on the results of the review of previous articles, the gap analysis of this research is the success of the tourism village can be seen from the point of view of interpersonal communication effectiveness using Partial Least Square (PLS) analysis. So it is necessary to research the effectiveness of interpersonal communication in Pokdarwis Arumsari, because by knowing how to interpersonal communicate effectively, the results of the research can help the success of Pokdawis in managing the Pandansari Tourism Village. Based on this then, this research aims to analyze the effectiveness of interpersonal communication and its influence on the success of Pokdrarwis Arumsari in Pandansari Village.

2. Theoretical Underpinning

Communication is important things a part of our life. We need communication not only to transmit information and knowledge to one

another, but also, to relate to one another as humans in the context of relationships, families, organizations, and nations.

Abraham Maslow developed a hierarchy of human needs. He described our most basic needs must be met first such as food, water, and shelter. Once these basic needs are met we can progress upward in the hierarchy toward the fulfillment of needs for safety, security, love, belonging, and esteem. According to Maslow the highest human needs revolve around finding one's purpose and realizing one's full potential, culminating at the pinnacle of the hierarchy is self-actualization. Maslow's hierarchy of human needs can be applied to interpersonal communication (Vertino, 2014).

Interpersonal communication has an important role in the organization. The effectiveness of interpersonal communication always requires openness, a supportive attitude, and a positive attitude toward interpersonal relationships with each individual. Interpersonal communication is important because it can improve emotional relationships between each individual so that carrying out their duties and responsibilities in the organization can be carried out comfortably. Interpersonal communication will also improve the quality and quantity of performance because the tasks carried out are carried out without pressure (Sazwani et al., 2020).

Vertino (2014) explained two variables of interpersonal communication that are 1) internal variables consist of thoughts, feelings, and perceptions. 2) external variables such as the behavior of others and situations. Two variables of interpersonal communication could influence the outcome and effectiveness of interpersonal communication. Batlolona et al., (2020) also described that the efffective interpersonal communication can be seen from a humanistic point of view requires an open attitude, empathy, supportive attitude, positive attitude, and an attitude of equality. In this research will use the variable of interpersonal communication consisting of thought openness, empathy, support, positive action, and equality. Moreover, for explaining of the success of Pokdarwis, will use some variables like the existence the welfare, improvement of member's skill, achievement, and formation of collaboration.

In this research will use the variable of interpersonal communication consisting of thought openness, empathy, support, positive

action, and equality. Moreover, this research uses the success variables of Pokdarwis consist of thoughts existence the welfare, improvement of member's skill, achievement, and formation of collaboration.

3.   Research Methods

The research location was conducted in Pandansari Village, Batang Regency, Central Java. The research method used in this research is the case study method. Determination of respondents using a census, respondents used were all members of Pokdarwis Arumsari, amounting to 37 people. Data collection techniques used closed interviews, observation, and literacy studies. The data analysis method used is Partial Least Square (PLS). PLS analysis is a good alternative method and is a predictive model that aims to predict the value of the coefficient of determination (Rozandy et al., 2013). PLS analysis is used to analyze the effect of interpersonal communication effectiveness in increasing the success of Pokdarwis Arumsari. In this study, to achieve communication effectiveness using 5 indicators, namely openness, empathy, support, positive action and equality action (Prasetyo et al., 2017). Openness is one of the indicators in developing effective interpersonal communication and has a very big influence on this indicator. The second indicator is empathy. Empathy is an attitude that must be in the hearts of individuals that can help improve the effectiveness of interpersonal communication. Supportive good attitude is the third indicator that can increase the effectiveness of communication. A positive attitude is a positive perspective on oneself and in dealing with any communication situation. The fifth indicator is an attitude of equality where there is a desire to be equal in cooperation and be able to solve problems To measure and describe the 5 indicators of the effectiveness of interpersonal communication owned by Pokdwarwis assisted by using a Likert scale. The use of a Likert scale with a score of 1-5 with the following answer choices:
5: Very High
4: High
3: Medium
2: Low
1: Very Low

4.   Result and Discussion

The results and discussion have presented this study, including the characteristics of

respondents or an overview of the research object, findings or results of analysis, and research implications.

4.1. Characteristics of Respondents

Table 1 presents the percent distribution of interviewed respondents, by background of sex, education level, and age.

Table 1. Characteristics of Respondents

No	Item	Number of Respondents	Proportion (%)
1	**Sex**		
	Male	23	62,16
	Female	14	37,84
2	**Educational Level**		
	Junior High School		
	Male	8	21,62
	Famale	1	2,70
	Senior High School		
	Male	13	35,15
	Famale	8	21,62
	Diploma degree (DIII)		
	Male	1	2,70
	Famale	0	0
	Bachelor degree (S1)		
	Male	1	2,70
	Famale	5	13,51
3	**Age**		
	19-23	17	45,95
	24-28	9	24,32
	29-33	7	18,92
	34-38	3	8,12
	38-43	1	2,70

The proportion of Sex shows that the respondents are dominated by Male with 62,16%, then females with only 37,84%. The education level of male and female respondents showed that the majority are in senior high school with a percentage of 35.15% and 21.62%. However, when viewed as a whole, the education level of female respondents is higher than that of male respondents. This condition showed that the second highest level of education for women is at bachelor's degree, while the male respondents are at the junior high school. The Age of respondents shows that in the age of 19—23 respondents dominate the level of age with 45,95% then 24-28 years is the second. All the information above indicates that the respondents are still young, active, and have good communication among members.

4.2. Interpersonal Communication Effectiveness of Pokdarwis Arumsari

Effectiveness of interpersonal communication can occur if there is an agreement on information and the quality of relationships that are built-in routine, both in society and in groups. Effective interpersonal communication depends on the social position of the recipient and his interest in the information conveyed. The effectiveness of interpersonal communication can make positive relationships with others. Prasetyo *et al.,* (2017) states that to achieve effectiveness in interpersonal communication, there are five aspects that must be met, namely openness, empathy, support, positive action, and equality action. The results showed that the effectiveness of Pokdarwis Arumsari interpersonal communication was in the high category with a total average of 20.3 or 81.2% of the total maximum score of 25. The detailed measurement of variables is presented in Table 2.

Table 2. The Score of the Variabels of The Interpersonal Communication Effectiveness in Pokdarwis

Number	Indicator	Maximal Score	Acquisition Score	Percentage (%)	Categories
1	Openness	5	4,3	86	Very High
2	Empathy	5	4,2	84	High
3	Support	5	3,9	78	High
4	Positive Action	5	3,8	76	High
5	Equality	5	4,1	82	High
	Total	25	20,3	81,2	High

Based on Table 2, it can be seen that the openness indicator has a value of 86%. This indicator is included in the very high category which means that the members of Pokdarwis Arumsari have opened up to each other. This openness can be seen from the mutual disclosure of information between members, for example, information on group activity schedules, competition information, training information, and so on. This information can be known by each

member through the group WhatsApp group and other members. The openness of Pokdarwis Arumsari is also shown in planning the preparation of program activities and group financial accounting. These activities are carried out by discussing with members in regular group meetings.

Indicators of empathy are included in the high category with a percentage value of 84%. This condition means that Pokdarwis members have empathy. Empathy can be seen from the existence of mutual assistance between members, for example when one member cannot coordinate or is overwhelmed in guiding the event, other members, both the chairman and secretary, are ready to help. In addition, when one member gets into a disaster, the other members are always ready to assist. Through an attitude of empathy by understanding what is felt and experienced by others, it shows that humans as social beings always need one another. As stated by Vipinkumar & Karippai (2002) that empathy is the extent to which a person is able to understand the feelings of others and understand them as he feels. Supported by the opinion of Far-far (2011), empathy should be embedded in the heart of every individual, because the presence of these feelings will be able to show that every human being is an individual who has feelings, thus encouraging us to be human beings who are beneficial to others.

The value of interpersonal communication effectiveness with supportive indicators is 78%, so this indicator is included in the high category. This condition shows that every member of Pokdarwis Arumsari has a supportive attitude. Supportive is where members are supportive and not defensive. Pokdarwis Arumsari's supportive attitude can be seen from the participation of members in programming, participation in conflict resolution, and exchanging information with one another. Another supportive attitude is also shown by providing equal opportunities to each member such as participating in training and competitions.

According to Tampubolon (2018) positive action is a positive view of oneself, having positive feelings towards others and various interpersonal communication situations. A positive attitude in the effectiveness of interpersonal communication is one of the important factors in the communication process. Based on the results of the study, it shows that the positive action indicators are included in the high category with a percentage of 76%. Positive actions at Pokdarwis Arumsari are shown by their mutual respect for each other's opinions, working together in groups, and trying to build good relationships by communicating frequently. In line with the opinion of Lestari *et al.,* (2019) who state that positive actions and thoughts can overcome the problem of communication crisis in a group.

Based on Table 2, it can be seen that the equality indicator is included in the high category with a percentage value of 82%. The equality indicator describes a desire that is explicitly expressed to work together in solving a problem. Indicators of equality in the effectiveness of interpersonal communication at Pokdarwis Arumsari can be seen in the presence of the same values, attitudes, behaviors and experiences, and similarities in conversation. This condition is seen by the existence of an attitude of justice in the group. The attitude of justice is like providing equal opportunity for each member to have an opinion or provide input. In addition, in granting incentive rights for members where members receive incentives following the responsibilities given, not based on position in the group.

4.3.   The Success of Arumsari Pokdarwis

Pokdarwis success is measured by how the group achieves the desired goals. The success of Pokdwarwis Arumsari in the research is seen from the existence, welfare of Pokdarwis, improvement of group skills, Pokdarwis achievements, and the formation of cooperation. The results of the study show that the success of Pokdarwis Arumsari participation is included in the high category with a score of 19.8 or 79.2% of a maximum score of 25. Details can be seen in Table 3.

Table 3. Scores of Arumsari Pokdarwis Success Variables

Number	Indicator	Maximal Score	Acquisition Score	Percentage (%)	Categories
1	Existence	5	3,5	70	High
2	The Welfare of Pokdwarwis	5	4,4	88	Very High
3	Improvement of Member's Skill	5	4,1	82	High

Number	Indicator	Maximal Score	Acquisition Score	Percentage (%)	Categories
4	Achievement of Pokdarwis	5	3,8	76	High
5	Formation of Collaboration	5	4,0	80	High
	Total	25	19,8	79,2	High

Table 3 shows that the existence indicator is in the high category with a percentage of 70%. The existence referred to in this study is how the existence of Pokdwarwis Arumsari in its social environment. To show the existence of Pokdwarwis Arumsari, it is necessary to carry out various forms of activities in accordance to establish Pokdarwis. The form of existence of Pokdwarwis Arumsari can be seen from the continuity of Pokdarwis activities and the tourist attraction is quite popular with the community. Pokdarwis Arumsari is known by the public through social media and branding from the government. Pokdarwis Arumsari uses social media to introduce managed tourism potential, namely through Facebook, Instagram, and YouTube. In addition, the existence of the group can be seen from the sustainability of the Pokdarwis which was established in 2015 until now, and the achievements of various achievements up to the provincial level.

The welfare indicator of Pokdarwis Arumsari is seen from the conditions that occur in the group. Based on the research, it is known that the Pokdarwis welfare indicator is in the very high category with a percentage value of 88%. This condition means that the welfare of Pokdarwis Arumsari members is very prosperous. This is evidenced by the support from various parties in carrying out the development of tourism and groups. The support is in the form of assistance for adding infrastructure, grants, providing training to improve human resources, as well as tourism branding. Another welfare that can be felt by Pokdarwis Arumsari members is the success of the group in giving appreciation to each member by providing wages or incentives. In addition to improving welfare, Pokdarwis Arumsari has developed several entrepreneurial activities in the form of homestays, food stalls, and souvenir shops. In accordance with the opinion of *Bona et al.,* (2017) which states that one of the goals of forming Pokdarwis in order to increase regional tourism potential is to increase their living income and welfare.

Table 3 also shows that in measuring success it can be seen from the increase in group skills. From the research results, it is known that the skill indicator gets a percentage value of 82% and is included in the high category. The improvement of group skills at Pokdarwis Arumsari can be seen from the ability of members to provide services to tourists. These services include being a tour guide, explaining tourist attractions, using Indonesian well, and other skills such as making souvenirs and traditional dance skills. The improvement of group skills is also supported by the holding of various group development training at Pokdarwis Arumsari.

The success of Pokdarwis Arumsari can also be seen from the achievement indicators. Based on table 2, the results show that the achievement indicators are in the high category with a percentage of 76%. The high percentage of achievement indicators is evidenced by the success of Pokdarwis Arumsari in winning various competitions from the district to provincial levels. These achievements include: 1) 1st Place Pokdarwis Jamboree at provincial and district levels in 2015, 2) 1st Place Pokdarwis Jamboree at the district level in 2016, 3) 1st Place Whitewater Rafting the Provincial Sports Week (PorProv) at the provincial level in 2018, 4) 2nd place in Pokdarwis Institutional Appreciation provincial level in 2019, and 5) 2nd place in tourism village at the provincial level in 2021.

The value of the indicator for the formation of cooperation is 80% and is included in the high category. This means that Pokdarwis Arumsari has succeeded in establishing good cooperation with outside parties and has continued until now. The results showed that Pokdarwis Arumsari succeeded in collaborating with Corporate Social Responsibility (CSR) Electricity Company in Indonesia (PT. PLN) Persero, Batang Regency Government, Sectoral Police Force, Asem Shop (Warung Asem), Community Lovers of Nature, and Pokdarwis outside Pandansari Village. One of the forms of cooperation carried out is the assistance of tourism support facilities and the local community's economy, namely with a sales

cart grant. In addition, to coordinate the security of tourist attractions with the Warung Asem Police.

4.4. The Effect of Communication Effectiveness on the Success of Pokdarwis Arumsari

The effectiveness of communication on the success of Pokdarwis Arumsari was analyzed using Partial Least Square (PLS) to find out how much influence it had. The measurement stage used is a structural model. The results of the structural model PLS analysis can be seen in detail in Illustration 1 and Table 3
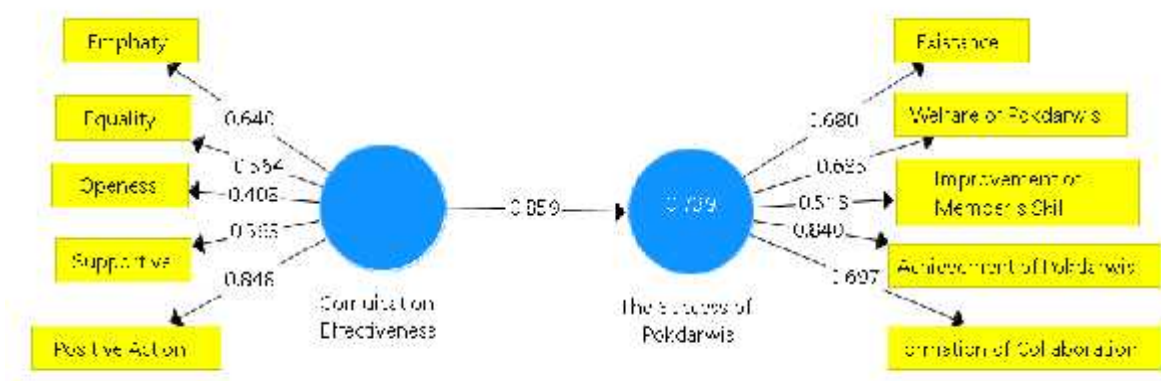

Figure 1. Path Diagram of PLS Analysis Results

Table 4. The Value of Path Coefficient and R Square

	Path coefficient	R Square
X > Y	0,859	0,739

Illustrations 1 and Table 4 show that the path coefficient value is 0.859, so the direction of the relationship between interpersonal communication effectiveness and the success of Pokdarwis Arumsari is positive. This means that if there is an effort to increase the effectiveness of interpersonal communication in the group, the success of Pokdarwis will increase. In line with the opinion of Cheboi & Mberia (2014) which states that effective interpersonal communication can achieve the desired results. The results of the analysis show that the effectiveness of interpersonal communication can explain 73.9% of the success of Pokdarwis Arumsari. This indicates that the effectiveness of interpersonal communication has a very strong influence on the success of Pokdarwis Arumsari. This is in accordance with the opinion of (Ubaidillah, 2020) which states that the value of R Square > 0.7 is included in the strong category.

The effectiveness of interpersonal communication which consists of openness, empathy, support, positive action and equality can explain the success of Pokdarwis Arumsari from the existence, welfare of Pokdarwis, increasing member skills, Pokdarwis achievements and the formation of cooperative relationships. The impact of effective interpersonal communication is a change in knowledge, feelings and attitudes, as well as behavior and actions to achieve a better one (Yulida. R et al., 2019).

Openness in the group can create members' comfort and trust the group. For example, in the preparation of an activity program that is carried out openly through group meetings, it provides an opportunity for each member to contribute and know and not keep each other secret so as to create member comfort and trust. Lahap *et al.*, (2016) stated that regular meetings between the chairman and members of a group are very important to determine the success of the organization.

Routine meetings held are not only limited to group activity schedules, training information, competition information, but more importantly all Pokdarwis Arumsari members must know the purpose of the organization, how to achieve organizational goals, and programs run by the organization so that Pokdarwis Arumsari's role as village manager Tourism can be run optimally to attract tourist visits and increase local community participation, thereby bringing benefits to the welfare of local communities.

The existence of regular meetings between Pokdarwis Arumsari members is one of the applications of effective intepersonal communication for the long-term survival of the organization. At these regular meetings, each member gives an opportunity to contribute and know and not keep each other secret so as to create member comfort and trust. According to Raharso (2011) that information disclosure can create a sense of security, comfort, and protection in groups.

The feeling of comfort and security makes it easier for the group to maintain the sustainability of the group, including the existence of the group. Effective interpersonal communication within the group has succeeded in creating relationships or cooperation both within the group and with parties outside the group. In accordance with the opinion of Lestari *et al.,* (2019) which states that the ability of community groups with complex interpersonal communication systems will have extensive local networks and receive more information and knowledge.

In addition to openness, equality in Pokdarwis Arumsari can support and realize group welfare, for example by not discriminating between one another. Such as being given the same opportunity to participate in training, competitions, and get incentives. This equality can realize the welfare of members in the group. This is under the opinion of Marwanti & Astuti (2012) who states that equality can achieve group welfare. Positive and supportive actions in the group help members improve skills because there is no defensive action. Members support each other, help and respect each other to achieve the desired goals. In accordance with the opinion of Vipinkumar & Karippai (2002) states that positive action is defined as the quality of a person who has a positive attitude towards himself and others.

5. Conclusion

Communication is the process of exchanging messages or signs of information that aim to create a common meaning. Every organization seeks to be more effective and achieve superior results. The strategy used to achieve the success of an organization is the effectiveness of interpersonal communication. This execution occurs when the members of the organization have an open attitude, empathy attitude, support attitude, positive action, and equality. Based on the results and discussion, it can be concluded that the effectiveness of

interpersonal communication and the success of Pokdarwis Arumsari are included in the high category with a percentage score of 81.2% and 79.2%, respectively. This shows that Pokdwarwis Arumsari has good interpersonal communication effectiveness between its members so that success is realized in achieving the goals of Pokdarwis Arumsari. In addition, the effectiveness of interpersonal communication has a positive effect on the success of Pokdarwis Arumsari and the effectiveness of interpersonal communication can explain the success of Pokdarwis Arumsari by 73.9%. This paper identifies indicators of interpersonal communication. Thus the most important effectiveness of interpersonal communication was the members can maintain relationships with each others, so that carrying out their duties and responsibilities in the organization can be implemented well.

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Import of Agricultural Products in the Intra-Regional Comprehensive Economic Partnership (RCEP)

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ABSTRACT

The flow of agricultural products through imports has the potential to increase with the geographical conditions of adjacent RCEP countries. Economic and non-economic factors can affect imports of agricultural products. This study aims to analyze the spatial effect and the factors that influence the import of agricultural products in Intra RCEP. This study uses a data period from 2013-2019. The analytical method used in this research is Moran's global index, Local Indicator of Spatial Autocorrelation (LISA), and Geographically Weighted Panel Regression (GWPR). The results show a spatial effect of imports of agricultural products in intra-RCEP. China, Japan, and South Korea are countries that are geographically concentrated in importing agricultural products within the intra-RCEP. The factors that significantly affect the total value of imports of agricultural products are GDP per capita, trade openness, Foreign Direct Investment (FDI), and government effectiveness. The policy recommendations in this study are implementing the RCEP agreement in the long term, open market access, encouraging increased investment in the agricultural sector, and an efficient bureaucracy.

Keywords: agricultural product; GWPR models; import; RCEP; spatial effects

How to cite :

1. Introduction

ASEAN member countries (Indonesia, Malaysia, Singapore, Philippines, Thailand, Vietnam, Myanmar, Laos, Cambodia, and Brunei Darussalam) and ASEAN FTA Dialogue Partners (China, Japan, South Korea, Australia, and New Zealand) signed the *Regional Comprehensive Economic Partnership* (RCEP) trade pact on 15th November 2020, with one of the RCEP's representations being 27% of world trade (Gultom, 2020).

One of the products traded in intra-RCEP is products in the agricultural sector. Industrialization and the global economy's modernization have overtaken the agricultural sector's role. A slowdown in agricultural growth is inevitable as the share of the manufacturing and service sectors takes precedence over agriculture as the economy grows and matures. The decline in the importance of agriculture is evident in the fall in the growth rate of global agricultural trade from time to time (Hidayatie, 2014).

One of the activities in trading agricultural products on the global market is imports. The percentage of imports by type of product by intra-RCEP countries in 2018 was agricultural products (9.7%), industry (67.9%), and fuel with mining products (19.2%) (WTO, 2020).

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Agricultural products are in the lowest position against imports in intra-RCEP. In order to advance the agricultural sector among countries in the Asia Pacific area, agriculture is one of the most strategically important economic sectors to expand and increase cooperation in (Hermanto, 2018). Agriculture is growing due to lowered trade barriers (FAO, 2020). Trade liberalization will be accomplished through reduced tariffs under the RCEP framework. Many tariffs will be eliminated right away, Many tariffs will be eliminated immediately, while others will gradually decrease over the course of 20 years. The remaining tariffs will mostly apply to vital industries like agriculture, where several RCEP members have chosen not to make any liberalization commitments. Since many RCEP countries already have low import duties, the pact will provide primarily lower these tariffs on imports from China, Japan, and the Republic of Korea (UNCTAD, 2021).
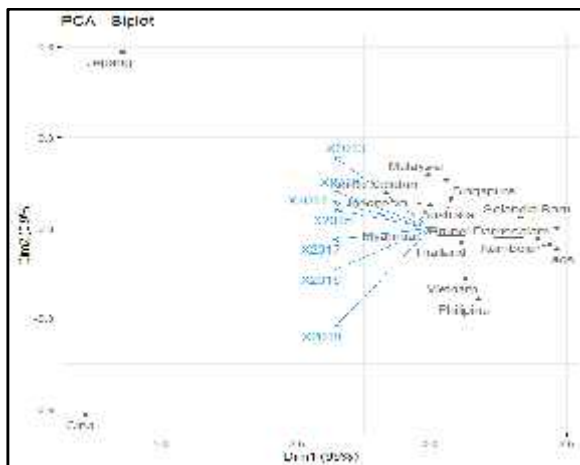

Figure 1. Biplot of Agricultural Product Imports in Intra-RCEP

An attempt to describe data as a two-dimensional graph is called a biplot analysis. The biplot's information incorporates variables (the total value of agricultural product imports) and research objects (15 nations participating in the intra-RCEP) in a single image. Dimension 1 displays the relationship between nations based on the total amount of agricultural products imported, whereas Dimension 2 displays the same relationship. Ninety-nine percent of the data on dimension 1 are diverse, while just 0.9 percent of the data on dimension 2 are diverse. Between dimensions 1 and 2, the total data diversity is 99.88 percent. The link between nations and the total value of agricultural product imports in 2013 and 2019 are both well explained by this information. Brunei Darussalam, Cambodia,

Myanmar, and Laos are a group of countries with a total import value of agricultural products that tends to be the same. Indonesia and Australia also have a total import value of agricultural products, which tends to be the same. The total value of imports of agricultural products from RCEP countries from intra RCEP has a high correlation in 2014, 2015 and 2016, 2017, 2018, and 2019. Countries with neighboring positions have more powerful interaction and influence than far-apart countries. Hence, the flow of goods through imports, especially agricultural products in intra-RCEP, has the potential to increase with the geographical conditions of adjacent RCEP countries. Spatial effects are one of the factors that play a role in the trade of agricultural products within the RCEP, the influence of which is determined by the proximity of the RCEP countries' territories (Figure 1). RCEP as Asia's new trade architecture can revive the Doha cycle, and agricultural trade liberalization is key to RCEP (Hsieh, 2017). Previous research on imports within RCEP was generally related to service products, namely (Azhari & Widyastutik, 2016). This study analyzes the total agricultural products. Previous studies related to intra-RCEP trade or imports generally used *the gravity model,* such as Yunarwanto (2019), Azhari & Widyastutik, (2016), and Chang et al., (2020). These previous studies did not use the spatial aspect in the analysis method. RCEP is a trade agreement between countries that influence each other and areas between countries that are geographically close to each other, namely the Asia Pacific region. This research uses a spatial approach. This study aimed to analyze the spatial effects and factors that influence the import of agricultural products in intra-RCEP.

2. Theoritical Underpinning

International trade is by residents between countries based on mutual agreements. Import is an international trade activity that makes the market more competitive (Mankiw, 2007). A country can import goods produced using scarce local resources (Krugman et al., 2015). Imports are domestic demand based on foreign goods (Blanchard & Johnson, 2017).

Economic interaction across space is called geographic economics (Krugman et al., 2015). Based on the new economic geography model (*new economic geography model*), spatial factors have become essential to international trade (Zhu, 2019). Various factors can affect imports. Economic factors that influence imports are real

income per capita (Mwangi, 2021), exchange rates (Blanchard & Johnson, 2017), investment and infrastructure support (Gultom, 2020), *Liner Shipping Connectivity Index* (Lin et al., 2020), and trade openness (Alamdarlo, 2016). Non-economic factors that influence imports are bureaucratic policies, one of which is government effectiveness (Ayuwangi & Widyastutik, 2013).

3.   Research Methods

This study used secondary data from 15 intra-RCEP countries (Indonesia, Malaysia, Singapore, Philippines, Thailand, Vietnam, Brunei Darussalam, Cambodia, Laos, Myanmar, China, Japan, South Korea, Australia, and New Zealand) with a period of 2013-2019. Agricultural products analyzed in this study use codes 01-24 in the *Harmonized Commodity Description and Coding System* (HS) catalog. This study analyzes the spatial effects and factors that influence the import of agricultural products in intra-RCEP with the analytical method described as follows:

3.1.   Method of Analysis of Spatial Effects on Imports of Agricultural Products in Intra-RCEP

The analysis of the global Moran index serves to see whether or not there is a spatial effect. Globally or across countries in intra-RCEP. Calculation of the Global Moran index using the following formula:

$$I = \frac{n \sum_{i=1}^{n} \sum_{j}^{n} w_{ii} \left(x_i - \bar{x}\right)\left(x_j - \bar{x}\right)}{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}$$

Description :
I= moran index of agricultural product imports; n=number of countries in intra-RCEP; x_i= value of imports of agricultural products in country i; x_j=total value of imports of agricultural products in country j; $\bar{x}$=The average value from n countries; w_{ii}=Elemen on a standardized weighting between countries i and j.

Analysis and grouping of countries with significant similarities to the value of imports of agricultural products locally using the *Local Indicator of Spatial Autocorrelation* (LISA) analysis method. The formula for calculating the global Moran index is:

$$I_i = Z_i \sum_{i=1}^{n} W_i\ Z_j$$

Description :
I_i = LISA Coefficient;
Z_i dan Z_j = Standardized data;

W_i = weighting between countries i and j where j is the country located around i (other than i).

The results of the LISA analysis on the grouping of the total value of agricultural product imports in intra-RCEP consist of four quadrants which show four import groupings, namely: (1) *High High cluster* (Quadrant I), namely countries that have high import value of agricultural products surrounded by countries with a high import value of agricultural products; (2) *Low-High outliers* (Quadrant II), namely countries with low import values surrounded by countries with high import values; (3) *Low-Low cluster* (Quadrant III), namely countries that have a low import value of agricultural products and are surrounded by countries with a low import value; and (4) *High-Low outliers* (Quadrant IV) are countries with a high import value of agricultural products but surrounded by countries with a low import value of agricultural products. Global Moran index analysis method and *Local Indicator of Spatial Autocorrelation* (LISA) using R Studio 4.1.2.

3.2.   Methods of Analysis of Factors Affecting Imports of Agricultural Products in Intra-RCEP

The model of import of agricultural products in intra-RCEP represents the factors that affect the total value of imports of agricultural products in intra-RCEP. Factors affecting imports of agricultural products are Real Gross Domestic Product (GDP) per capita, percentage of total Foreign Direct Investment (FDI) inflow to total Foreign Direct Investment (FDI) inflow, real exchange, trade openness, Liner Shipping Connectivity Index (LSCI) and governance effectiveness.

Determination of the variables used in the regression model of the factors that affect the import of agricultural products in intra-RCEP based on the theoretical basis and previous studies have been described on the theoretical basis. Source of research data obtained from: (a) the International Trade Centre (the total value of imports and exports of agricultural products in intra-RCEP); (b) World Bank (Real Gross Domestic Product per capita, percentage of total Foreign Direct Investment inflow to total Foreign Direct Investment inflow, Liner Shipping Connectivity Index-LSCI, and governance effectiveness); (c) International Monetary Fund (real exchange rate).

The definition of each variable consists of (a) The average income of a country's population at a particular moment is measured as per capita income; (b) The Liner Shipping Connectivity (LSCI) Index is an average measurement of the five factors that make up the marine transportation industry: the number of ships, their container carrying capacity, the largest ship size, the number of services, and the number of businesses that use container ships in the port economy (LSCI), which UNCTAD calculates, essentially serves as a measure of the availability of shipping services; (c) a person of a foreign country who invests in another country is said to have made a foreign direct investment (FDI) if they receive loans from that country or buy stock in a foreign company; (d) trade openness is calculated as nominal GDP divided by the sum of intra-RCEP agricultural exports and imports; (e) The real exchange rate is the product of the nominal exchange rate and the foreign price level divided by the domestic price level; (f) government effectiveness is a stand-in for Worldwide Governance Indicators (WGI), the information for which is sourced from the World Bank's official electronic website. The efficacy of the government's policies is determined by perceptions of quality concerning service to activities in general and the community, independent political pressure, quality policy design, implementation, commitment, and credibility. The regression that uses panel data (combined time series and cross-section data) is panel data regression. This study uses panel data (15 intra-RCEP countries for the period 2013-2019). The panel data regression model used in this study are:

$$LnIKP_{it} = \beta_0 + \beta_1 LnPDK_{it} + \beta_2 FDW_{it} + \beta_3 LnNTR_{it} + \beta_4 KBP_{it} + \beta_5 LnLSC_{it} + \beta_6 LnEFP_{it} + \mu_{it}$$

Description:
$LnIKP_{it}$: natural logarithm of the total value of imports of agricultural products in country i year t (USD); $LnPDK_{it}$: natural logarithm of real GDP per capita of country i year t (USD); FDW_{it}: percentage of total Foreign Direct Investment (FDI) inflow to total Foreign Direct Investment (FDI) inflow of country i year t (percent); $LnNTR_{it}$: natural logarithm of the real exchange rate of country i against the year t USD (LCU/USD); KBP_{it}: trade openness in country i year t (percent); $LnLSC_{it}$: natural logarithm of Liner Shipping Connectivity Index country i year t (index); $LnEFP_{it}$: natural logarithm of the effectiveness of state government i year t (index); μ_{it}: *error term* country i year-t; β_0: intercept; $\beta_{1,2,3,4,5,6}$: estimation parameters; i: 15 RCEP member countries; and t: 2013-2019 period.

The location of a country influences trade cooperation between countries. Geographical location determines the distance between countries, which is called the spatial effect (Saputro et al., 2018).

This research is continued by using spatial analysis. Spatial analysis correlates with spaces or spatial correlation because each country is assumed to be not stochastic-free. The conditions of all observed areas are not the same, for example, geographical factors. This difference allows the emergence of spatial heterogeneity. The analytical method that can overcome spatial heterogeneity is Geographically Weighted Regression (GWR). The GWR analysis method only analyzes one country at a time or uses cross-section data. Factors affecting imports of agricultural products in intra-RCEP using panel data. Modifying the regression model, which combines the GWR model and panel data regression, is the Geographically Weighted Panel Regression (GWPR) model. The GWPR model is built from the point approach method, which is based on the position of the latitude and longitude coordinates.

GWPR is a classical regression model development with each model parameter calculated in each country so that each country studied has a different regression parameter value and processed with R Studio 4.1.2. The GWPR model of the factors that affect the import of agricultural products in intra-RCEP are:

$$LnIKP_{it} = \beta_0(u_i,v_i) + \beta_1(u_i,v_i)LnPDK_{it} + \beta_2(u_i,v_i)FDW_{it} + \beta_3(u_i,v_i)LnNTR_{it} + \beta_4(u_i,v_i)KBP_{it} + \beta_5(u_i,v_i)LnLSC_{it} + \beta_6(u_i,v_i)LnEFP_{it} + \mu_{it}$$

Description: u : latitude coordinates of country i and v : longitude of country i.

The stages of the GWPR analysis method in this study are: (a) data exploration; (b) spatial effect test; (c) panel data regression analysis (poled least square, fixed, and random models); (d) selection of the best panel data models using Chow and Hausman test; (e) classical assumption test consisting of normality (Shapiro-Wilk normality test), non-autocorrelation (Durbin Watson test), homoscedasticity (Breusch-Pagan test), and non-multicollinearity (Variance Inflating Factor-VIF); (f) test for spatial diversity using the Breusch-Pagan test; (g) the estimation

of the GWPR model which consists of determining the optimum bandwidth, comparison of the regression model of the FEM and GWPR panel data, mapping the significance of the variables.

4.   Results and Discussion

RCEP is a trading block regulated as the world's largest trading block, which can become a new center of attraction in world trade. The agricultural sector is one of the economic sectors within the framework of the RCEP cooperation, in addition to the natural resources and industrial sectors. Agricultural trade in intra-RCEP generated a profit of US$ 10 billion, equivalent to an increase of 7 % (UNCTAD, 2021). This study analyzes the trade potential of agricultural products (imports) of RCEP member countries in the intra-RCEP region prior to the signing of the RCEP on 15th November 2020. This study focuses on trade in agricultural products among RCEP countries within the RCEP region. The total import value of agricultural products is the sum of the import values of HS 01 to HS 24 of RCEP member countries from intra-RCEP.

4.1.   Results of Analysis of Spatial Effects on Imports of Agricultural Products in Intra-RCEP

The results of the spatial effect analysis based on Economy protection on a broader geographical scale is one of the motives for joining a country in a *Regional Trade Agreement* (RTA). The flow of goods and services and investment can increase for the countries involved based on the geographical aspect is the goal of RCEP (Karina and Puspaningrum, 2014) the global Moran index are presented in Table 1.

Table 1. The Result of The Global Moran Index

Year	Moran Index Value	p-value
2013	0.570	0,000*
2014	0.572	0,000*
2015	0.569	0,000*
2016	0.570	0.000*
2017	0.565	0,000*
2018	0.562	0,000*
2019	0.545	0,000*

Note: * Significant at the 0.05 level of significance

The global Moran index of agricultural product imports in intra-RCEP is significant. It means a positive autocorrelation or the total import value of agricultural products tends to be clustered in adjacent countries so that there is an interaction of imports of agricultural products between adjacent countries (Table 1).

The results of this study follow the economic theory of geography related to cross-spatial economic interactions (Krugman et al., 2015), spatial influence on international trade (Zhu, 2019), and the increase in trade is influenced by the proximity of geographical distances between research countries (Yunarwanto, 2019); (Kabir et al., 2017).

Table 2. Distribution of the Moran index and the significance of the LISA value of the total import value of agricultural products in the intra-RCEP period 2013-2019

Quadrant	Country
I *High-high* (HH)	Cina*, Jepang* dan Korea Selatan
II *Low-high* (LH)	-
III *Low-low* (LL)	Kamboja*, Laos*, Australia, Brunei Darussalam Myanmar, Philipina, Selandia Baru, Singapura, Thailand, Vietnam Indonesia (2015, 2019), Malaysia (2017-2019)
IV *High-Low* (HL)	Indonesia (2013-2014, 2016-2018), Malaysia (2013-2016)

Note: *Significant at the 0.05 level of significance

Table 2 shows that the total value of imports of agricultural products is more grouped in quadrant II and less in quadrants I and IV. China and Japan (RCEP countries originating from ASEAN+1) are significant countries in quadrant I. It means that these countries have a high total value of agricultural products surrounded by countries with a high import value of agricultural products or countries with a high value of agricultural products. The country is geographically concentrated in carrying out intra-RCEP imports of agricultural products (Table 2).

China and Japan have a value of imports that is greater than the value of agricultural product exports (WTO, 2020). RCEP member countries originating from ASEAN are generally in quadrant III, meaning these countries have a low import value of agricultural products surrounded by countries with a low import value of agricultural products. The agricultural sector is one of the important

trade sectors in ASEAN. The export value of US$ 141,026.2 million is greater than the import value of ASEAN agricultural products of US$ 102,548.7 million in 2019 (Secretariat, 2020). ASEAN+1 countries such as China and Japan can import agricultural products from ASEAN countries, Australia and New Zealand. The results of this study contribute to the spatial mapping of imports of agricultural products in intra-RCEP, which should be contained in the one map policy. Karsidi (2014) stated that the one map policy is a policy for the preparation of geospatial information.

4.2. Results of Analysis of Factors Affecting Imports of Agricultural Products in Intra-RCEP

Import is one of the trade transactions in implementing the RCEP agreement (Gultom, 2020) and contribute to trade through product availability (WTO, 2021). The average value of total imports of agricultural products from intra-RCEP countries from intra-RCEP for the 2013-2019 period is USD 120.8 billion (ITC, 2021).
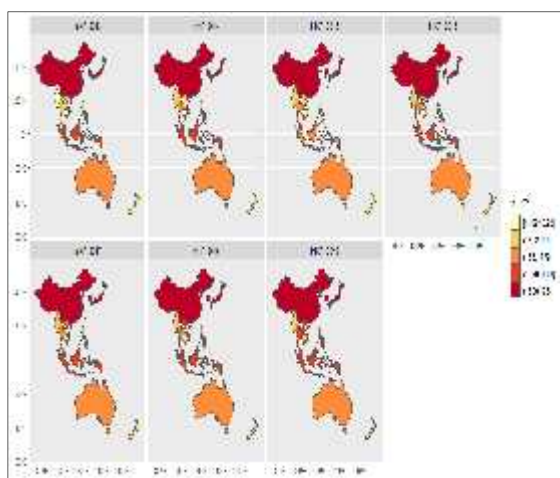

Figure 2. Mapping the Total Value of Imports of Agricultural Products from 15 RCEP Countries for the 2013-2019 Period

Countries in dark red have higher total imports of agricultural products. China, Japan, and South Korea had the highest total import values in intra-RCEP (Figure 2). International trade is by residents between countries based on mutual agreements. Import is an international trade activity that makes the market more competitive (Mankiw, 2007) and domestic demand based on foreign goods (Blanchard & Johnson, 2017).

The result of the GWPR analysis began with the results of the spatial effect test (as

explained in the description of the results of the global Moran index and LISA analysis), then continued with the results of panel data regression analysis and GWPR.

Table 3. Chow and Hausman Test Results of Panel Regression

Test	*p-value*	Result
Chow	< 2.2 e-16*	FEM model is better than CEM
Hausman	< 2.2 e-16*	The FEM model is better than the REM model

Note: *Significant at the 0.05 level of significance

The panel data models analyzed in this study consist of Pooled Least Square (PLS) model, Fixed Effect Model (FEM), and Random Effect Model (REM). The selection of the best intra-RCEP agricultural product import panel model among the three-panel data models uses the Chow and Hausman tests. Based on the results of the Chow and Hausman test, it was found that the fixed effect panel model (FEM) was significant as the best panel model (Table 3). The fixed effect estimation model (FEM) of agricultural product imports in intra-RCEP is:

$$\widehat{IKP}_{it} = 1{,}290\,PDK_{it}^* + 0{,}002FDW_{it} + 0{,}072\,NTR_{it} + 141{,}270\,KBP_{it}^* + 0{,}005\,LSC_{it} + 0{,}124\,EFP_{it}^*$$

Result analysis of the FEM models shows that real income per capita, trade openness, and government effectiveness significantly positively affect agricultural products' imports in intra-RCEP. The R-Square value is 0.912, meaning that the independent variables in the model can explain the variable imports of agricultural products in intra-RCEP by 91.2%. In contrast, other variables outside the model explain the rest.

The results of the classical assumption test on the FEM panel regression model are significant at the 5% significance level. The normality test with a *p-value* = 0.0006471 means the model has a residual that is not normally distributed. Non-autocorrelation test with *p-value* = 0.02354, meaning autocorrelation exists in the model. The Homoscedasticity test with a *p-value* = 0.0004324 concluded that there was heteroscedasticity. Non-multicollinearity test model with a *Variance Inflation Factor* (VIF) value lower than 5 indicates no high risk of multicollinearity between independent variables. The cause of heteroscedasticity is the observation location or country condition that is not the same

or homogeneous, resulting in a spatial effect strengthened by the Breusch-Pagan Test (Wati et al., 2021).

The spatial diversity test in this study used the Breusch-Pagan test. The results of the Breusch-Pagan test are the BP value of 24,445 with a p-value = 0.000, which is significant at a significance level of 0.005, meaning that there is spatial diversity in the resulting panel regression model. The Geographically Weighted Panel Regression (GWPR) model is a model that is suitable for use under conditions of heterogeneous diversity in each intra-RCEP country.

Table 4. Comparison of Kernel Weighting Functions

Kernel Function	Kernel Weighting Function	AIC	R-Square
Adaptive	Gaussian	-271.009	0.923
	Exponential	-278.530	0.930
	Bisquare	-289.800	0.939
Fixed	Gaussian	-271.721	0.925
	Exponential	-287.573	0.939
	Bisquare	-269.593	0.921

The estimation of the GWPR model begins with determining the optimum bandwidth presented in Table 4. Based on the model's goodness, modeling using the *Adaptive Bisquare* produces the smallest AIC value and the highest *R-Square* value compared to other kernel weighting functions. Therefore, the GWPR modeling uses spatial weighting with the Adaptive Bisquare kernel function.

Table 5. Comparison of Fixed Effect and Geographically Weighted Panel Regression Models

Model	R-Square	RSS	RMSE	AIC
GWPR	0.939	0.333	0.063	-289.800
FEM	0.912	0.477	0.075	-254.264

Based on R-square, Residual Sum of Squares (RSS), Root Mean Squared Error (RMSE), and the Akaike Information Criterion (AIC) that the GWPR model is better than the FEM model of imported agricultural products in intra-RCEP (Table 5).

GWPR produces model estimates at each location (country). The estimated value of the estimated coefficient of the resulting GWPR model differs for each country in the intra-RCEP.

One of the GWPR models in intra-RCEP is the GWPR model for imports of Indonesian agricultural products, described as follows:

$$\widehat{IKP}_t = 1.281\ PDK_t^* - 0.001\ FDW_t + 0.114\ NTR_t + 145.373\ KBP_t^* + 0.024\ LSC_t + 0.070\ EFP_t$$

Real income per capita and trade openness have a significant positive effect on imports of Indonesian agricultural products. The R-Square value is 0.931, meaning that the independent variables in the model can explain the import of agricultural products by 93.1%, while other variables outside the model explain the rest.
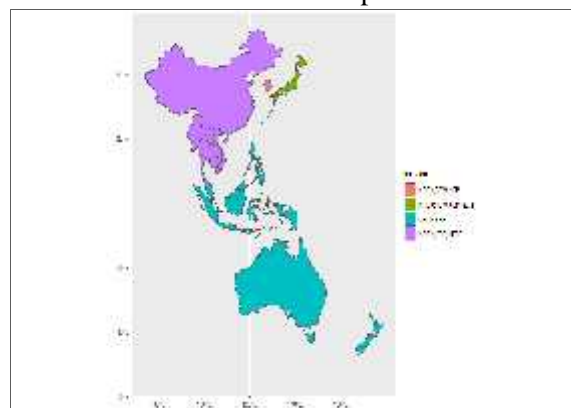

Figure 3. Factors that significantly affect the Import of Agricultural Products in the Intra-RCEP Period 2013-2019

Variables significantly affect the total value of imports of agricultural products intra RCEP by country at a significance level of 5 %. The real GDP per capita and trade openness variables significantly affect the total value of agricultural products in Australia, New Zealand, Indonesia, Singapore, the Philippines, and Brunei Darussalam (light blue). The value of total imports of agricultural products in other countries is influenced by real GDP per capita, trade openness, Foreign Direct Investment inflow, and government effectiveness (purple, green and pink colors) (Figure 3).

The analysis of the GWPR models shows that real income per capita has a positive and significant effect on imports of agricultural products in all RCEP countries. The results of this study follow the results of research by Mwangi (2021), which states that the GDP per capita has a positive and significant impact on imports of agricultural products. The average GDP per capita of 15 RCEP countries is US$ 19,507.9. RCEP countries can gain extensive trade benefits if the RCEP agreement has the same scope as other agreements and is

implemented in the long term so that the effect on GDP increases larger (Shepherd, 2019). The projected total income earned by RCEP member countries in 2030 is US$ 43,516 billion (ADB, 2020).

Trade openness significantly affects the total import value of agricultural products in all intra-RCEP countries. The results of this study follow the results of Alamdarlo's (2016) research. The average trade openness of 15 countries in the intra-RCEP period 2013-2019 is 0.005. China has a positive and high influence on trade openness on imports of agricultural products in intra-RCEP. Imports of cheap agricultural products are influenced by trade openness, and trade openness is influenced by market access effects (Djokoto, 2013). One of the potential benefits or benefits of RCEP is increasing market access among ASEAN+1 FTAs, which are still closed (Gultom, 2020).

FDI has a positive impact on exports and imports (Safitriani, 2014). The GWPR models indicate that imports of agricultural products in Japan and South Korea are significantly affected by positive signs of FDI. This study's results follow the research results of Pasaribu *et al.* (2021). The average FDI of 15 countries in the intra-RCEP period 2013-2019 was 4.896%, with Singapore as the country with the most significant percentage of FDI, which was 24.343%. The increase in FDI in the agricultural sector is enhanced with a focus on flexibility in trade policies (Osabohien *et al.* 2021), paying attention to aspects and conditions of the agricultural sector consisting of : (a) specific features and production of the agricultural sector, (b) improvement of the national agricultural situation and agrarian structure, (c) market regulation, (d) the role of the state, (e) rural development, (f) level of competitiveness as critical agricultural issues, (g) provision of incentives for FDI in the agricultural sector in the context of improving macroeconomic conditions and the investment climate (Jovovic et al., 2014).

The GWPR models show that imports of agricultural products in Japan, China, Myanmar, Laos, Thailand, Malaysia, Vietnam, and Cambodia are significantly affected by positive signs of government effectiveness. The results of this study follow the results of research by Suntharalingam dan Hassan (2016). The average government effectiveness was 66.061% in intra-RCEP. The RCEP countries consist of 10 ASEAN countries and 5 ASEAN+1 countries.

The average government effectiveness of ASEAN countries is 55,759%, lower than the average government effectiveness of ASEAN+1 countries of 86,667%. ASEAN countries generally comprise developing countries, and ASEAN+1 countries are developed countries. Ariabod et al., (2019). An effective bureaucracy controls the seamless flow of exports and imports of goods (Ayuwangi & Widyastutik, 2013).

5. Conclusion

RCEP member countries have a spatial effect so that there is an interaction of imports of agricultural products between neighboring countries in intra-RCEP. China and Japan are geographically significant countries importing agricultural products in intra-RCEP. The GWPR model is the best model to analyze the factors that influence the import of agricultural products in intra-RCEP. Factors that significantly positively affect imports of agricultural products in intra-RCEP are real per capita income, trade openness, FDI, and government effectiveness.

This study recommends a one-map policy related to imports of agricultural products, implementation of the RCEP agreement in the long term, more comprehensive market access for imports of agricultural products, increasing foreign investment in the agricultural sector, and implementation of efficient bureaucratic policies.

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Feasibility Assessment of Nampu Leaf (*Homalomena occulta*) Processing Bussines: a Case Study in The Mount Sawal Area

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ABSTRACT

Dried nampu leaves have become an export commodity as raw materials for the pharmaceutical, cosmetic, and herbal cigarette industries. However, the massive exploitation of nampu leaves in their natural habitat in forest areas has raised concerns that it could disrupt forest sustainability. Therefore, financial analysis is needed to find out whether this business could be expanded or not. This study aims to examine the feasibility of processing nampu leaves into dried chopped leaves, the challenges and the prospects for its development. We conducted a case study on a nampu leaf processing business group in Cihaurbeuti Subdistrict, Ciamis, West Java. Data was collected through in-depth interviews and field observations. The results showed that the nampu leaf processing business was feasible because of the availability of resources, an easy process and a relatively short payback period as indicated by the R/C value of 1.17 and BEP production of 2,596.15 kg and BEP sales of IDR38,942,307 which can be achieved in less than 1 year. The challenges of this business are the availability of raw materials, marketing guarantees and forest sustainability. Government assistance is very important in supporting the sustainability of this business.

Keywords: feasibility assessment; nampu leaf processing; *Homalomena occulta*

How to cite :

1. Introduction

Mount Sawal is one of the non-volcanic mountain ranges in the north Ciamis region, West Java. Mount Sawal area includes several districts, such as Panjalu, Kawali, Cipaku, Cikoneng, Cihaurbeuti, Sadananya, and Panumbangan (Widodo, 2013). Mount Sawal provides benefits for protection and also a variety of natural resources that can be utilized by the surrounding community.

The existence of forest and owned forest areas scattered at Mount Sawal foothill has a fairly important position as a buffer for the area and adds to the adequacy of green spaces in the Ciamis Regency. Moreover, community forests are also the same as natural forests, providing

environmental services such as water management regulators, carbon storage and shelters for various organisms, both micro and macro (Arts & Koning, 2017). The people who live around Mount Sawal use a lot of forest resources to meet their needs. As mentioned (Diniyati, 2014) that forests have benefits both direct and indirect. The direct benefits of forests are in the form of timber and non-timber products.

One of the obstacles in the management of community forests in the Mount Sawal Forest area is the economic pressure of the community which causes the land use change of community forests such become tourist attraction spots such as cafés, or agricultural land (Utomo et al., 2021). As mentioned economic pressures caused communities to turn forests into intensive agriculture. This threatens the success of conservation. Therefore, a more diverse employment field is needed to meet these needs (Diniyati & Afri Awang, 2010). To reduce threats

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and disturbances to the sustainability of the Mount Sawal Forest area, preventive and repressive efforts are needed through the empowerment of communities around the forest (Diniyati, 2014).

Currently, forest management by communities around the forest is carried out by many tropical countries. This is due to the assumption that the awareness of local communities about forests and the involvement of communities around the forest can provide mutual benefits both socially and environmentally (Boedhihartono, 2017). These benefits include poverty alleviation, deforestation reduction, and fire reduction (Meijaard et al., 2021).

One of the efforts to empower the community around the forest is to utilize plants around the Mount Sawal Forest which have economic value. *Nampu* (*Homalomena javanica*) is a plant of the Araceae (taro-taro) family that grows a lot around the forests of Mount Sawal. Currently, *nampu* leaves have become a primadonna in the export market as a substitute for tobacco, raw materials for the cosmetics industry and biopesticides.

Research on nampu leaves is still limited to the chemical content (Astuti et al., 2022; Ngan et al., 2022; Wei et al., 2022; Yang et al., 2019; Zhang et al., 2021) and traditional use of nampu leaves (Febriyanti, Hikmat, & Zuhud, 2017; Herlina et al., 2016; Liu et al., 2014; Supiandi et al., 2020, 2021). However, information regarding the use of nampu leaves on a business scale is still rarely found. This study aims to examine the feasibility of processing nampu into dried chopped nampu leaves as an export commodity along with the challenges and prospects for its development.

2. Theoretical Underpinning

The plant genus Homalomena is predominantly found in the Neotropics and Asian tropics (Yeng et al., 2013). The Homalomena genus consists of more than 500 species and is the least known, which makes them very complex, most of them are used as a medicinal plant (Boyce, 2011). Nampu or *Homalomena javanica* is a wild plant, which has not been widely cultivated. This species; which have other heterotypic synonyms i.e. Homalomena paliformis Alderw. and Homalomena latifrons Engl., is native to Sumatra, Java and Borneo island (Royal Botanic Garden, 1912). This species has not been studied much, considering it has a large genus and a narrow species distribution. Some related research on nampu includes nampu as a cultural commodity, nampu as a medicinal plant and nampu as an anti-bacterial (Andriyanti et al., 2019; Dubost et al., 2019; Gowthami et al., 2021; Islamiati et al., 2020; Kurniasih et al., 2022; Rudra et al., 2021; Siregar, 2018).

Nampu has the potential, usefulness, and market opportunity so that nampu in nature is taken for sale. Nampu leaves have become an export commodity to Japan, Australia, and America which are used as herbal raw materials and as a substitute for tobacco (Jatmika, 2022). Starting from here, the business of processing *nampu* leaves becomes interesting to be developed.

An economic feasibility study is a detailed study of a business or project to determine its likelihood to flourish in the future by considering all critical aspects, including potential problems or issues. In business, success is usually defined by the return on investment primarily, in which the breakeven point analysis viewpoint is used. However, there are other aspects to be considered on both pros and cons sides such as the environmental impact, or community approval.

The increased demand for nature-based health remedies and the integration of endemic flora into global value chains may have negative effects on ecosystems, even though improvements in the sustainable management of natural resources have developed over time (Volenzo & Odiyo, 2020). Thus, a detailed understanding of their demand and production systems is important for the exploitation and commercialization of wild medicinal plants. On the other hand, the primary justification for wild plant cultivation is through an economic feasibility study (van Wyk & Prinsloo, 2018). Therefore, an economic feasibility study of nampu is needed. To assess the feasibility of processing *nampu* leaves business, a cost and revenue analysis approach is used (Rahim et al., 2012; Suratiyah, 2015). Business feasibility analysis with this approach has been widely used, such as a financial analysis of the casava industry (Hardyastuti et al., 2021; Wong & Boyce, 2020), the financial feasibility of citrus (Sari et al., 2020), the economic feasibility of longevity spinach extract (Tristantini et al., 2021), and financial analysis of small-scale mango (Adams et al., 2019).

This research used Revenue Cost Ratio (R/C) dan Break Even Point analysis. R/C analysis is intended to determine the efficiency of the capital used by comparing the total revenue with the total cost. Farming is said to be feasible if the

R/C value is more than 1. While the Break Even Point analysis is the point of return that occurs in a business where the total revenue is equal to the total cost. This analysis is used to find out when the position of the business gets a profit either in production or in total sales. Both analyses are also widely used in agricultural research to assess the feasibility of their business (Arianti & Saputro, 2020; Arwati et al., 2022; Asciuto et al., 2019; Audry & Djuwendah, 2018; Fadhilah et al., 2022; Nurnimah et al., 2020).

3.   Research Method

The research was conducted in Cihaurbeuti Village and Panumbangan Village, Ciamis Regency. The area is on Mount Sawal foothill with varied topography, including flatland, and hills and is traversed by several rivers. The location of community forests around Mount Sawal Area with altitudes ranging from 200 meters above sea level-700 meters above sea level with an average rainfall of 3,360 mm/year (Herdian et al., 2020). The natural shade tree for *nampu* is mahogany, *sengon*, African mahogany, bamboo, and gmelina. *Nampu* grows naturally under community forest stands without maintenance.

Data collection was carried out through in-depth interviews and field observations. Detail-oriented information can be gathered by conducting in-depth interviews. The main benefit of conducting in-depth interviews is that they offer far more thorough information than other data collection techniques, including surveys. They might also offer a more informal setting for information gathering; people might feel more at ease talking to you about their program than completing a survey (Boyce & Neale, 2006). Interviews were conducted with key respondents who were considered to understand *nampu* and its use in the Mount Sawal area. The respondents included farmers who took *nampu* from private forest/state forest areas, community leaders, village officials, as well as *nampu* collectors/dealers, and the leaf processing business actors. The gathered information includes the origin of *nampu*, cultivation, utilization, processing, and marketing of *nampu* leaves. Cost and income data to calculate the financial analysis were obtained from an interview with one of the informants, the leaf processing business actors.

The data obtained were processed and analyzed descriptively. To assess the feasibility of the *nampu* management business, the Revenue Cost Ratio and Break Even Point analysis approach was used. Furthermore, the business is categorized as feasible if the period of return on investment from the business can be achieved less than the economic life of fixed capital (buildings and production machines).

$$R/C = \frac{TR}{TC} \qquad (1)$$

$$BEP\ Production = \frac{TFC}{(P_y - VC)} \qquad (2)$$

$$BEP\ Sales = \frac{TFC}{(1 - (TVC/NP))} \qquad (3)$$

Remark:
TFC   = Total Fixed Cost
Py   = Unit Price
VC   = Variable Cost per kg
TVC   = Total Variable Cost
NP   = Total Sales

Furthermore, the business is categorized as feasible if the R/C value > 1 and the break-even point of the business can be achieved in a faster time.

4.   Result and Discussion

4.1.   Ethnobotany *nampu*

The Homalomena family has many species, according to (Wong & Boyce, 2020) there are already six species, and *H. javanica* is one type of wild plant that thrives in mountain areas, riverbanks, and lake banks. *Nampu* is also grown as an ornamental plant in a shaded area or the community garden. *Nampu* has regional names called *Cariyang bodas* and *Cariyang beureum* (Sundanese), *nampu* (Java) (Kurniasih et al., 2022). *Nampu* rhizomes contain several chemicals such as saponins, flavonoids, tannins and polyphenols, while the leaves contain saponins and flavonoids (Dalimartha, 2003).

Nampu is typically 50-100 cm tall when mature. They have a woody round stem, with brownish-purple colour and form an elongated rhizome. The leaves are single, around 50-60 cm long, fleshy rounded, with a heart-built shape leaf blade, pointed tip and flat edges, the leaf surface is slippery and the colour is dark green. Hump-shaped clustered with purple colour flowers grow in the leaves node and the fruits are round in red with brown seeds (Dalimartha, 2003). Two types are known, i.e. green *nampu* and red *nampu*.

Figure 1. *Nampu* grows wild on the floor of Mount Sawal Area

Nampu has several uses, such as an ornamental, medicinal plant, herbal cigarette raw material, raw material for compost, food wrapping, and also as biopesticide material as presented in Table 1. The use of *nampu* as an ornamental plant is more widely known than knowledge of the use of *nampu* as a medicinal plant and other uses, such as food wrapping (dry *tape*/fermented cassava) or use as a medicinal plant. In some areas, *nampu* has also been used by the community for various purposes. In Pamarican Subdistrict, Ciamis Regency, the community has used *nampu* leaves to help the fermentation process of *kepayang* or *picung* seeds and close the palm juice *pagasan* so that it is not disturbed by bees and as a protection from sunlight and rain. Not only in Ciamis, but *nampu* is also widely used by the community for various purposes as a property that must exist in traditional and cultural events.

Nampu leaves combined with other types of plants are irreplaceable conditions in the "Ngalaksa" culture which is a symbol of farmers' gratitude for the rice harvest in Rancakalong District, Sumedang Regency (Islamiati et al., 2020; Komarudin, 2016). Almost the same phenomenon also occurs in Borogojol Village, Majalengka Regency, where *nampu* leaves are used by the community in a series of cultural activities "*Buku taun*" which are held as a form of gratitude for the rice harvest. *Nampu* leaves are used in the process of squeezing rice which will be used as an ingredient in making processed food called *baliung* (Andriyanti et al., 2019). Moreover, in Sindanglaya village, Lebak Regency, Banten, *nampu* leaves are used by the people of Kasepuhan Pasir Eurih as a cover for *pagasan* (the part of the tapped bunches of palm flowers) for 2-3 days

before the sap water is accommodated in a bamboo tube for the sap to come out more (Febriyanti, Hikmat, Ervial, et al., 2017).

As a medicine, *nampu* can cure various diseases such as rheumatoid arthritis, and anti-inflammatory and abdominal pain (Kurniasih et al., 2022). Other species such as *H. aromatics* are used for gout, rheumatism, snakebite, dysentery, aromatics, stimulants, and flu (Rudra et al., 2021). This is because *nampu* has various secondary metabolite compounds, the phenolic compounds, steroids, and saponins which are useful as medicines (Siregar, 2018). The root and stem of *H. occulta* are used as a medicine for digestive and rheumatism. The rhizome of *Homalomena sp.* is used for skin ulcers (Dubost et al., 2019). *H. aromatica* in India is primarily used by locals for health care (Gowthami et al., 2021). *H. occulta* is used for rheumatism, numbness of limbs, traumatic injury, and bone fracture in China (Hong et al., 2015). *H. philippinensis* (*Pajaw*) is taken orally for Beri-Beri diseases in the Philippines (Langenberger et al., 2009). However, the use of *nampu* for medicine is still rarely done by the people around Mount Sawal.

Table 1. *Nampu* utilization

Utilization of *nampu*	Used part
As a medicinal plant	Leaf, tuber/root, stem
As an ornamental plant	All parts of the plant
As a raw material for herbal cigarettes	Leaf
As a raw material for compost fertilizer	Leaf
As a food wrapper	Leaf
As a biopesticide	Leaf

Source: Primary data; (Dalimartha, 2003; Hartati, 2011; Jatmika, 2022; Kurniasih et al., 2022; Rudra et al., 2021; Sihombing et al., 2016; Siregar, 2018).

4.2. Feasibility of *nampu* leaf processing business

There are several weeds such as *nampu* that could be advantageous for people, animals, and the environment. Although the ancient society's perspective does not yet have economic value, *nampu* frequently becomes a property requirement that must be present in the local tradition in West Java. However, the community's perception and value of these plants have changed recently.

Nampu leaves have been improved to the point where they are now valuable export products with a competitive advantage over other plants.

Nampu has recently been processed as the basic ingredients for cosmetics, herbal cigarettes and compost for export markets. This makes the business of processing *nampu* leaves for export commodities quite prospective during the pandemic. On the other hand, the pandemic has proven to have a significant impact on the global economy, including Indonesia. The sectors affected during the COVID-19 pandemic are transportation, tourism, trade, health and other sectors (Susilawati et al., 2020). To fulfil the demands, the community around Mount Sawal collect the *nampu* leaves from the surrounding forest intensively.

Figure 2. *Nampu* leaf processing

As news about *nampu* can be obtained from numerous internet sources, the *nampu* leaf processing industry has become increasingly widespread. Moreover, the raw materials are still abundant in the forest. The *nampu* leaf processing industry produces semi-finished goods. Typically, they purchase from local forest harvesting. The leaves are subsequently dried, wilted, and then shredded to the buyer's specifications. Because it doesn't need many employees, this kind of business is rather simple. As an illustration, one person can operate one shredding machine.

The process of shredding leaves is done well in the morning. Since the drying processes rely on sunshine. Typically, one machine unit is only utilized to process *nampu* leaves weighing approximately 200 kg. Even though the equipment is capable of processing 200 kg per hour. The yield of *nampu* leaves from wet to dry is approximately 7:1, meaning that it takes as much as 7 kg of wet leaves to generate 1 kg of dry leaves. *Nampu* leaves are fermented until they turn yellow before being collected. The quality of the dried product is greatly determined by this fermentation process. The grade and price of the leaves increase with their colour. The lighter colour of shredded leaves has better quality.

Table 2. Costs and benefits analysis of processing *nampu* leaf in one year

No.	Description	Volume		Cost (IDR)	Benefit (IDR)
1	Fixed costs:				
	-Investment costs of facilities and infrastructure of production units per year	Package	1	3,000,000	
	-Land rent per year	m^2	700	1,500,000	
	-Tool depreciation costs per year			3,000,000	
	Total fixed cost			7,500,000	
2	Variable costs:				
	-Procurement of raw materials per year	Kg	75,600	75,600,000	
	-Labour costs per year	Working day	720	54,000,000	
	-Electricity cost per year	Package	1	1,200,000	
	Total variable cost			130,800,000	
3	Total Cost			138,300,000	
4	Production	Kg	10,800		
5	Price per kg			15,000	
6	Income				162,000,000
7	Business feasibility criteria				
	-R/C	1.17			
	-BEP production (Kg)	2,596.15			
	-BEP sales (IDR)	38,942,307.7			

The very minimum of facilities and equipment, such as huts for the wilting and shredding process, land, shredding machines, drying trays and equipment, are required to set up

a leaf processing operation. The minimum cost required for the investment is around IDR30,000,000 for economic use for 10 years or IDR3,000,000 per year. In addition to investment costs, other cost needs of a non-fixed nature are the purchase of raw materials, electricity tokens and labour costs. The requirement of raw materials in one-month averages 6,300 kilograms of wet *nampu* leaves or 75,600 kg per year. Meanwhile, the required workforce is IDR54,000,000 per year.

The *Nampu* leaf processing business has good prospects because it can generate positive income. The R/C value of 1.17 indicates that every IDR1,- of capital invested in the business can generate revenue of IDR1.17,-. This shows that the business of processing *nampu* leaves into dried chopped leaves is currently still feasible. From 75,600 kg of wet *nampu* leaves, on average, they can be processed into dry shredded leaves with a 14.2% yield to produce 10,800 kg of dried shredded leaves per year. The best grade of shredded leaves can be sold for Rp. 15,000 per kilogram. Therefore, the potential income of the processing business in one year reaches IDR162,000,000. It takes at least 2,596.16 kg of production to reach the *nampu* leaf processing business to reach the Break-even point or at least IDR38,942,307.7 total sales.

The *nampu* leaf processing business is very prospective from cost and benefit analysis as long as the raw material from nature is abundant and the export market are stable. As mentioned by (Nursodik et al., 2021) that the production factor is one of the factors that affect export volume. The time required to return investment capital is relatively short because it is less than two years. Therefore, this business has a positive prospect and is worth running. Based on the description above, *nampu* as an agricultural commodity contributes to the economy of the community around the Mount Sawal Forest. As stated by (Saleh et al., 2020), the agricultural sector still plays an important role in economic development in Indonesia. Moreover, it is hoped that farmers in West Java will seize this opportunity by taking part in the development of *nampu* cultivation because there is a great market demand for export (Sukmana, 2021).

4.3. Opportunities and Challenges of *nampu* in the future

This industry began with opportunities to export half-finished *nampu* leaf products. The *nampu* leaf industry is appealing to farming communities due to the high cost of processed leaves for export and the availability of natural raw materials for free exploitation. However, middlemen and exporters of *nampu* products are still limited. This issue and closed marketing chains cause farmers or Micro, Small, and Medium Enterprises (MSMEs) to depend solely on demand from middlemen/exporters. During the Covid-19 pandemic, the market was still closed causing fluctuating demand by exporters. This is a challenge for farmers to anticipate alternative domestic markets. It is crucial for the government to promote the provision of market data and assurances that farmers' products would be accepted by the industry. When making recommendations for public policy, the relationship between the state of financial resources and the techniques used within the frameworks of market orientation and entrepreneur orientation is advantageous (Eggers, 2020).

In rural areas, small industries of cigarettes made from *nampu* are categorized as MSMEs. MSMEs tend to be low in capital and low in productivity. However, MSMEs are more flexible to adapt to a new business environment than large companies (Soriano & Dobon, 2009). Consequently, they have a stronger survival power against change (Liñán et al., 2020). The challenge is to generate innovation to maintain industry performance (Espallardo & Ballester, 2009). The market potential stimulates the community to collect leaves from natural distribution around the forest, both community forests and conservation forests (Sukamana, 2021). If this activity is prolonged, *nampu* leaves will vanish in their native habitat, endangering the operation of the business. The demise of the business is due to a lack of resources and innovation (Neil Lee et al., 2015).

The challenge is to direct the community's motivation to get income from the *nampu* plant to be sustainable while preserving the ecosystem service provided by the forest. In many cases, economic pressure often destruct the environmental services of ecosystems whilst conventional agriculture has relatively negative environmental and social effects (Godfray et al., 2010). Moreover, one of the main threats towards wild medicinal plants is the significant loss of genetic diversity driven by unsustainable exploitation and habitat destruction Awuchi (Awuchi, 2019). Therefore, it is important to cultivate *nampu* underneath the community forest, considering that its existence in nature is getting

scarce. This practice could be a long-term agricultural solution to uphold the community's ability in performing both economic and environmental functions (Hairiah & Ashari, 2013).

The other issue is the availability of farmers' capital for production facilities and infrastructure. This requires incentives from the government in the form of intensification training for farmers or funding for the development of agroforestry community forests (Achmad et al., 2022; Diniyati & Achmad, 2016; Diniyati & Afri Awang, 2010; Martini et al., 2017). It is essential to improve the managerial, technical, and social ability of farmers to provide resources, technical cultivation, product marketing, partnerships, and resource management, such as in the development of social media accounts, the design of promotional materials, and sales (Suprayitno, 2011) through training, assistance and counselling (Ruhimat, 2014). The other essential thing needed from the government is the intelectual property rights of the *Nampu*, since this species is native to Borneo, Java and Sumatra island. As stated by (Hishe et al., 2016; Volenzo & Odiyo, 2020), an inadequate regulatory framework on intellectual property rights might exacerbate the exposure of the genetic resources to biopiracy, which could become a hindrance in the flourishing the *Nampu* leaf industry.

The majority of villagers are conducting home industry, which typically has limited resources and connections in the business world (Barnawi, 2019). In order to assist its development, the Village Fund can be used as social assistance, training, and capital in empowering rural MSMEs. Furthermore, collaboration built with distributors, suppliers, and research institutions is needed (Markovic et al., 2021).

The selection of external factors is an essential factor in increasing open business to business innovation management (Bigliardi & Galati, 2016). This can be in the form of supply of raw materials, joint marketing, management and exchange of information. The working relationship is one of the factors that make SMEs survive and facilitates the provision of raw materials according to market demand (Widiyanto et al., 2021). Collective action will make the management of the SME industry that is more efficient and streamline.

Lack of digitalization, technology adoption and limited online individual and family-owned SMEs are the problems faced recently (Bartik et al., 2020). In the era of the industrial revolution 4.0, traditional industries that do not modernize technology and develop product, output, and marketing products will be reduced or unable to compete (Barnawi et al., 2019). A strategy is needed by adopting digital transformation to maintain industry sustainability (Bai et al., 2021). This requires the support of the government, partners, marketing chain and community

5. Conclusion

Nampu leaf processing business by small and medium enterprises around the Mount Sawal area deserves to be developed because the process is easy and the time required to reach the break even point for the business is quite short. Some of the challenges in this business are the availability of raw materials, marketing guarantees, and forest sustainability. For this reason, government support and assistance is needed so that the *nampu* leaf processing business is more profitable and sustainable. Government support can be conducted in the form of community empowerment to improve management, social and technical skills as well as capital. Communication skills with foreign markets are required. Digital transformation is needed for the sustainability of small industries in rural areas. Assurance of market sustainability is important so that the *Nampu* leaf SME business continues to encourage the rural economy. Product value chain analysis is needed to determine the role between parties, effectiveness and business sustainability Furthermore, optimization of agroforestry patterns under community forest stands is necessary so as not to depend on natural plants and to ensure the availability of raw materials for the *nampu* leaf industry.

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Risk Analysis of Indonesian Mango Sustainable Supply Chain For Singapore Market

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ABSTRACT

UD WN Mango Sultan, Gresik succeeded in exporting 1 ton of mangoes to Singapore in 2021. However, exports are still not sustainable because they are constrained by several risks faced in the mango supply chain. To support the development of mango sales, it is inseparable from good and sustainable supply chain management. Good supply chain management can reduce or anticipate the risks that are often faced by every supply chain actor. To reduce the impact of emerging risks, it is necessary to identify priority risks for further risk mitigation actions. This study aims to identify risks seen from the perception of each sustainable supply chain actor and evaluate the highest priority risk of each sustainable supply chain actor in mango commodities. The study uses primary data by conducting interviews and filling out questionnaires by informants from businessmen, farmers, and collector of mango commodity in Gresik District. Fuzzy Failure Mode and Effect Analysis (FFMEA) technique is used to determine the priority of risk mitigation efforts. The results show that there are 16 risk components for UD WN Mango Sultan and collectors, and 11 risk components for farmers. Meanwhile, the priority risks for farmers, collectors, and UD WN Mango Sultan are operational risk (5,355), social risk (7,414), and environmental risk (7,917).

Keywords: risk; sustainable supply chain; FFMEA; mango

How to cite :

1. Introduction

Mango has the prospect of becoming a leading horticultural commodity, both for domestic needs and for export purposes (Mulyawanti I et al., 2008; Maharani, 2020; *Le et al.,* 2022). According to the Central Bureau of Statistics (2019), East Java occupies the first position as a national mango production center with total mango production reaching 1,148,121 tons in 2019. This number shows an increase from the previous year which only reached 1,059,326 tons. Mango production in East Java is spread over several areas such as Situbondo, Pacitan, Bondowoso, Pasuruan, Lumajang, and Gresik. According to the (Rhendy K.W, 2014; Alam, 2018; Shrestha, Raj Joshi, & Pandey, 2020; Le et al., 2022) , mango (*Mangifera indica*) is a national superior fruit commodity that can act as a source of vitamins and minerals, increase farmer's income, and support industrial development and exports.

In 2003, the export volume of Indonesian mangoes reached 559 thousand tons or equivalent to 461 thousand US$ while the import volume reached 348 thousand tons or the equivalent of 329 thousand US$. So the export volume of Indonesian mangoes is still higher than the import volume of 211 thousand tons or equivalent to 132 US$ (Kencanaputra, 2014). Mango is one of the fruits that is excellent in both local and international markets. The suitability of the land and the tropical climate in Indonesia makes it easy for farmers to cultivate mangoes. So that mango production is abundant and has increased every year. However, the data shows that the large amount of mango production is not matched by the improvement in the quality of mangoes for export. Based on Outlook mango written by Kencanaputra (2014) it is projected that the number of mango

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exports from 2014 to 2019 will experience a decline. However, this volume does not exceed the volume of mango imports in Indonesia. In fact, in 2019 exports of several agricultural products increased, including mangoes. According to Maharani (2020) it is noted that although in the 2019 - 2020 period there was an economic slowdown, in 2020 the export of mango and mangosteen commodities increased by 134.49 percent. With these developments, it will open up opportunities in developing trade and local mango processing in Indonesia. To support this development, the sustainability of mango production must be maintained so that local and export demand for mangoes can be met.

UD WN Mango Sultan is one of the mango entrepreneurs in Gresik and managed to export to Singapore in 2021. However, exports made by UD WN Mango Sultan are still not continuous. Mango sales continuity efforts must be supported by sustainable supply chain management. SSCM or sustainable supply chain is the management of the flow of material, information and capital which is a collaboration between companies along the supply chain by integrating objectives that include the three dimensions of sustainable development, namely economic, environmental, and social which are described from the demands of customers and stakeholders (Seuring, 2013; Song, Ming, & Liu, 2017; Rostamzadeh et al., 2018; Valinejad & Rahmani, 2018). The existence of sustainable procurement can support the sustainability of the mango export business in Gresik Regency. The increase in mango production and the development of the mango sales network must continue to be carried out as an effort to increase the superior commodity of Gresik Regency.

In the distribution of mango itself, there are several actors involved in it. According to Sulistyowati et al., (2016); Alam (2018); Pedekawati et al., (2017) actors who play a role in the mango supply chain include farmers, collectors, traders, exporters, and processing industries. The large number of actors involved, can indicate the existence of risks in an increasingly diverse supply chain. According to Song et al., (2017); Rostamzadeh et al., (2018); Xu et al., (2019); Moktadir et al., (2021) risks in a sustainable supply chain are divided into operational risks, environmental risks, social risks, and economic risks. Risk itself is a possible situation or situation that can threaten the achievement of the goals and objectives of an organization or individual (Riyadi, A et al., 2018; Giannakis & Papadopoulos, 2016; Gurtu & Johny, 2021). Therefore, the emergence of risks in supply chain activities can cause losses, so these risks need to be controlled so that the activities carried out are more efficient.

According to Aini (2014) and Gurtu & Johny (2021) good risk management is needed to manage supply chain risk so that it can produce an effective and efficient supply chain to increase the competitive advantage of the mango supply chain. Good risk management starts from identifying risks that may occur along with the factors that cause them. Then risk measurement is carried out on the potential risks that have been identified to determine mitigation efforts (Mishra, P.K. and Shekhar, 2011; Herlambang, Batt, & McGregor, 2005; Gurtu & Johny, 2021). So in this study, researchers conducted a study on "Risk Analysis in Sustainable Supply Chain of Mango Commodities in Gresik Regency". This study aims to (1) identify risks seen from the perception of each sustainable supply chain actor for mango commodities in Gresik, East Java, (2) evaluate the highest priority risk of each sustainable supply chain actor in mango commodities in Gresik, East Java.

2.   Theoritical Underpinning

Sustainable supply chain management is the coordinated creation of supply chains through voluntary integration with economic, social and environmental considerations with key inter-organizational systems designed to effectively and efficiently manage materials, information and capital flows relating to procurement, production and product or service distribution business in order to meet the requirements of stakeholders and increase the profitability, competitiveness, and resilience of the organization in the short and long term (Seuring, 2013; Dubey et al., 2017; Koberg & Longoni, 2019; El-Sayed et al., 2021).

In this study, the sustainability aspect can be seen from 4 aspects, namely social (Giannakis & Papadopoulos, 2016), environment (Moktadir et al., 2021), economy (Xu et al., 2019), and operational (Song et al., 2017). Of the four risks studied, it can have an impact on the losses of each supply chain actor. So it is necessary to carry out sustainable supply chain management. Risk management refers to the implementation of strategies and plans to manage supply chain networks through constant risk assessment and

reduce vulnerabilities to ensure resilience in supply chain (Gurtu & Johny, 2021).

Jaya, R et al., (2014) conducted a research on sustainable supply chain risk analysis with the aim of knowing the most influential risk factors and determining their mitigation in the Gayo coffee supply chain structure. The results show that for farmers, the biggest risk is quality and cultivation with mitigation in the form of improving cultivation technology, focusing on pest and disease management. For collectors, the fulfillment of quality and price, with mitigation in the form of improving drying techniques through the use of para-para and mechanical dryers. Meanwhile, in the agro-industry the biggest risks are quality and price.

The research conducted by Winanto and Santoso (2017) in this research shows that there are several identified risks to supply chain actors in terms of supply and demand. The priority of supply chain risk for farmers (suppliers) is related to the risk of government policies, namely policies related to the import of shallots; priority supply chain risk of intermediaries (distributors) related to the risk of competition with shallot importers; and the priority of a retailer's supply chain risk is the risk of competing with other retailers. Previous research was also conducted by Syamsiyah, N et al., (2019) where the research aimed to identify the risks of mango farming in agro-tourism development in Cirebon Regency. The result of risk identification is that the risks in mango farming are classified into 4 categories, namely supply risk, operational risk, financial risk and environmental risk. In farming activities carried out by mango farmers, the risk that has the highest

value is the natural/environmental risk. This is an equation in this study, namely analyzing risk in a sustainable supply chain. This study looks at the risk that is a priority for each supply chain actor by looking at the risk components of the sustainability pillar. The risks faced are divided into social, operational, environmental and economic risks, each of which is composed of several risk components. In the situation of this research, supply chain actors have different risk priorities based on their views on sustainability aspects.

3.   Research Method

The approach used in this research is a quantitative approach. Based on Samsu (2017), quantitative research methods are used to study a particular problem that requires an explanation of the variables used, can know the number of respondents quantitatively, analyze the research data obtained in the form of numbers displayed in statistics and graphs, and identify impartially as well as objective. The research location is in Gresik District as one of the largest mango producing areas and has become an icon in Gresik. While informants are needed to identify variables and the supply chain actors, verify the system that was built and provide justification for the risk component in the sustainable supply chain of mango commodity. The informant selected has to have comprehensive knowledge related to mango supply chain, so the informants in this research are farmers, Mango Collector, and UD WN Mango Sultan.   Risk factor at this research can be identified at this table.

Table 1. Risk Factor of SSCM

Risk Factors	Description
Operational Risk Factors (Song et al., 2017)	
R1: Uncertainty about mango supply and demand	Inaccurate demand forecasting, uncertainty in the face of competition in the market, excess or shortage of mango supply (Tang and Musa, 2011)
R2: Failure to choose a good supplier	Failure to select suppliers that have better sustainability performance according to social, economic and environmental objectives (Jharkharia dan Shankar, 2007)
R3: Poor ability to respond to changing requests	Failure to respond to changing requests quickly and at a reasonable cost (Simchi-Levi, 2010)
R4: Poor quality and process for handling supply sources in the field	Failure to identify, monitor, and reduce disruptions in production and distribution so that products can be damaged during shipping or during production. (Tummala and Schoenharr, 2011)

Risk Factors	Description
R5: Lack of coordination between supply chain actors	Coordination is needed to reduce distortion of information, differences in masters between supply chain actors, or reduce disputes between supply chain members (Kanda and Deshmukh, 2008)
R6: Limited knowledge about sustainability and technology	Lack of necessary IT infrastructure and mechanisms to capture and disseminate timely information among supply chain members (Dubey et al, 2017)
R7: Lack of market information	Access to market information results in a lack of information on prices, promotions, and distribution locations of mangoes.
R8: Product quality diversity	The resulting product has a different quality or quality (Rostamzadeh et al., 2018)
Economic Risk Factors (Xu et al., 2019)	
R9: Price and cost volatility	Instability of prices and costs that can affect reliability in making timely deliveries and maintaining product quality (Tang dan Musa, 2011)
R10: Reduction of market share	Reduction of market share due to external and internal reasons (such as: competition and poor quality) (Afgan dan Carvalho, 2004)
R11: Inflation, taxes and export costs	Inflation and variations in tax uncertainty that can affect the finances and effectiveness of a sustainable supply chain (Tummala dan Schoenherr, 2011)
R12: Low market share at the farmer level	Low market share due to external and internal reasons (such as competition and poor quality) (Afgan dan Carvalho, 2004)
Social Risk Factors (Giannakis and Papadopoulos, 2016)	
R13: Dangerous work environment	Unhealthy working conditions in the workplace and threaten the health and safety of workers (Halldorsson et al., 2009)
R14: Violation of business ethics	Activities that violate business ethics at work (Clift, 2003)
R15: Failure to fulfill social commitments	Involvement in local community activities, education, cultural development, technology, job creation, and social investment (Maloni dan Brown, 2009)
R16: Unskilled workers	The workforce used is still not very skilled because they are still inexperienced.
R17: Unhealthy competition between farmers	Activities that violate business ethics at work (Clift, 2003)
Environmental Risk Factors (Moktadir et al., 2021)	
R18: Natural disasters/climate change	Disturbances caused by natural disasters and climate change (Waters, 2011)
R19: Inefficient use of natural resources	Inefficient use of natural resources during production and distribution (Diesendorf, 2007)
R20: Environmental pollution	Water, air and soil contamination due to poor operation at the time of production (Blackbum, 2007)
R21: Hazardous waste generated	Substances or unused waste materials produced during the production process (Dues et al., 2013)
R22: Pests and plant diseases	The risk of pests and diseases in plants is due to the fact that farmers have not been able to determine the

Risk Factors	Description
	appropriate and economical pest treatment so that it affects the condition of pests and plant diseases that are susceptible to spread.

Risk assessment on sustainable supply chains is carried out using the Fuzzy FMEA analysis method. Fuzzy FMEA method is used to obtain the priority level of the risks in the variables from the scoring results that have been carried out. Fuzzy logic in categorizing problems or causes of risk in the supply chain uses 3 criteria considerations, namely Severity (S), Occurrence (O), Detection (D). Wang, K et al., (2009) said that, the steps taken to analyze the mode factors using the FMEA method in fuzzy logic are as follows:

a.   Determine the scale value on O, S, D.
b.   Performing the calculation of the aggregation of fuzzy ranking assessments on the O, S, D scale factors.
c.   Calculating the aggregation of importance weights for factors O, S, D.
d.   Determine the value of FRPN (Fuzzy Risk Priority Number) for each failure mode.
e.   Adjusting the final result of the FRPN value obtained with the output variable scale of Fuzzy FMEA where the highest result of the FRPN value will be the priority risk for discussion and a solution will be given.

Severity (S), is a category for quantifying the seriousness of the condition in the event of a failure or risk. According to the seriousness, severity is assessed on a scale of 1 to 10. The severity scale can be seen in table 2.

Table 2. Severity Scale (Wang, K et al., 2009; Valinejad & Rahmani, 2018; Rayesa et al., 2019)

Criteria	Effect	Rating	Fuzzy Number
Danger without warning	Very high severity without warning	10	(9,10,10)
Danger with warning	Very high severity with warning	9	(8,9,10)
Very High	Very high impact on sustainability	8	(7,8,9)
High	High impact on sustainability	7	(6,7,8)
Moderate	Moderate impacton sustainability	6	(5,6,7)
Low	Low impact on sustainability	5	(4,5,6)
Very Low	Very low impact on sustainability	4	(3,4,5)
Minor	The impact is not so visible on sustainability	3	(2,3,4)
Very Minor	Almost no impact on sustainability	2	(1,2,3)
None	There is no influence	1	(1,1,2)

Occurrence (O) to indicate the probability that a failure will occur is indicated on a scale of 1 to 10 where the scale starts from (1) indicating an event that almost never occurs, to a scale (10) which indicates the event that is most likely to occur or is difficult to avoid. The scale of occurance can be seen in table 3.

Table 3. Occurrence Scale (Wang, K *et al.,* 2009; Valinejad & Rahmani, 2018; Rayesa et al., 2019)

Criteria	Failure Probability	Rating	Fuzzy Number
Very High (VH): Error cannot be avoided	1:2	10	(8,9,10,10)
	1:3	9	
High (H): Repeated errors	1:8	8	(6,7,8,9)

Criteria	Failure Probability	Rating	Fuzzy Number
Moderate (M): Errors sometimes occur	1:20	7	
	1:80	6	(3,4,6,7)
	1:400	5	
Low (L): Relatively few errors	1:2000	4	(1,2,3,4)
	1:15000	3	
Remote (R): An error might not occur	1:150000	2	(1,1,2)
	1:1500000	1	

Detection which is an indication of the level of escape from the cause of failure from a predetermined filter control. Detection shows the fuzzy ranking in the risk0 detection category contained in the variables used. Detection scale can be seen in table 4.

Table 4. Detection Scale (Wang, K *et al.,* 2009; Valinejad & Rahmani, 2018; Rayesa et al., 2019)

Criteria	Definition	Rating	Fuzzy Number
Absolute uncertainty (AU)	No chance to detect errors	10	(9,10,10)
Very Minor (VR)	Very small chace to detect errors	9	(8,9,10)
Minor (R)	Small chance to detect errors	8	(7,8,9)
Very Low (VL)	Very low chance to detect errors	7	(6,7,8)
Low (L)	Low chance to detect errors	6	(5,6,7)
Moderate (M)	Moderate chance to detect errors	5	(4,5,6)
Moderately High (MH)	Moderately high chance to detect errors	4	(3,4,5)
High (H)	High chance to detect errors	3	(2,3,4)
Very High (VH)	Very High chance to detect errors	2	(1,2,3)
Almost Certain (AC)	Almost certainty to detect errors	1	(1,1,2)

4.   Result and Discussion

The Result of this study can be explained as follows:

4.1. Sustainable Supply Chain Network at Mango Commodity for Singapore Market

The sustainable mango supply chain network for mango commodities for the Singapore market is quite long. The main factor that underlies this is the minimal use of processing technology used so that there are quite a lot of supply chain actors in mango commodities. UD WN Mango Sultan itself has not been able to export mangoes directly because their capital is still minimal, so they do not have refrigeration truck technology, so the risk of product damage when shipping often occurs. The following is an overview of the mango supply chain network for the Singapore market.
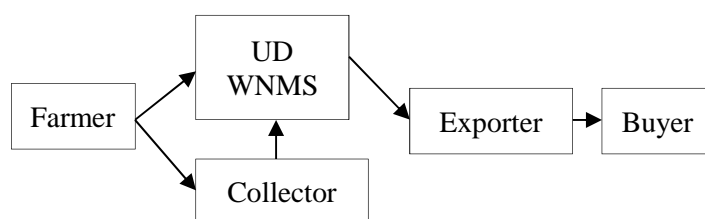

Figure 1. Supply Chain Network

From the figure it can be seen that there are several supply chain actors who support the export of mangoes at UD. WN Mango Sultan. To meet the existing demand for mangoes, UD WN Mango Sultan has increased the amount of supplies obtained from several farmers in several nearby villages, as well as collectors in Gedangan village. The collected mangoes will be sent to the exporter and then sent to the buyer. The number of mangoes exported at one time is 1 ton to

Singapore, and will still be developed to several other countries.

The export system used by UD WN Mango Sultan is through an intermediary exporter. This is because UD still has minimal capital, little buyer information, and quite complicated procedures and inadequate human resources. In addition, the number of super quality mangoes still does not meet the demand for exports, an exporter intermediary is needed to reduce the necessary transportation costs.

In a sustainable mango supply chain, the products offered are of superior quality with minimal use of pesticides and chemical fertilizers. This can be a distinct advantage for mango products produced by UD WN Mango Sultan.

4.2. Identification of Mango Supply Chain Risks

a. Farmers

At the farmer level, the social risk variable consists of components of unskilled workers and unhealthy competition. Farmers find it difficult to deal with pest and climate problems or natural disasters, so they often face losses. Not only losses but the quality of the mango produced is also often affected. The large number of farmers in Gedangan Village resulted in intense competition and not infrequently the competition was carried out unfairly, causing conflicts at the farmer level in the village. Lack of good cooperation in the sale of mangoes so they still sell mangoes individually. This can result in low bargaining power of farmers.

The second risk variable is environmental risk which consists of components of natural disasters/climate change, hazardous waste generated, and plant pests. Environmental risk variables are often difficult to detect by farmers, especially those related to climate change/natural disasters so that the resulting impact is quite large for mango farming. The risk of climate change or natural disasters is still difficult to handle because farmers still apply traditional agriculture. In addition to natural disasters/climate change, the risk of plant pests and diseases is also a risk that is often faced by farmers. Leafhoppers and smallpox in mango are one of the concerns of farmers in mango farming. This risk can still be detected and is usually handled using pesticides or chemical fertilizers. This can pose a new risk, namely hazardous waste generated from the farming process.

Economic risks faced by farmers include unstable mango prices and low market share. Gedangan Village farmers do not know with certainty the condition of mango prices in the market because usually farmers only get this information from collectors. This can lead to low market share received by mango farmers. The fluctuating condition of mango causes the selling price of mango to be relatively unstable. The last risk variable is operational risk which consists of limited knowledge about sustainability and technology, lack of market information, uncertainty of mango supply and demand, and product quality diversity. This risk is still often faced by farmers because the average education of farmers in Gedangan Village is quite minimal.

b. Mango Collector

There are 3 components of social risk at the collector level, namely unhealthy working conditions, violations of business ethics, and failure to fulfill social commitments. Social risk occurs due to a lack of commitment between supply chain actors so that they often violate predetermined agreements. In addition, the absence of cooperation can result in supply chain actors experiencing losses. In a sustainable supply chain, supply chain actors must be able to pay attention to the social conditions of the surrounding environment by providing CSR programs to the surrounding community. However, the lack of knowledge of collectors about this has resulted in the failure of collectors in fulfilling their social commitments.

Components of environmental risk variables consist of natural disasters/climate change, inefficient use of natural resources, environmental pollution, and waste generated. The cause of the collectors still getting this risk is because the collectors do not have sufficient knowledge in overcoming these problems so that the risk can have an impact on the profits obtained. Next is economic risk, which consists of components of price and cost volatility, reduced market share, inflation, taxes, and export costs. Environmental risk variables are generally not the main risk for collectors. Because the collectors will give a low price for the purchase of mango and a high price when the mango is resold. In addition, collectors only act as intermediaries and do not carry out export activities.

The next risk is operational risk which consists of uncertainty in supply and demand for mangoes, failure to choose suppliers, poor ability to respond to changes in demand, poor quality and

process for handling field resources, lack of coordination between supply chain actors, limited knowledge about technology sustainability. Operational risk often occurs and has a large enough impact on the business of the collectors. This is due to several factors such as lack of knowledge, skills, and lack of cooperation between supply chain actors.

c.   UD WN Mango Sultan

The social risk component at UD WN Mango Sultan consists of an unhealthy working environment as a result of the competition that occurs in Gedangan Village and the lack of work safety guarantees at UD WN Mango Sultan. This has an impact on business conditions and the safety of workers. In addition, social risks also consist of violations of business ethics, and failure to fulfill social commitments. This is due to mistakes in selecting business partners, lack of cooperation between supply chain actors, and lack of knowledge about sustainability.

Meanwhile, environmental risk consists of components of natural disasters/climate change, inefficient use of natural resources, environmental pollution, and waste generated. Environmental risks are caused by the practice of using fertilizers and pesticides in plant care. In addition, knowledge about sustainability and technology is still minimal so that the handling of environmental risks is hampered. The next risk variable is economic risk consisting of price and cost

volatility, reduced market share, and inflation, taxes, and export costs. Economic risk can have an impact on the profits obtained by UD WN Mango Sultan. The fluctuating price conditions resulted in uncertainty in mango sales, in addition to inflation, taxes, and quite large export costs that could have an impact on the discontinuity of mango export activities due to the lack of capital availability.

Operational risk variables consist of uncertainty of supply and demand for mangoes, failure to choose suppliers, poor ability to respond to changes in demand, lack of coordination between supply chain actors, and limited knowledge about technology sustainability. Operational risk variables occur due to several factors such as lack of skills and knowledge of workers, lack of cooperation, and less selective in choosing partners. This risk can have an impact on business sustainability at UD WN Mango Sultan itself.

4.3. Mango Supply Chain Risk Assessment Using Fuzzy Failure Mode and Effect Analysis

The risk priority assessment can be seen from the FRPN value owned by each component. The risk with the highest FRPN value will receive priority in risk mitigation. So for the analysis of Severity, Occurrence, Density and FRPN at the farmer level can be seen at table 5.

Table 5. Analysis of FRPN Value of failure mode at farmer level

No	Variable	Indicator	S	O	D	FRPN	Ranking
1	Social Risk	**Unskilled worker**s	1.597	2.129	1.089	3.701	1
		Unfair competition	1.597	1.597	1.263	3.220	2
2	Environmental Risk	**Natural disasters/climate change**	1.588	1.588	2.122	5.353	1
		Hazardous waste generated	1.535	1.191	1.376	2.517	2
		Pests and plant diseases	1.641	1.588	2.007	5.232	3
3	Economic Risk	Unstable price	0.952	2.276	1.241	2.689	2
		Low market share	0.952	2.466	1.552	3.641	1
4	Operational Risk	Limited knowledge about sustainability and technology	1.747	2.118	1.235	4.570	2
		Lack of market information	1.271	2.294	1.059	3.086	3
		Uncertainty about mango supply and demand	1.694	2.471	1.279	5.355	1

Based on the table above, at the level of mango farmers, there is still minimal knowledge about the amount of demand and supply so they do not know for sure how many mangoes must be

sold according to market demand. This minimal knowledge results in mangoes owned by farmers being bought by collectors at low prices. So that the market share received by farmers is also small.

The condition of mango farmers' farming in Gresik is still considered traditional, so that natural disasters and climate change are enough to cause considerable losses for farmers, because they experience crop failure.

Other supply chain actors, namely collectors, collectors have a function as distributors of mangoes that are collected from farmers and resold to distributors. Many people in Gedangan work as mango collectors because of the on farm risk and do not have land to produce their own. In contrast to the risk at the farmer level, the risk at the collector level has 16 risk components with different priorities. FRPN analysis at the collector level can be seen in the following table 6.

Table 6. Analysis of FRPN Value of failure mode at Mango Collector level

No	Variable	Indicator	S	O	D	FRPN	Ranking
1	Social Risk	Unhealthy working conditions	0.900	1.000	0.900	1.125	3
		Violation of business ethics	2.050	2.333	2.050	7.414	1
		Failure to fulfill social commitments	1.150	1.167	1.150	1.677	2
2	Environmental Risk	**Natural disasters/climate change**	1.295	1.591	3.123	6.437	1
		Inefficient use of natural resources	0.364	0.545	2.536	0.503	3
		Environmental Pollution	0.682	0.568	1.636	0.634	2
		Hazardous waste generated	0.364	0.659	1.555	0.373	4
3	Economic Risk	**Price and cost volatility**	1.829	1.667	1.371	4.180	1
		Low market share	1.029	0.595	0.800	0.490	2
		Inflation, taxes and export costs	0.610	0.452	0.971	0.268	3
4	Operational Risk	**Uncertainty about mango supply and demand**	1.846	1.692	1.292	4.038	1
		Failure to choose a supplier	0.962	0.738	0.954	0.677	6
		Poor ability to respond to changing requests	1.788	1.231	1.385	3.048	3
		Poor quality and process for handling field supply sources	1.558	1.077	1.431	2.400	4
		Lack of coordination between supply chain actors	1.327	1.692	1.015	2.280	5
		Limited knowledge about technology sustainability	1.962	2.154	0.923	3.900	2

The table above shows that the priority risk at the first collector level is a violation of business ethics. The system of work agreements between farmers and collectors or farmers with distributor partners is mostly familial. This resulted in the absence of a binding agreement between the perpetrators so that the possibility of contract violations could occur. Climate change and natural disasters are also risks faced by collectors. This is because suppliers (farmers) in Gresik are still having difficulty adapting to climate change and natural disasters so that it affects the decline

in mango production. Price fluctuations in mangoes are caused due to the uncertain continuity of mango production. If there are abundant mangoes circulating in the market, the price of mangoes will also fall and vice versa. Another risk faced by collectors is the uncertainty of demand and supply of mangoes. This risk can be minimized by strengthening the system and market information so that the demand and supply of mangoes can be known.

UD WN Mango Sultan, not only acts as a seller but also as a producer of mangoes. Similar to collectors, the number of risk components in UD WN Mango Sultan is 16 components. The risk priority for UD WN Mango Sultan can be seen in table 7.

Table 7. Analysis of FRPN Value of failure mode at UD WN Mango Sultan

No	Variable	Indicator	S	O	D	FRPN	Ranking
1	Social Risk	Unhealthy working conditions	1.364	1.364	1.500	2.789	2
		Violation of business ethics	**2.045**	**1.705**	**1.636**	**5.705**	**1**
		Failure to fulfill social commitments	1.364	1.705	0.682	1.585	3
2	Environmental Risk	**Natural disasters/climate change**	**2.000**	**2.500**	**1.583**	**7.917**	**1**
		Inefficient use of natural resources	0.750	1.250	0.625	0.586	2
		Environmental Pollution	0.750	0.833	0.750	0.469	3
		Hazardous waste generated	0.625	0.833	0.500	0.260	4
3	Economic Risk	**Price and cost volatility**	1.500	1.000	1.200	1.800	3
		Low market share	1.500	0.750	1.650	1.856	2
		Inflation, taxes and export costs	**1.800**	**1.000**	**1.800**	**3.240**	**1**
4	Operational Risk	**Uncertainty about mango supply and demand**	1.125	2.500	0.625	1.758	3
		Failure to choose a supplier	0.875	1.250	1.125	1.230	4
		Poor ability to respond to changing requests	0.625	0.833	0.500	0.260	6
		Poor quality and process for handling field supply sources	**1.500**	**1.667**	**1.000**	**2.500**	**1**
		Lack of coordination between supply chain actors	0.750	1.667	0.750	0.938	5
		Limited knowledge about technology sustainability	1.250	1.667	0.875	1.823	2

The risk priority at the UD WN Mango Sultan level with the highest FRPN value is the components of climate change and natural disasters. Uncertain natural conditions at this time make mango production can not be maximized. UD WN Mango Sultan is still having difficulties in overcoming the impact of natural disasters and climate change because these conditions are unpredictable. To sell the mangoes that are produced, UD WN Mango Sultan cooperates with

several partners in several regions. The large number of partners results in the risk of violating business ethics also frequently occurring. Therefore, the selection of partners must be done properly. In addition to domestic partners, UD WN Mango Sultan also partnered with foreign parties, but due to the high cost of exporting mangoes, this activity could not be sustainable.

5. Conclusion

The conclusion from the Fuzzy FMEA analysis on a sustainable mango supply chain shows that the trigger that must be a priority at the farmer level is the uncertainty of mango supply and demand. On the other hand, at the collector level, the main risk of concern is the violation of business ethics. Meanwhile, at UD WN Mango Sultan, the main trigger priority is natural disasters/climate change. These results are based on the mitigation efforts that can be done to maintain the supply chain at the farmer level, namely by improving the marketing related to mangoes and strengthening the supply chain network so that there is more demand and price for mangoes. At the collector level, business ethics violations can be reduced by strengthening existing agreements and finding reliable partners that can reduce the occurrence of social conflicts between supply chain actors. While UD WN Mango Sultan needs to improve the ability to adapt to climate change and natural disasters. The supply of mangoes will always be there both inside and outside the mango season.

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Food Security Analysis of Shallot Farmer Household During the Covid-19 Pandemic in Probolinggo Regency
(A Case Study on Shallot Farmer Household in Mranggonlawang Village, Dringu District, Probolinggo Regency)

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ABSTRACT

The Covid-19 pandemic has had an impact on the agricultural sector, both in terms of trade, prices, and the decline in farmers' income levels. Amid the COVID-19 outbreak, food security is something that the government must pay attention to so that there is no food crisis. If farmer households have not realized food security, it won't be easy to create food security at higher levels such as the village, district, provincial, and national levels. This study aims to analyze food security based on EAR and SFE values and determine the effect of socioeconomic factors on household resilience. Determination of the research location was determined purposively, and the number of samples was taken by cluster sampling. The analytical method uses the Jonnson and Toole model to determine household food security and multiple linear regression analysis to determine the effect of socioeconomic factors on EAR. The results of the food security analysis show that 51.7% of households with energy consumption >80% and expenditure of 60% are categorized as food vulnerable. The results of the analysis of socio-economic factors that can affect EAR are income, number of dependents in the family, length of education of housewives, and age of the head of the family with a confidence level of 80%. The analysis results show that most shallot farming households are in a food-insecure state.

Keywords : farmer household food security; EAR; SFE

1. Introduction

In early February 2020, the COVID-19 pandemic in Indonesia began to be confirmed, the number of people infected with this virus every day continued to increase (Pulubuhu *et.al.*, 2020). The Covid-19 outbreak has had a significant impact on various aspects of human life both economically and non-economically, including the agricultural sector (Rozaki, 2020). At the

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household micro scale, the pandemic has an impact on decreasing people's purchasing power in terms of food consumption and changes in behavior and mobility of family members (Relawati *et.al.*, 2021 and Syafiq *et.al.*, 2022).

The World Food Program in 2020 stated that during the COVID-19 pandemic there were 768 million people who experienced chronic hunger due to increasing world poverty. In dealing with the spread of COVID-19, the agricultural sector is a priority need because it is directly related to national food security (Syakirotin *et.al.,* 2022). If the trade in agricultural commodities is disrupted, food stability will also be disrupted

(Sadiyah, 2021). Directly, the COVID-19 pandemic affects food systems through impacts on food supply and demand, and indirectly through reduced purchasing power, ability to produce and distribute food (Food and Agriculture Organization, 2020).

The government's effort to break the chain of the spread of COVID-19 is that people are encouraged to reduce social interactions by maintaining social distance and physical distancing. In addition, the government also issued a policy of Large-Scale Social Restrictions (PSBB) and restrictions on the operation of land, sea and air transportation facilities that apply to several regions in Indonesia (Masniadi *et.al.*, 2020). However, the implementation of the PSBB policy has an impact on hampering the flow of trade in several types of goods and services as well as decreasing people's purchasing power (Prasada, 2021).

Due to the COVID-19 pandemic, food security has become the most discussed issue by various parties. This is because food is a basic need of every individual that must be met. Moreover, during a pandemic, people are required to be extra in maintaining their body's immunity due to viruses that easily spread and infect the body. However, this is not matched by the economic capacity that is getting worse due to declining farmers' income. Thus, it is necessary to conduct research on food security which is determined based on the pattern of expenditure and the energy adequacy rate of shallot farmers, especially in Mranggon Lawang Village, Dringu District, Probolinggo Regency. This paper offers efforts that farmer households can take to improve food security amid of the Covid-19 pandemic.

2. Theoretical Underpinning

Food security is defined as a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2002). Household food security is determined by various factors such as food access, availability of food consumption, food consumption, and household stability (Mohamed, 2017). In this study, the household food security of shallot farmers is determined based on the food availability factor.

Measuring food security at the household level involves five categories of indicators dietary diversity and food frequency, spending on food, consumption behaviors, experiential indicators, and self-assessment measurements (Peng and Berry, 2019). Boly and Sanou (2022), food security can be measured using indicators such as daily per capita energy consumption, number of malnourished people, and food production index.

Several studies have used calorie expenditure and consumption indicators to measure food security (Diramo *et.al.*, 2018; Kahsay *et.al.*, 2019; Ruhyana *et.al.*, 2020; Mohammed, *et.al.*, 2021; Getaneh *et.al.*, 2022). In contrast, Ouba and Sawadogo (2022) and Ngema, *et.al.* (2018), measured food security using a household food consumption and diversity score.

Food security at the household level is largely determined by various social, economic, demographic and institutional factors. Acheampong *et.al.*, (2022) used variables such as gender, age, family size, farming experience, gender of the head of the household, education, increasing variation, total household income, marital status, residence status, association membership, extension access, access to credit, household heads and regions to see the determinants of food security. Getaneh *et.al.*, (2022), added variables such as the size of irrigated land, livestock owned, improved pasture production practices, experience with shocks, food assistance and contact with development agents in measuring household food security.

The research results of Ruhyana *et.al.* (2020), the status of rural households is dominated by households with food vulnerability. Meanwhile, the factors that influence household food security are education, age, smoking habits, number of household members, rural residence, and employment as farm laborers. Different from Limi *et. al.,* (2021), food security is influenced by income, the age of the head of the household, and the age of the housewife. In the research of Getaneh *et.al.*, (2022), these findings reveal that household status is dominated by the food insecure category. Based on the logit regression model; age, marital status and family size negatively affected household food security. Whereas, irrigation land use, livestock ownership and access to credit were affected positively.

3. Research Methods

The research location was conducted in Mranggon Lawang Village, Dringu District, Probolinggo Regency which is one of the shallot production centers in East Java. The population of this study is farmer households who grow

shallots in the planting season in January-March 2021. The method of determining the sample uses a *cluster sampling technique* and the number of samples is determined using the Slovin formula so that 60 respondents are obtained. Data were collected by interview using a questionnaire.

3.1 Analysis of Energy Adequacy Ratio (EAR)

The percentage of energy adequacy rate figures is formulated by the following equation:

$$EAR= \frac{E}{2} \text{x}100\% \dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where:
EAR   : Energy Adequacy Rate (%),
ECAE   : Energy Consumption per Adult Equivalent (kcal)
2100   : EAR standard set by WNPG XI 2018.

3.2 Food Expenditure Calculation Analysis

The share of food expenditure is the amount of food expenditure issued by households in one year. The formula for calculating the share of food expenditure as presented by Ilham and Sinaga *in* Mulyo *et.al* (2015) is as follows:

$$SFE= \frac{E}{T} \text{x}100\% \dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where:
SFE   : Share of Food Expenditure (%)
EFF   : Expenditure of Food Expenditure (Rp/year)
THE   : Total Household Expenditure (Rp/year)

3.3 Crosstab Analysis of Energy Adequacy Figures on the Share of Food Expenditure

The trend of the energy adequacy rate in influencing the share of expenditure is seen by the crosstab method. Considering that the energy adequacy rate is considered to be higher if the share of food expenditure decreases.

3.4 Household Food Security Analysis

Household food security was analyzed using the *Jonnson and Toole model*. In this method, cross-classification is carried out between the energy adequacy rate (EAR) and the share of food expenditure (SFE). The results of the analysis obtained four categories of household food

security, namely food security, food insecurity, food insecurity, and food insecurity. Farming households are said to be "Food Secure" if the EAR value is >80% and the PPP value is <60%. Meanwhile, a household is said to be "Food Vulnerable" if the EAR value is >80% and the SFE value is 60%. Farming households are said to be "Food Less Secure" if the EAR value is 80% and the SFE value is <60%. Meanwhile, a household is said to be "Food Insecure" if the EAR is 80% and the SFE value is 60% (Jonnson and Toole, 1991 *in* Maxwell *et. al*, 2000).

3.5 Analysis of the Effect of Socio-Economic Factors on Household Food Security

To determine the effect of socioeconomic factors on the energy adequacy rate, the researchers used multiple linear regression analysis. Here's the equation model:

$$EAR = a+b_1I + b_2NFD + b_3LEH +b_4 AFH+ b_5 LEFH+ e \dots\dots\dots\dots\dots\dots\dots\dots (5)$$

Where:
EAR   : Energy Adequacy Rate (kcal)
a   : Constant
$b_1 - b_4$: Coefficient
I   : Income (Rupiah)
NFD   : Number Family Dependents (Persons)
LEH   : Length of Education Housewife (Years)
AFH   : Age of Family Head
LEFH   : Length of Education Family Head
e   : Error Rate

4. Result and Discussion

4.1 Analysis of Energy Adequacy Rate

The energy adequacy rate is determined by comparing the amount of energy consumption with the recommended energy adequacy rate. The energy adequacy rate generated from the measurement of energy consumption for each household can reflect household food security in Mranggonlawang Village, Dringu District, Probolinggo Regency. A household can be said to be food insecure if it reaches at least 80% of the fixed energy adequacy rate in accordance with the 2019 Minister of Health Regulation. The results of the analysis of the distribution of food security for shallot farmer households are presented in Table 1 below.

Table 1. Distribution of Household Food Security of Shallot Farmers in Mranggonlawang Village

Category Energy Adequacy Rate (EAR)	Total Household	Percentage (%)
Less (80% Energy Adequacy Rate)	5	8,3
Sufficient (>80% Energy Adequacy Rate)	55	91,7
Total	**60**	**100**

Table 1 shows that the distribution of energy supply levels for shallot households is more than 80% from fixed levels of 2,100 kcal/capita/day (WNPG XI, 2018). This shows that 91.7% of shallot farming households have sufficient energy absorption, which means food security. as per the research results of Aisy *et.al.* (2022), farmer households are classified as food insecure. While the remaining 8.3% is included in the poor category, which means that it is not food safe. The average daily food consumption of a person is 1754.87 kcal/capita/day or 83.56%. This means that the average level of energy adequacy per person in the shallot household is above 80% or is included in the sufficient category. Meanwhile, the average food consumption per household is 6463.8 kcal/capita/day or 106.18%.

4.2 Analysis of Share Food Expenditure

The share of food expenditure is a comparison between spending on buying household food with total expenditure consisting of food and non-food expenditures. The following is the average allocation of food and non-food consumption of shallot farmer households which is presented in Table 2 below.

Table 2. Average Allocation of Household Consumption of Shallot Farmers in Mranggonlawang Village in One Year

Consumption Allocation	Annual Expenditure (Rp)	Percentage (%)
Food Consumption	20.059.125	54,3
Non-Food Consumption	16.899.188	45,7
Total	**36.953.313**	**100**

Based on table 2, the average consumption allocation for farmer households is dominated by food expenditure, which is Rp. 20,059,125 or 54%. Food expenditure which is greater than non-food expenditure indicates that farmers are still focused on meeting their basic needs. The results of this study are in line with previous studies which showed that the household expenditure of farmers was dominated by food expenditure (Cahyani *et.al.*, 2020; Martadona and Leovita, 2021; Ariyadi, 2021).

The expenditure components are from each food and non-food consumption group. The following are the details of household consumption expenditures of shallot farmers on food consumption by component or type, which are presented in Table 3.

Table 3. Proportion of Household Food Expenditure of Shallot Farmers in Mranggonlawang Village in One Year

Types of Food Expenditure	Average Expenditure (Rp)	Percentage (%)
Grains, Roots and Processes	4.243.210	21,6
Meat and Processed	1.303.050	6,5
Fish and Processes	2.528.820	12,6
Eggs and Milk	852.750	4,2
Vegetables	1.537.245	7,6
Fruits	785.500	3,9
Nuts and Processes	1.554.450	7,7
Spice	1.617.500	8,1
Fat	1.052.900	5,2
Prepared Foods and Other Food	1.353.600	6,7
Ingredients Foodstuffs/ Beverages and Tobacco	3.230.100	16,1
Average Amount	**20.059.125**	**100**

Based on table 3, the highest food expenditure was expenditure on grains, tubers, and their processed products, amounting to Rp. 4,243,210 or 21.6% of total food expenditure. This is because the expenditure of grains, namely rice, is the staple food of shallot farmer households in the village of Mranggon Lawang. These results are in line with previous studies if the highest food expenditure of farmers is the type of grains, especially rice (Suyudi *et.al.,* 2020; Utami *et.al.*, 2021; Anzaini *et.al.,* 2022).

Table 4. Proportion of Non-Food Expenditure of Onion Farmers Households in Mranggonlawang Village in One Year

Types of Non-Food Expenditure	Average Expenditure (Rp)	Percentage (%)
Lighting Fuel, Electricity and Water	1.859.262	11,1
Household Equipment and Maintenance	1.864.402	11,2
Clothing	1.633.433	9,6
Personal Items	564.400	3,3
Health Services and Medicines	481.513	2,9
Physical Care and Cosmetics	972.275	5,7
Education, Recreation and Sports	1.237.560	7,3
Transportation and Communication	5.283.440	31,3
Land and building tax and other taxes and other expenses	879.345	5,2
Average Amount	**16.899.188**	**100**

Expenditure on transportation and communication ranks first in non-food expenditure with an average annual expenditure of IDR 5,283,440 or 31.3% of total non-food expenditure. This expenditure is dominated by communication expenditures for the purchase of data packages. This is because school activities are conducted online, thus requiring an internet connection. While the smallest expenditure is health services and medicines with an average of Rp 481,513. This is because most shallot farmers rarely get sick and when they are sick they prefer to buy their own medicine instead of going to the doctor. Thus the results of research from Adriani *et.al*., (2020) state that most members of farmer households, if they are sick, they tend to seek treatment themselves or use health insurance from the government.

The following is a distribution table for the share of household food expenditure of shallot farmers in Mranggonlawang Village obtained from the comparison of food consumption and total household consumption, which is presented in Table 5 below.

Table 5. Distribution of Household Food Expenditure Share of Shallot Farmers in Mranggonlawang Village

Share Food Expenditure Category	Total Household	Percentage (%)
Low (60% Share Food Expenditure)	26	43,3
High (60% Share Food Expenditure)	34	56,7
Total	**60**	**100**

Table 5 shows that the share of food expenditure of most shallot farming households is in the food insecure category. This is because the proportion of food expenditure is high and the energy consumption is still lacking. This condition is also the same as the results of research from Adelina *et.al*., (2019) which states that the level of household resilience of farmers is classified as food insecure. According to Apid *et.al*. (2022), the share of food expenditure has the opposite relationship with food security. This means that the higher the share of food expenditure, the lower the food security, and vice versa.

4.3 Trend Analysis of Energy Adequacy Figures on the Share of Food Expenditure

Cross-tabulation analysis was used to see food trends toward the energy levels of onion farmers' households. The following are the results of the cross-tabulation analysis which are presented in Table 6.

Table 6. Results of Crosstab Energy Adequacy Rate Analysis of Food Expenditure Share in Shallot Farmer Households in Mranggonlawang Village

Share Food Expenditure Category	Energy Adequacy Rate (%)	Total Household
Low (60% Share Food Expenditure)	67.78-80.00	3
Low (60% Share Food Expenditure)	80.01-129.16	25
High (60% Share Food Expenditure)	60.85-80.00	2
High (60% Share Food Expenditure)	80.01-136.69	30
Total	**60**	**100**

There is a tendency for households with a high portion of food expenditure to have a higher level of energy sufficiency. These results prove that households allocate most of their expenditures to food needs so that the level of energy sufficiency can be fulfilled. In meeting energy needs, shallot farmers consume rice as the main energy source. According to Anzaini *et.al.* (2022) rice is the main staple of the largest energy contributor. The second source of energy for shallot farming households is fish, according to research from Utami *et.al.* (2021), fish is the second largest expenditure after rice. On the other hand, the food expenditure of onion farmer households in processing fish by frying has an impact on increasing consumption of cooking oil which increases in food expenditure. In order to be able to see the large changes in the energy adequacy rate along with the share of food expenditure, it can be seen in Figure 1 below.
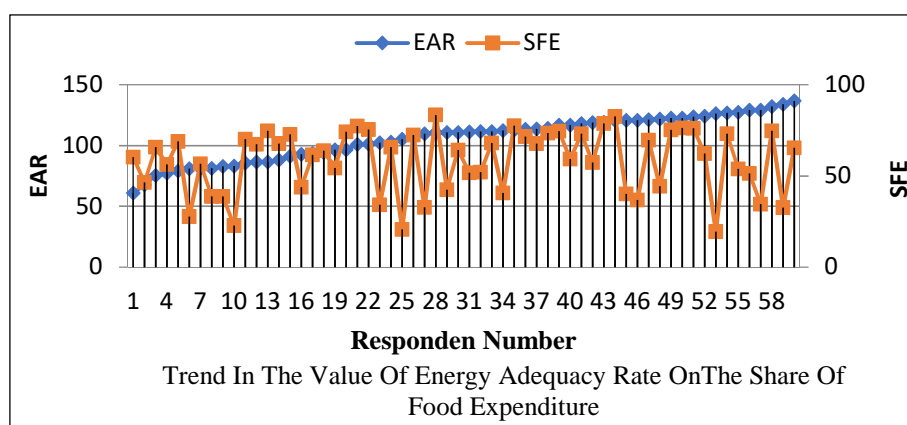
Figure 1. Graph of Crosstab Analysis of Energy Adequacy Rate Figures on Food Expenditure Share of Shallot Farmers in Mranggon Lawang Village

Based on Figure 1, there is a tendency that the higher the energy adequacy level of the shallot farmer household tends to result in the proportion of the share of food expenditure getting smaller and at a certain point an increase in the proportion of the share of food expenditure. This indicates the possibility of a transition from consumption of non-food expenditure to food expenditure. The increase in household food consumption is caused by several factors, including the increase in the number of family dependents which causes household food needs to increase (Azhar, *et.al.*, 2022) and are increasingly diverse to fulfill. In addition, higher household incomes also have an impact on the ability of households to obtain more diverse food and spend on food products of better quality and higher prices. This is to Yanti's statement (2019) that higher household income can affect increasing food expenditure so that the ability to choose and buy food is higher and more diverse. For example, it was found that some shallot farming households have a high proportion of food expenditure allocation but are at a high level of energy sufficiency. Upon further investigation, the household allocated more to buy chicken meat, fish, and eggs than other expenses. These three products have a higher price compared to the prices of other foodstuffs. So it will increase the proportion of food expenditure.

4.4   Household Food Security Analysis

After knowing the value of the Energy Sufficiency Rate and the Food Expenditure Share of shallot farmer households in Mranggonlawang Village, it can determine household food security by cross-classification between the two components. and Share of Food Expenditure using the Jonnson And Toole model. Energy Sufficiency Rate is directly proportional to food security while Food Expenditure Share is inversely proportional. Thus, a household will have better food security if the Energy Sufficiency Rate value is high (>80% Energy Adequacy) and the Food Expenditure Share is low (60% Total Expenditure). The following is a cross-classification between the energy adequacy rate and the share of food expenditure, which is presented in the following Table 7.

Table 7. Household Food Security of Shallot Farmers in Mranggonlawang Village

Energy Consumption per Adult Equivalent Unit	Share Food Expenditure	
	Low (60% Total Expenditure)	High (60% Total Expenditure)
Sufficient (>80% Energy Adequacy)	Food Secure 24 (40%)	Food Vulnerable 31(51.7%)
Less (80% Energy Adequacy)	Food Less Secure 2 (3.3%)	Food Insecure 3(5%)

The results show that 51.7% of shallot farming households are classified as food insecure. Food households are households that have a high share of food but consume enough energy. Due to their low income, they have only enough to spend on food, so the household energy figures can be fulfilled (Purwaningsih *et.al.*, 2010). According to Sabaora *et.al.*, (2021) food insecurity conditions are caused by the lack of employment opportunities in rural areas in urban areas, so rural houses have limitations in terms of income sources. In addition, the income received from available jobs in rural areas is relatively lower than in urban areas.

4.5 Analysis of the Effect of Socio-Economic Factors on Household Food Security

Socio-economic factors that affect the food security of farmer households were analyzed using multiple linear regression. The dependent variable in this study is Household Energy Adequacy which is influenced by the independent variables, namely income, number of family dependents, length of education of housewives, age of family head, and education of family head. The results of the regression analysis of the influence of socio-economic factors on the energy adequacy rate can be presented with the following multiple linear regression equation.

EAR = 3491.70 +0.068 I -266.047 NFD + 87.887 LEH + 36.315 AFH + 21.063 LEFH+ e

Information:
EAR = Energy Adequacy Rate (kcal)
I = Income (Rupiah)
NFD =Number of Family Dependents (Persons)
LEH =Length Of Education Housewife (Years)
AFH = Age of Family Head (Years)
LEFH =Length of Education Family Head (Years)
e = Error Rate

Based on the above equation, the results of the multiple linear regression analysis of the influence of socio-economic factors on the energy adequacy rate in Mranggonlawang Village are presented in Table 8 below.

Table 8. Results of Regression Analysis of the Effect of Socio-Economic Factors on Household Food Security in Mranggonlawang Village

Variable	Coef. Regression	t-value	Sig.	Information
Constant	3491,70	2,372	,021	
Income	.068	6,521	,000	Significant at the 99,9%
Number of Family Dependents	-266,047	-1,384	,172	Significant at the 83%
Housewife Education Length	87,887	1,519	,135	Significant at the 87%
Age of Family Head	36,315	1,840	,071	Significant at the 93%
Family Head Education Length	21,063	,357	,722	Not Significant

Dependent Variable : Energy Adequacy Rate
R^2 : 0,510
F-value : 11,232; F-table: 0,466
T-table : 1,296
Confidence level : 80%

Based on table 8, it can be seen that the coefficient of determination (R^2) is 0,5010, meaning that 50,10% of the variation in the dependent variable can be explained by the independent variables in the model. While 49,90% is explained by variables outside the model. The results of the F test show that the variables in the model can simultaneously affect the energy adequacy figures.

The t-test was conducted to see partially whether each independent variable had a significant effect on the dependent variable. The test is determined by looking at the significance value of each independent variable. In this study,

four variables affect the energy adequacy figures. The first independent variable that has an effect is income with a significance value of less than 20% alpha, which is 0,000. The regression coefficient value of the income variable is 0,068 and is positive so that it can increase income by one unit, it will increase the energy adequacy rate by 0,068 units. Ndhleve *et. al*. (2021); Limi *et.al*. (2021) state that a high level of income will increase food security and vice versa.

The variable number of family dependents has a significant value of less than 20% alpha, which is 0,172. The regression coefficient value of the variable number of family dependents is -266,047 and a negative value so that it can be interpreted that every increase in the number of family dependents will reduce the energy adequacy rate by 266,047 units. The addition of one family member can reduce the possibility of household food security status (Fikire and Zegeye, 2022; Ruhyana *et.al*., 2020). Ceteris paribus, each additional member of a household increases the probability of food insecurity (Ademola *et.al*., 2021). According to Getaneh *et. al*., (2022); Ayinu *et.al.,* (2022); Makonnen *et.al.,* (2021) which states that household size with a high ratio has a role in influencing the likelihood of households becoming food insecure.

The variable length of the mother's education has a significant value of less than 20% alpha, namely 0,135. The regression coefficient value of the variable length of the mother's education is 87,887 and is feasible to be positive. This means that increasing the length of a mother's education will increase the energy adequacy rate by 87,887 units. The longer the education of the housewife, the better the nutrition of the food, so that the food consumed is more nutritious (Sadevi, *et.al*., 2020).

The age of the family head, this variable has a significant value and a coefficient of 0,71 and 36,315, respectively. The coefficient value on the age family head variable is positive. That means if the age of the family head increases, it will increase the energy estimate by 36,315 units. Households with an older age of head of the household tend to be more food secure than the younger age of head of the household (Joshi and Joshi, 2017; Abdullah *et.al*., 2019; Fikire and Zegeye, 2022; Awoke *et.al.,* 2022).

5.   Conclusion

The results of this study can be concluded that the household food security of shallot farmers

is mostly included in the food vulnerable category, namely 51.7%. Analysis of socioeconomic factors that have a positive and significant influence on the energy adequacy rate is the income variable, the mother's length of education, and the age of the head of the family. While the variable number of family members has a negative and significant effect on the household energy adequacy rate. When viewed from the income variable, increasing the energy adequacy rate can be done by conducting training on more efficient farming methods and creating a Prosperous Family Empowerment program. In future research, it is hoped that Raskin can be used as an independent variable to see its effect on the energy adequacy rate.

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The Characteristics of Persian Historical Gardens (Case Study: Emarat Birooni Garden of Urmia, Iran)

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ABSTRACT

Persian gardens are valuable historical and cultural human-built landscapes however, Persian gardens are deteriorating gradually. Thus, comprehensive studies would be helpful in obtaining deeper insights into different aspects and meaning of Persian gardens. The descriptive-analytical approach was used to review the EmaratBirooni garden of Urmia (Campus of Urmia University) as it is the only remnant of Qajar period demonstrating a clear image of the past of the Persian garden model in Urmia. Data were employed through literature review and on-site field study. It was found that the Campus of Urmia University had three historical eras- era 1: Before the garden was purchased by American missionaries, era 2: The settlement of American missionaries, era 3: After American missionaries left and delivered the garden to the government. By examining the periods, it was seen that the survival of the campus stemmed from proper uses in each era. This suggests that new uses suiting the contemporary conditions could be beneficial in protecting historical gardens. In this respect, it is essential to protect historical gardens since these gardens can become a cultural capital to the future generations.

Keywords: persian historical gardens; urmia university; garden; environment; era

How to cite :

1. Introduction

Technological advancements and urban expansion have led to human invasion of nature and ecosystem and reduced human-environment interaction (Maleki and Saeedi, 2015; Lembi et al., 2020; Richter and Bixler, 2022). To cope with this contradiction, it is necessary to develop green spaces as the lungs of cities. A deep review of the past indicates how Iranian ancestors maintained this mutual relationship by building gardens based on the climate and culture (Dabestani and Baghaei, 2016). Today, to properly respond to human needs, the construction of new urban green spaces and the protection and revival of historical gardens would help not only identify the precise model of historical gardens but also contribute to the historical, cultural, and social identity of Iran

(Goudarzian, 2012). Currently, there is only general knowledge of Persian gardens obtained from foreign research. However, Iranian researchers have recently been conducting significant studies at different levels. There is a wide scope of research and questions to identify the unknown aspects of Persian gardens since Persian gardens have not only physical but also conceptual dimensions (Etezadi and Golestani, 2018). Historical gardens have been increasingly destroyed, and some little-known gardens are living their last days of life across Iran. Direct observations, written works, photographs, plans, verbal history, and legends are the best references to research Persian gardens (Irani-Behbahani, 2018).

The present work presents a case study of the Campus of Urmia University as a deteriorating Persian garden. It is the only remnant of Qajar Iran in Urmia. This garden is a rich structure in terms of garden construction, history, and use variety in different historical eras (Aghlmand and Pakand,

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2012). The present work attempts to understand why the gardens of Urmia have been destructed and how the campus managed to survive, even though it is a damaged building. Optimistically, this garden exists as the only remnant of old Iran. However, there are few references to conduct a perfect research work on Persian gardens. Concerning the Campus of Urmia University, no studies had been conducted. Thus, this study seeks to take a small initial step to enable future great ones. The most important limitations of the study were the unavailability of the first generation who observed the life of the garden, the shortage of written comprehensive references, documents, and plans, and the disappearance of important garden elements for known and unknown reasons. The remaining parts of the garden and some documents, photographs, and maps can be mentioned as the research components. The primary goal of the study is reviewing and recovering the design of the garden in different eras to identify the Persian garden model in Urmia in Qajar Iran. The other objectives of the study are to discuss the destruction causes of historical gardens in Urmia and realize how this garden has survived and how it could be protected as a national and cultural heritage.

2.   Theoretical Underpinning

Historical gardens demonstrate how the identity concepts and values of nations continue to exist, even though many of historical gardens have changed or disappeared. Failure to consider the histories of gardens leads to incomplete protective schemes.

Based on Albert et al. (2022) study, the identity-building function of heritage and its sustainable protection assume a critical role, since heritage creates identity. Based on the Convention (i.e., 50 Years World Heritage Convention: Shared Responsibility – Conflict & Reconciliation), destruction of the heritage is multifunctional and, its deterioration of a natural heritage is very harmful impoverishment of the world. It should be stated that until now there is no pattern or planning for the protection of the historical gardens in Iran. Thus, it is possible to utilize global theories regarding to the conservations of such heritages and monuments.

As known, there is no particular policy dedicated to the increasing devaluation of World Heritage through commodification. It might cause to devaluation, such as those resulting from tourism development with damaging effects, on infrastructure and other facilities specifically on urban landscapes. Nevertheless, until today, commodification as a complex mechanism in the World Heritage system has not been recognized as a threat (UNESCO World Heritage Committee, 2017).

Based on (Albert et al. 2022) the protection of World Heritage requires knowledge of potential conflicts and their avoidance and appropriate implementation strategies.

According to (Labadi & Logan, 2016) in today's interdisciplinary field of heritage study, heritage is considered and understood as a social and political construction in which heritage results from a selection process, often government-initiated and supported by official regulation.

It is also possible to consider all heritage protection principle through main Charters such as The Venice Charter (1964), The Florence Charter (1981), The NARA document on authenticity (1994) and The San Antonio Document (1996) which they are mostly accentuate on the Originality and Identity of the natural and heritage and monuments.

According to Camilo Boito's belief, the method of the restoration of heritage buildings is deferent from case to case (Rouhi, 2016) and restoration should be based on respecting the artistic and historic values of heritage buildings, whilst Boito considered alteration as untrustworthy (Kim, 2010).

In the contemporary era, adaptive reuse has been considered as a strategy for protecting these buildings for both present and future generations. At present, the 19th and 20th century conservation and restoration theories are the backbone of the contemporary adaptation movement by introducing different forms of adaptive reuse over time (Yazdani Mehr, 2019)

To this end, in order for protecting gardens, it is required to consider the entire social, cultural, and symbolic values of the landscape since it would provide a more consistent and flexible background for new identity solutions (Mahdizadeh and Rajendran, 2019). The Burra Charter 1982 defines conservation as an objective to protect valuable cultural features (garden buildings and sites). The protection of historical gardens allows for keeping gardens as cultural capital and delivering them to future generations (Carneiro et al., 2004).

2.1.   Overview of Persian gardens

Gardens are among the most elegant phenomena of human life and have existed for a

long time. They have had a significant position on cultures and civilizations. The backbone components of gardens, i.e., water, flowers, and grasses, can never be replaced (Vilbar, 2011). Iranian historians suggest that gardens known as *Pardis* were built nearly 3000 years ago around most Persian houses. Persian garden artworks can be observed in the pictures on clay pots. These pictures often involve a tree of life surrounding a pool, a parkway with two parallel lines, and a pool within each garden (Pouya et al., 2015).

The Passenger Gate Gardens in Pasargadae were the first Persian gardens. They were constructed by Cyrus the Great of Persia, 600 BC. These gardens were divided into four elements, including soil, fire, water, and wind, based on the Zoroastrian classification (Faghih and Sadeghy, 2012). As a perfect structure, Persian gardens represent the close relationship between Persian, culture, nature, and art. This demonstrates cultural and historical identities and the close relationship between the environment and human needs (Pouya et al., 2015).

2.2.   Evolution of Persian gardens

Persian gardens undergo an evolution from the beginning of construction to becoming a complete garden. Sense of place is considered to be the major characteristic of Persian gardens. Persian garden designers select garden sites based on the environment and land use (Mirfendereski, 2004). In the initial Islamic era, the Islamic world adopted two garden styles from Persians, and these styles were promoted among Muslims for centuries. Historians claim that the Abbasids constructed a Sassanid-style garden with porches and planted trees on the shores of the Tigris. There were two types of gardens in the Persian agriculture style, including ornamental gardens and gardens surrounded by trees and shrubs (e.g., fruit and tee gardens) (Haddadeadel, 2007).

The major characteristics of ornamental gardens include (1) a portal in most of walled gardens, (2) a road network with curbs, (3) small and large water bodies, (4) trees, flowers, and grass, (5) different buildings in the garden, and (6) tall and shading trees on the two sides of the street network. These gardens are divided into three groups based on the plan, including (1) plat and low-depth gardens, (2) sloped gardens, and (3) gardens constructed in lands with natural features. Ornamental gardens typically have a rectangular design. Layouts are a major characteristic of such gardens. The layout of a garden is dependent on factors such as the plan, design (shape), and size of the garden. Most gardens have two major north-south and east-west roads with a number of narrow roads perpendicularly running into the major roads (Islamic Encyclopedia Foundation, 1994). Gardens are irrigated using subterranean canals or some ducts from rivers or springs. The natural slops in most Persian gardens provide a suitable location for placing a summerhouse at a high elevation (Diba, 1995).

2.3.   Reasons for the construction of Persian gardens

Persian gardens have been constructed for several reasons, such as:
- Creating green, pleasant habitations in aggressive climates (e.g., in oases),
- Building gardens beneath a palace,
- Constructing garden shrines,
- Creating public and surrounded gardens in city squares, and
- Constructing gardens in private small/large yards.

Apart from their physical differences, nature-human equilibrium is a shared characteristic of gardens, particularly Persian gardens (Taghvaei, 2010).

2.4.   Persian garden systems

According to Shahcheraghi, the Iranian garden consists of 4 functional, geometric and motion, physical and meaning systems, which are shown in the form of a diagram in Figure 1. According to the need for research and in order to understand the physical system and geometric structure, they are described and studied below. Figure 1 shows the systems of Persian gardens (Shahcheraghi, 2019)
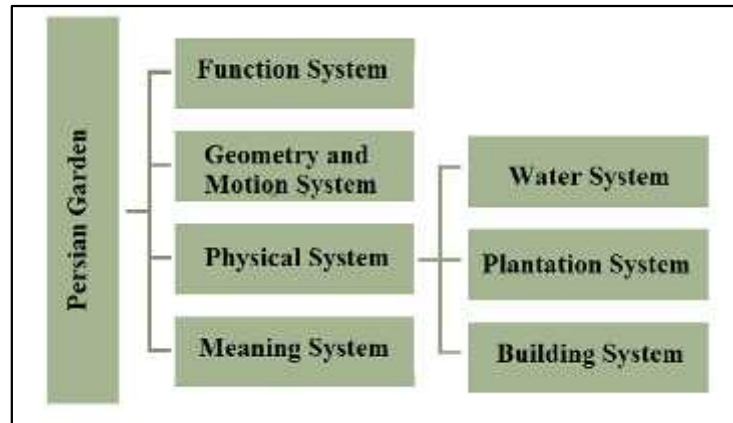
Figure 1. Persian garden systems (Shahcheraghi, 2019)

2.5. Geometric system

The geometry of a Persian garden includes a square or rectangular garden based on the water amount that could be supplied. The garden is terraced based on the land features. The geometric structure of a Persian garden is created by either applying three parallel lines along the garden or by creating two perpendicular lines and then dividing the garden into regular squares, as shown in Figure 2 (Mottaghi-Pisheh, 2013).
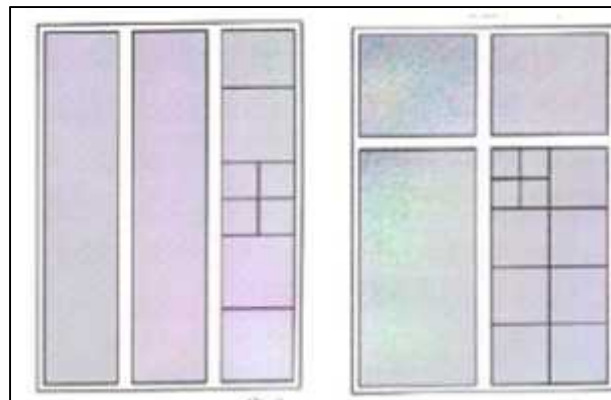

Figure 2. Persian garden geometries; (a) tri-line and (b) perpendicular line systems (Shahcheraghi, 2019)

2.6. Physical system

Water system: Water is an essential component of a garden as no garden can be constructed without water. It is the most important factor of garden liveliness. Water is also employed as an ornamental element in pools, fountains, and irrigation channels (Ebrahimi et al., 2016). The transfer of water from remote locations to the garden and distribution water within the garden were properly handled by the constructors of Persian gardens. Water was transferred through regular aqueducts and channels as the "artery" of the garden toward the ditches of the garden. This irrigation procedure influenced the design of gardens – that is, gardens were designed based on this irrigation procedure. The design divisions of gardens can be performed based on water passage, flowerbeds, and major and minor roads (Pirnia,

1969). The area of a Persian garden is a perfect square or rectangular, depending on the amount of water that could be supplied, and the garden is terraced in the form of a regular geometry based on the land features (Shahcheraghi, 2019).

Plantation system) The plantation system of trees and grasses in Persian gardens considers the climatic and geographical characteristics and brings specific quality in the body and space of the garden. It also brings subsystems such as shading subsystems and landscape subsystems distinct from the garden outdoor spatial systems of other civilizations. Terraces are based on rational regularity, harmonic size, geographic orientations, environmental characteristics, optimal sunlight utilization, and wind stability (Abolghasemi, 1995).

The primary plantation approach is planting trees in parallel configurations and certain distances within the terraces. The second plantation approach is five-point trees, in which four trees are planted at the four corners of a square, with another tree at the center of the square. The Persian garden plantation system represents green surfaces in two manners: (1) tall trees and a massive amount of leaves and (2) surfaces covered with short grasses such as clover and ornamental flowers. The relationships of the plantation system with the other systems include:

Plantation system and shading system: Tall, shading trees based on the geometric system of the garden produce a distinct system of light and shade in Persian gardens.

Plantation system and sound system: trees and other plants attract birds during the year, leading to pleasant songs of birds.

Plantation system and landscape system: Plantation emphasizes the landscape of the main road in the building direction (Sheybani et al., 2018).

2.7. Building system

The building system of Persian gardens brings buildings and artificial structures in order, organizes the garden space, and adds to the integration of the physical system by combining the plantation and water systems. The building, plantation, and water systems are consistent with the geometric system and deploy human-made elements in the garden. The building system determines not only the buildings but also garden components, the most important of which is the garden walls (Shahcheraghi, 2019). In most traditional gardens, particularly large habitation gardens with an integrated space, three major buildings existed, including the front building (Sardar), summerhouse (Kooshk), and private building (Andarooni). For example, Fin Garden in Kashan involves all three buildings along with side and service spaces next to the garden (Naeema, 2014).

2.8. Qajar gardens

The Qajar gardens and decorations were influenced by French landscaping, large grassed and ornamental tree areas, small basins, and flowers. Most Qajar gardens were organized based on geometric configurations, the fundamental element of which was straight roads. In general, when there was a longitudinal line, the garden would be divided into two sections, and the line was responsible to establish a visual relationship

and a physical relationship between the entrance and the main building. There were gardens divided by two perpendicular lines, with a building or pool at the intersection of the lines (Gharakhani et al., 2016).

The comprehensive geometry of the garden was intended to be combined with the landscape and environmental characteristics. Long landscapes replaced the short landscapes of gardens in the old Islamic ages, organizing the exterior and interior spaces. Specific plant species and shading trees were planted in the form of forest sectors along the major and minor lines of the garden. The front outdoor space was organized using ornamental plants and grass over time (i.e., the late Qajar era) (Naeema, 2014).

It became particularly important to find a visual relationship with the long landscape in the Qajar gardens. Apart from the previous attitude, they attempted to bring suitable landscape in the gardens and enable different parts of the gardens to enjoy wide views and have unique perspectives. They positioned the garden lines or main places such that landscapes inside and outside the garden would be achieved. Compared to the inside-oriented tradition of previous prominent gardens, it seems that the visual relationship between the garden and long landscape replaced the visual relationship of the internal landscape along the line between the building and entrance (Behbahani and Soltani, 2003). Perhaps this explains the exploitation of natural characteristics in country areas and the construction of gardens on mountainsides, particularly Shemiranat. In fact, in the Qajar era, the imitation of the western garden style became very common, without considering the cultural backgrounds (Mahan and Khorramrooei, 2020).

The use of new ornamental elements, such as sculptures, columns, bridges, arbors, and metal fences in the outer part of the garden, along the lines, or in front of the main building became common. In fact, these elements were added to gardens just to show modernism and Western cultural influence. As with previous eras, garden components such as the walls, front building, summerhouse (i.e., the main building), and private building represent the structural system of gardens. The layouts of these gardens represent the geometry of the garden, with the difference that the Qajar gardens did not insist on following decorative principles or landscape architecture that used to be adopted (Gharakhani et al., 2016).

2.9. Garden culture in Urmia

The people of Urmia have long had a strong desire for nature, and most of the wealthy class had personal gardens in the past. Those tourists that traveled Urmia support this claim. As Ali Khan Vaali said:

"There are many great buildings that belong to the rich, religious authorities, and merchants. The surroundings of the gardens are elegant. The rich of the region have glorious resorts by the Shahr Chay River" (Mohammadzadeh, 2013). French ambassador Eugene Aubin said:

"Urmia is a green region with fertile lands and full of water resources. There are willows by the roads, and short thatched walls separate the grape farms" (Aubin, 1983). Hajj Sayyah said:

"Urmia is famous due to its numerous gardens and pleasant climate. The city of Urmia is good and wealthy. The people of Urmia are types of pleasure. There are many gardens and flower beds. The people are rich and have many assets. Beautiful gardens exist around the city" (Sayyah, 1987).

Historical events, political conflicts, continuous foreigner interventions, border evolutions, the multiplicity of ethnicities, religions, and languages, and most importantly, the historical competition of Persia and the Ottoman Empire led to the collapse of peace in this region (Aghlmand, 2019). As Eugene Aubin said:

"The intervention of the Ottomans and religious authorities for political benefits induced an undesirable situation in this lovely village that used to be peaceful" (Aubin, 1983).

As a result of insecurity, the gardens were abandoned, and the people moved to the city to be safe and secure. The Islamic Revolution of Iran eliminated aristocracy, and the historical gardens began to deteriorate. The gardens have been destructed due to the abandonment by their heirs and the lack of proper administration (Aghlmand and Pakmand, 2012).

(a)   (b)

Figure 3. (a) House of Mirza Ali Khan Sartip, son of Baharol-Molk next to the Shahr Chay River, 1883-1885 and (b) House of Malek Ghasem Mirza, 24th Son of Fath-Ali Shah Qajar, owned by the heirs of Eghbaloddoleh, 1883-1885 (Ref. Ali Khan Vaali's photo album)

2.10. Gardens of Urmia

Assyrian references claim that gardens of fruit trees were built in the Azarbaijan region at command of the Urartu king (735-713 BC). These gardens created an elegant, glorious area out of the deserts around Ulhu (modern-day Salmas) in the northwest of Lake Urmia. As with other cities in Azarbaijan, Urmia had gardens inside and outside the city. However, all the gardens have been destructed, except for the Campus of the Urmia University. There are small pieces of information on these gardens in travelogues. Overall, it can be said that most gardens of Urmia existed by the rivers and river branches, and they were irritated traditionally by open, wide creeks so that they could be easily cleaned. It should be noted that Urmia has 22 aqueducts and 169 old creeks. As the aqueducts are in the northern part (residential section) of the city, farmlands and gardens were irrigated by branches of three rivers, including the Shahr Chay, Nazlu Chay, and Baranduz Chay rivers (Aghlmand and Daghighi, 2005).

It can be inferred from studies conducted on the gardens of Urmia that all the Urmia gardens had fences, and most of them were resort gardens with the main building, a private building, and a public building (Delgosha Garden) (Mirza Rashid Adib-ol Shoara, 1967). There were also state gardens, such as Sardari Garden. Karim Khan Zand was coronated in the citadel next to Sardari Garden (Nazarbaghi Garden, Dagh Baghi Garden, Ferdows Garden, Siavash Garden) (Aghlmand and Pakand, 2012). Gardens such as Kamalabad and Yeylaghi Khan had various cedar trees, plane trees, fruit trees, flowers, and basil (Saadabadi,

2001). Edalat, Vaali, and Nazmiyeh Gardens were the sloped gardens of the city (Aghlmand and Daghighi, 2005). Eugene Aubin described the Birooni Garden (the campus of the Urmia University) as: "There is the Castle of the American Commission after a roofed entrance. Brick houses resting under the shadow of plane trees…".

3. Research Methodology

3.1. Research design

This study adopts an interpretational-historical methodology, and data were collected using documentary and On-Site Field Study research. The approaches are dependent on analysis and inference and mostly comparative and holistic. This study has an open ending with step-by-step evaluation. In other words, this work reviews the literature on the protection of historical gardens and the theoretical foundations of Persian gardens in the Qajar era. Direct observations, written works, photographs, plans, verbal history, and legends are the best references to research Persian gardens (Irani-Behbahani, 2018) I, based on historical and photograph documents, travelogues, aerial photographs, On-Site Field Study, and verbal historical sources, the ancient model of the campus of the Urmia University is identified. The history of the campus was divided into three major historical eras, evaluating the evolutions of each era. The relative area of the campus garden was found by investigating the deed of gift in the first era, and

the buildings of the garden were somewhat identified. However, the structure was not identified.

In the second era, based on the remnants of the garden, aerial photographs captured in 1956, and verbal history, the structure of the garden was identified. Also, since the building had all been destructed, except for one building, the remaining photographs of the garden were collected, obtaining the overall image of the garden and its structural systems, including the geometry, water, and planation systems as well as buildings and visual landscape. Finally, in the third era, based on the structure and buildings of the garden, field studies, captured photographs, and reference to the history of the two earlier eras, solutions were proposed to protect and revive the garden. In the end, we will answer such following question that are "What are the factors that harmed and destructed the historical gardens of Urmia? And why has the campus been able to relatively last until now?

3.2. Research location

The campus of the Urmia University lies in the southwest part of Urmia, next to the Shahr Chay River. The campus is entered by both pedestrians and vehicles through the northern side (Shahid Beheshti Street). There is a secondary entrance on the eastern side (Mansour Afshar Street). The campus has a total area of 9.3 hectares and is surrounded by the Islamic Azad University, Road and Urban Development Office, Azarbaijan Hospital, and Qoba Mosque.

Figure 4. Aerial photograph of the campus in 2019

3.3. History of the campus

The garden had an area of 50 hectares and used to belong to Najaf Gholi Khan Biglarbeigi's

mother, who gifted it to her nephew Malek Ghasem Mirza, the 24th son of Fath-Ali Shah Qajar and the governor of Urmia. There is only a

deed of gift remaining from those days. However, the text of the deed provides significant information on the garden. The garden was later

bought by American Missionaries (Protestants) to offer medical services.

Figure 5. Deed of gift of the garden.

The introduction of Christianity to any part of the world has a story. Christianity was introduced in Iran in the Parthian era, 1st-2nd century AD. Fifty years after the arrival of the first Christian missionary in Iran, the first medical missionaries, i.e., Dr. Grant and Dr. Perkins, arrived in Urmia and founded schools in 1835. They offered medical services at their homes (Kavianpour, 1999). The missionaries not only paid for the education of the youth in Urmia but also offered free medication and drugs. Drugs were important as they related to families and created acceptance in families, leading to public acceptance over time (Mansouri, 2000). Later in 1878, Dr Joseph P. Cochran, born in the village of Seer, Urmia, and son of two American missionaries, completed his education in New York and returned to Urmia. Dr. Cochran bought 15 hectares of the garden to establish a hospital (Dehgha, 1969). Then, West Minster Hospital was launched in 1879 by Dr. Cochran. The hospital involved four separate buildings. Dr. Cochran and his colleagues established a medical and pharmaceutical education college due to the shortage of doctors (Gorgiz, 1918). Eastern people, particularly Persians, would respect a country that built hospitals for them (Garrote, 1990). It should be noted that the first modern medical center and medication school had been established seventeen years earlier by Dr. Perkins and colleagues in the village of Seer, which were then moved to the hospital of Dr. Cochran (Aghlmand, 2019). This medical center had simple and clean classrooms, a library, a clinic, a drug store, a women's hospital, and a separate building for patients with infectious diseases.

After years of hard work and significant services, Dr. Cochran died from typhus, at the age of 50 (Gorgiz, 1918). The attack of Sheykh Obaydollah, a Kurd commander of the Ottoman Empire, on Urmia was an important historical event in those years. During the attack, the flag of the UK was placed on the college's door, and Christians and Muslims were asked to gather in the garden for protection from the invaders since Sheykh Obaydollah would not harm those who were supported by Dr. Cochran (Speer, 2018). It should be noted that the people of the city believed that Dr. Cochran supported Sheykh Obaydollah's attack on the city (Mansouri, 2000). Six months earlier, Dr. Cochran treated Sheykh Obaydollah's severe disease, and this was the explanation for their friendship. Before Sheykh Obaydollah attacked, fifteen Christian families along with domestic animals ran to the college and stayed there for six weeks (Wilson, 2001).

The missionaries kept their activities until 1933 (Dehghan 1969), when Reza Shah Pahlavi ordered all foreigner missionaries to leave Iran. The lands of the missionaries were bought by the government and granted to the Ministry of Education. The garden was converted into the department of agriculture, and the buildings of the garden were destructed to be replaced with new buildings over time. Also, the portal of the building was alternated (Khalilzadeh, 2019). This garden became the Urmia University in 1977 (Gehghanm 1969). Today, 9.3% of the initial garden area remains unchanged, which was registered in the National Heritage List of Iran in 2016. This complex is currently the research

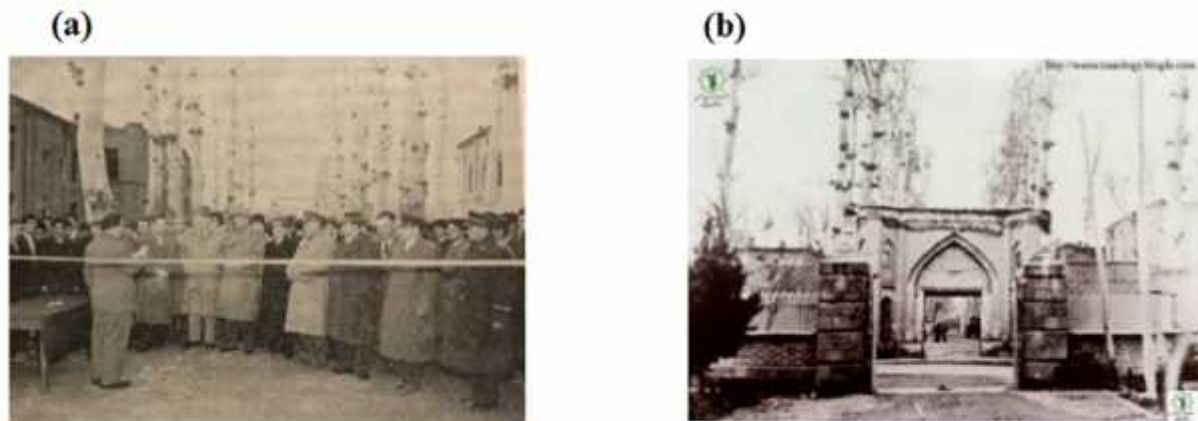center of the Urmia University (Urmia Cultural Heritage Archive).

Figure 6. (a) Opening of the Agricultural Department of the Urmia University in March 1956 (Ref. Ali Khan Vaali's photo album, 1983) and (b) the portal of the Urmia Agricultural School (Ref. Ali Khan Vaali's photo album, 1983).

4.   Result and Discussion

Urmia has lived and grown with nature. In light of fertile lands and pleasant climate, the people of Urmia have had a strong interaction with nature, and most of the middle and rich classes used to have gardens. The poor class worked in private gardens. Most of the people spend summer working in gardens and collecting crops. Apart from profitability, gardens were a place of recreation and amusement. However, people chose to move to cities as cities were more secure than country areas during domestic and foreign conflicts. As a result, the historical gardens were abandoned and disappeared over time. The Islamic Revolution in 1979 eliminated aristocracy,

and historical gardens were abandoned. Also, the heirs of the gardens did not protect their gardens. This represents another reason for the destruction and disappearance of historical gardens. Today, only some ruined buildings and idle lands remain as the relevant authorities did not attach importance to the gardens.

The development of the garden could be studied in three eras:

Era 1: Before the garden was purchased by American missionaries

Era 2: The settlement of American missionaries

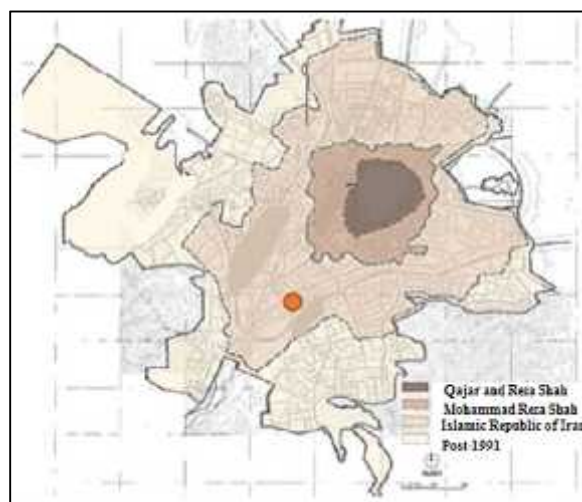Era 3: After American missionaries left and delivered the garden to the government

Figure 7. Campus area in different periods (Archive of the Art Department of the Urmia University)

4.1. Era 1 of development

The deed of gift provides significant information on the garden in its initial development period.

The area of the garden: The garden bordered the Bayaz Land used by Shahsavarkhan for farming to the east, Zereshkzar Garden to the west, Share-e Am (Public Road) to the south, and Shahr Ajoo Creek to the north.

Interior of the garden: The interior space of the garden involved fruit and non-fruit trees, private and public buildings, a workshop, a watch house, stables, and the bathroom. The other components of the garden rested in Siavash Garden.
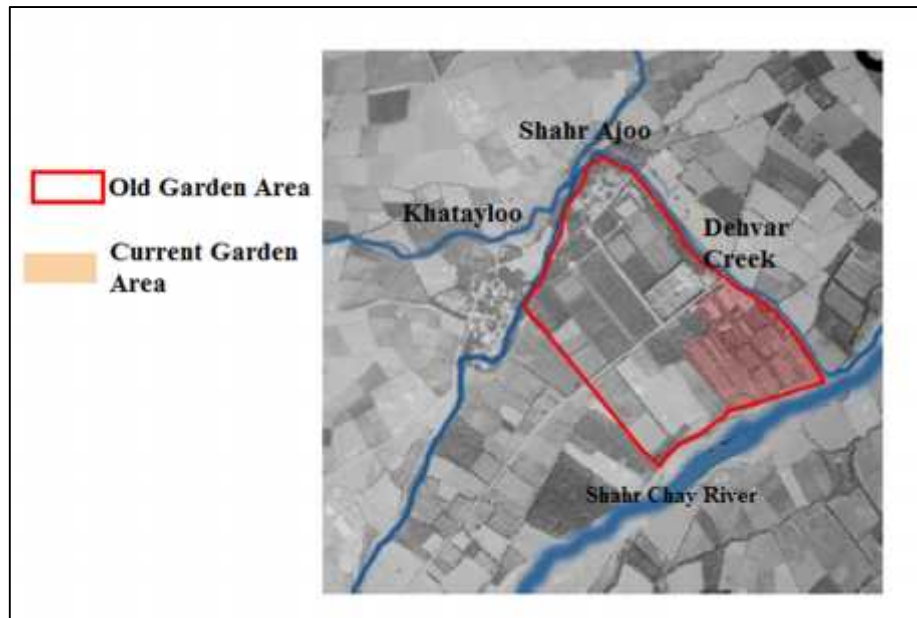
Figure 8. An aerial photo of Urmia in 1956.

As can be inferred from the interior space description of the garden, this campus used to be an ornamental, recreational, and aristocratic garden irrigated through Shahr Ajoo Creek. It involved Persian garden elements, such as the portal, walls, private building, public building, and trees. Also, given the architectural similarity of the portal of the garden to that of Delgosha Garden (one of the most famous gardens of Urmia), such as ogee arches, scale, proportions, and brickwork, it can be said that the two gardens were built in the Qajar era.
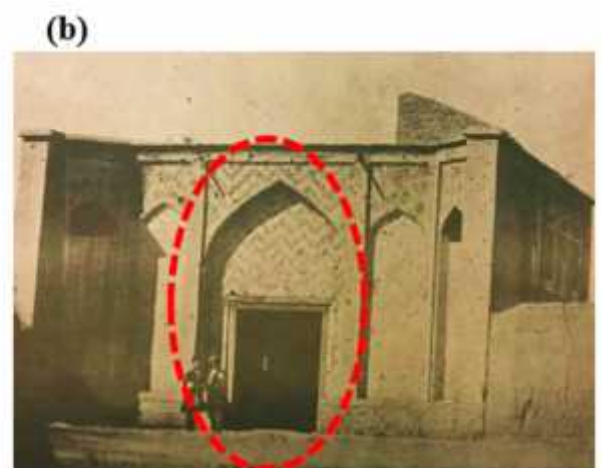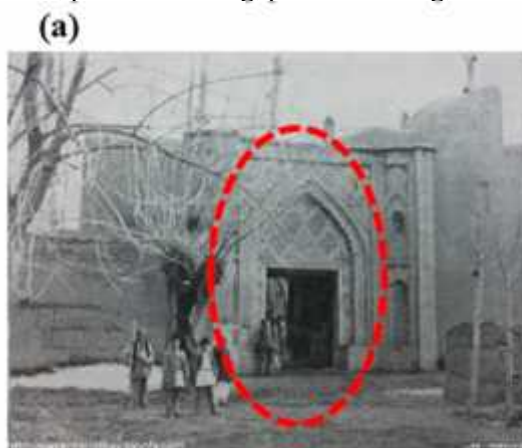

Figure 9. (a) Entrance of the campus with ogee arches and brickwork (Ref. Sina Eslam Noor's personal album) and (b) Exterior portal of Delgosha Garden (Ref. Ali Khan Vaali's photo album, 1983).

Given the location of the portal, approximated area, and the deed of gift, it seems that this garden involved two sections separated by a narrow road connecting the village of Band from the city of Urmia.
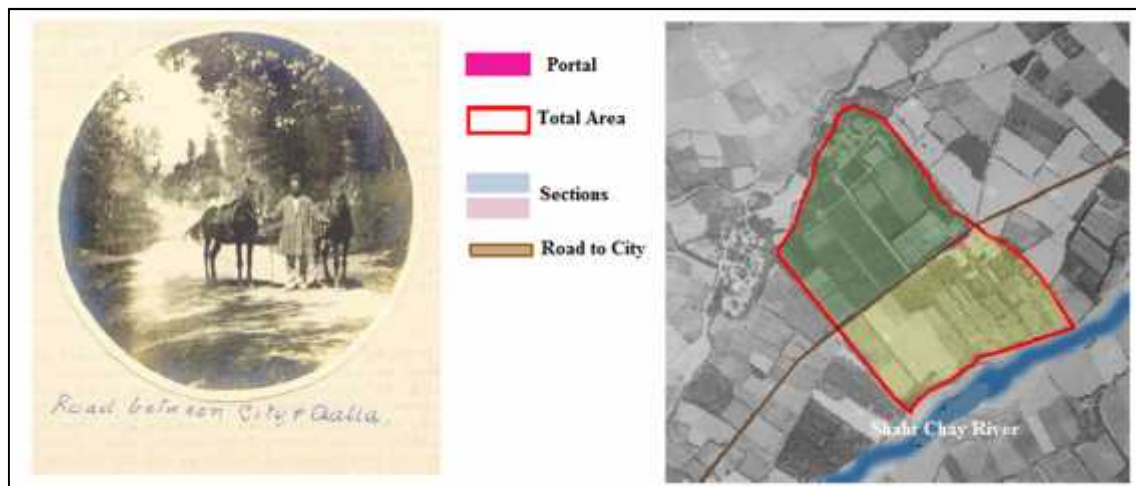
Figure 10. The two-section area of the garden.

4.2.   Era 2 of development

Indeed, the settlement of the Americans changed the structural system of the garden since the missionaries sought to enhance health levels, help patients, adhere to religious principles, and live a simple life without luxurious aspects. Avoiding luxurious aspects in the settlement space was necessary in order to gain public trust. The garden was seemingly selected to build the American hospital and college for a number of reasons, such as the rural region, the vicinity of the village of Seer (a Christian village and the place of missionary establishments), and significant water supply for health and hygiene purposes.
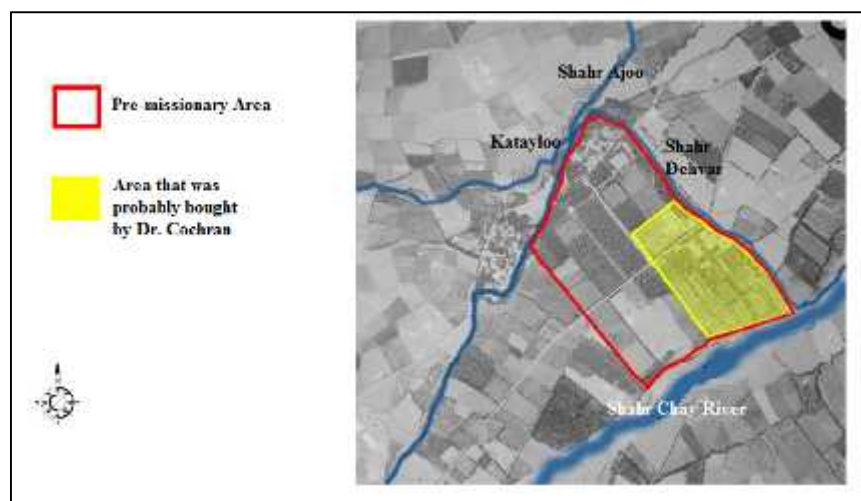

Figure 11. Pre- versus post-missionary areas of the garden.

4.2.1. Geometric system

As with other Persian gardens, this garden had a rectangular shape. However, it underwent a slight geometric alternation to follow the surrounding natural features (the river and creeks); that is, the northern part of the garden reduced, and the southern part lost its parallel position to the northern side. Overall, the garden changed from a rectangle into a trapezius.

Figure 12. Shahr Chay River and Dehvar Creek, 2019.

Based on field observations, the garden has a tri-line plan in terms of old plane trees on the two sides of the main roads and a perpendicular-line plan in terms of different line widths and perpendicular lines. Thus, the geometry of the garden can be said to be a combination of the tri-line and perpendicular-line plans.
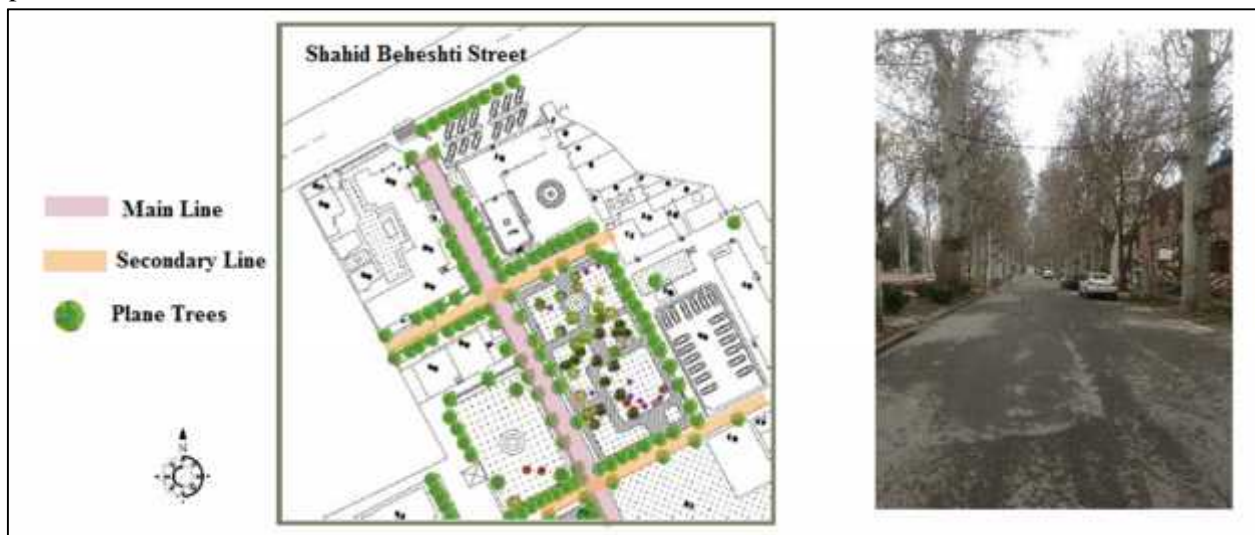

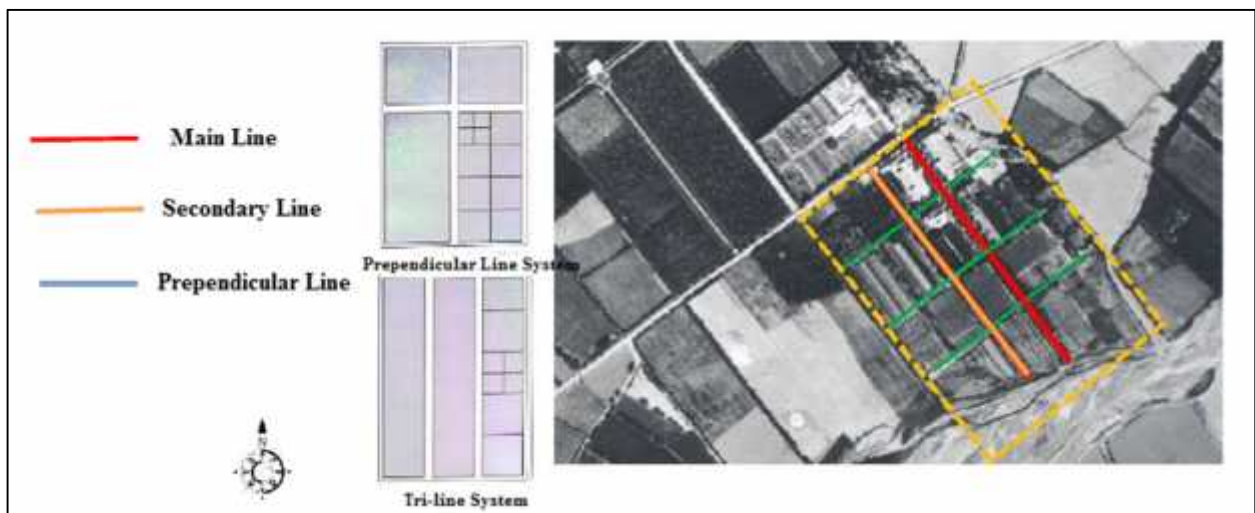**Figure 13.** Main and secondary lines and plane trees of the garden.

Figure 14. Geometric system of the garden (review by Dr. Alaei)

4.2.2. Physical system

Water system) The Dehvar Creek flows on the eastern side of the garden. The ground slopes are small in the northern and southern parts, with an elevation difference of nearly 1.5 from the ground and 2 m from the Shahr Chay River. Thus, the terraces were irrigated by the gravitation-induced flow of water from the north to the south. Unlike most Persian gardens, the entrance of the garden is located upstream.
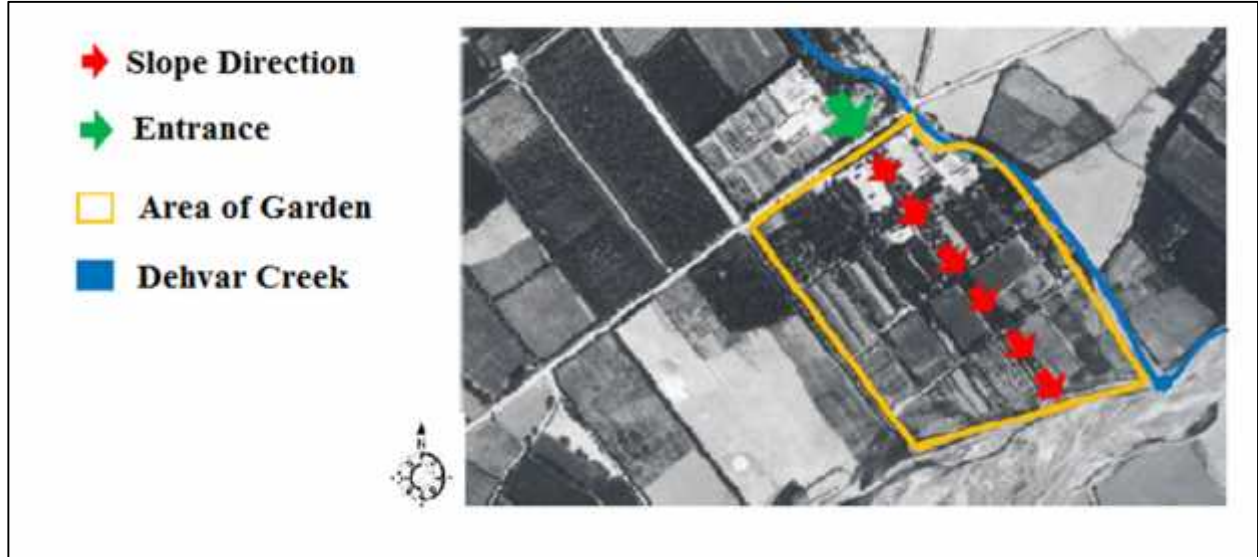

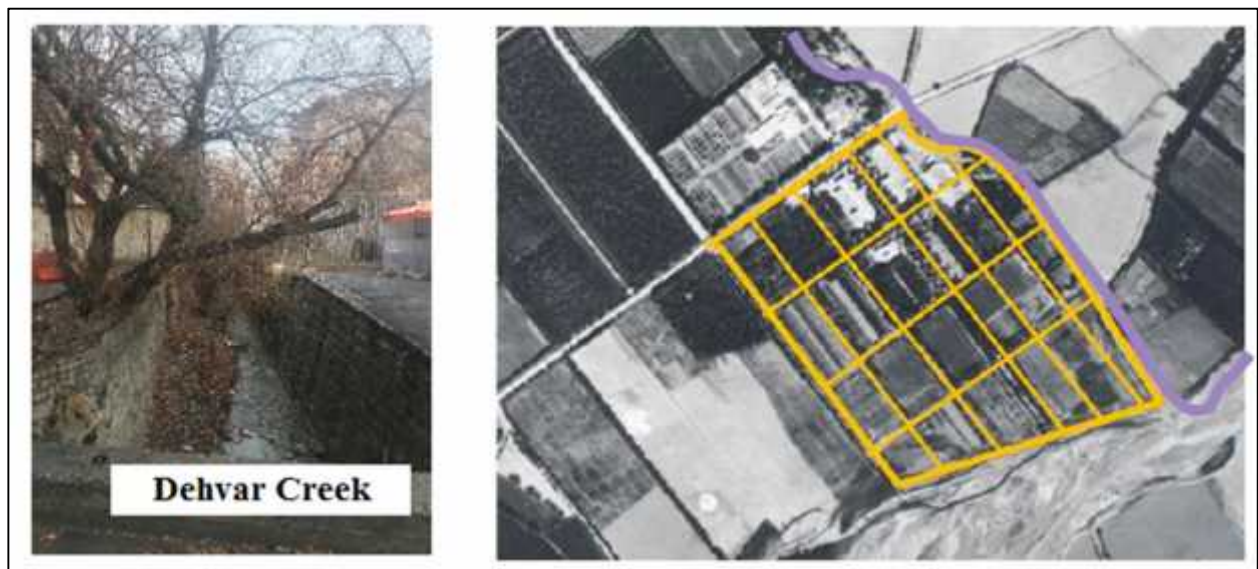**Figure 15.** Creek flow and ground slope directions.

Figure 16. Regular and asymmetric geometry of the garden based on the terraces and irrigation system.
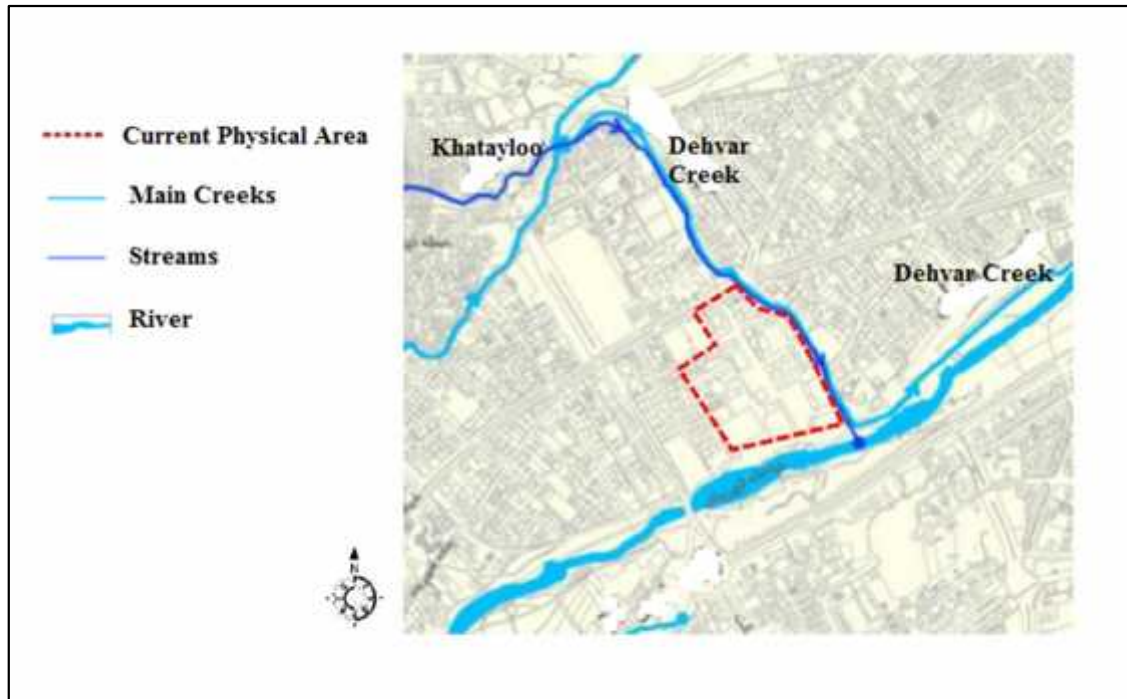
Figure 17. Adjacent water flows.

4.2.3. Plantation system

The vegetation of the garden represents not only ecological and aesthetical aspects but also public and identity dimensions. For example, the plane trees have a long history and are registered. They significantly help understand the geometric structure of the garden. However, the plantation system has significantly destructed, and only the trees can be mentioned, e.g., eastern redbud, Spiraea, maple, pomegranate, locusts, and Simaroubaceae trees. Even Pahlavi-planted flowers have disappeared, and most part of the garden has no vegetation.
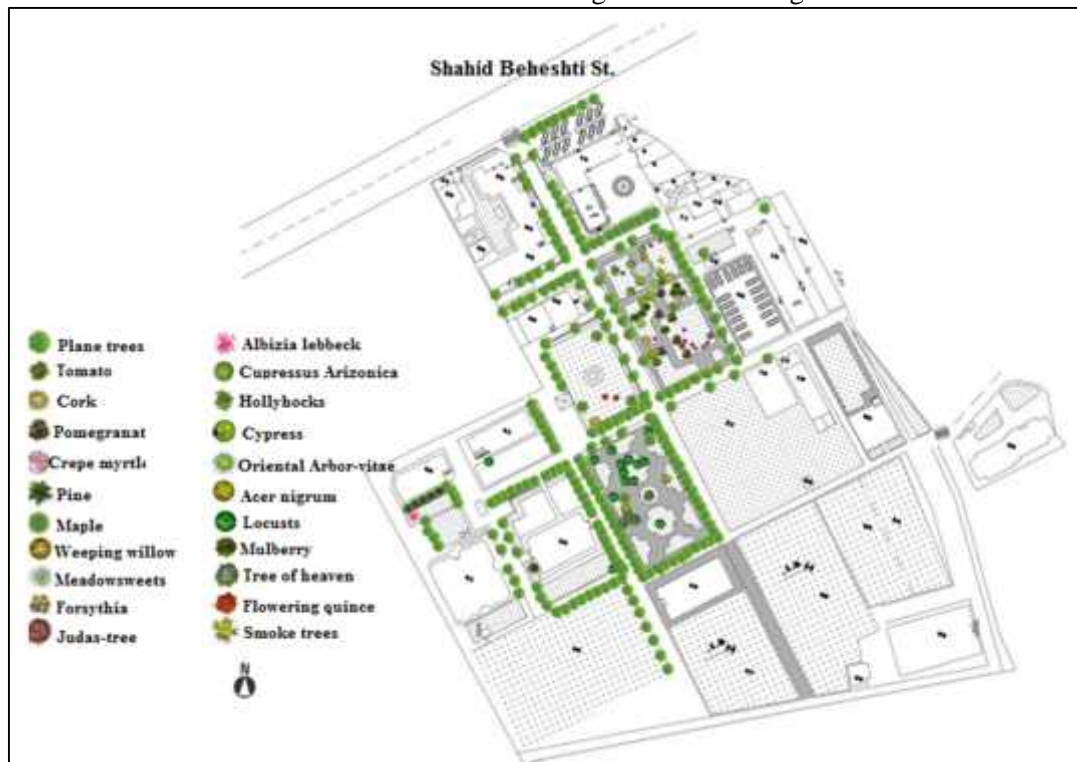

Figure 18. Vegetation of the garden.

The Qajar gardens of Urmia were all Persian gardens with Persian elements, including fences, portals, main buildings, and private buildings. Today, only the Tabib House and Arbabi House remain, which are surrounded by many modern residential buildings.

Figure 19. Gardens of Urmia.

Based on the deed of gift, the garden had several buildings, as with other Qajar gardens. However, the main building was not observed. The complete disappearance of the main building cannot be verified as no excavation was performed. The garden had fences and a portal since its construction. These two elements could contribute to the privacy and security of the garden. In the second era of development, the Americans applied a new architecture to the interior buildings; however, the portal was maintained unchanged. In the local language, the garden is called "Sibler Ghalasi," which means "the castle of masters." This suggests that tall walls existed around the garden. According to Dr. Firouz Mansouri, the public thought that the garden was planned to be converted into a stronghold. Overall, the French Renaissance influences can be found in the second era of development in the garden. For example, although there is a major line along the portal and some perpendicular roads, no main building or important buildings are observed in the intersections, unlike Persian gardens. Also, the distribution of the buildings within the garden resembles the French Renaissance architecture with larger gardens, higher tree variety, and asymmetric building architecture. The use of the same facades and the positioning of buildings around the main line are not Persian garden elements.

Divided into two sections by the main line, with no significant element at the intersections, unlike Persian gardens

Figure 20. The main axes of the garden.
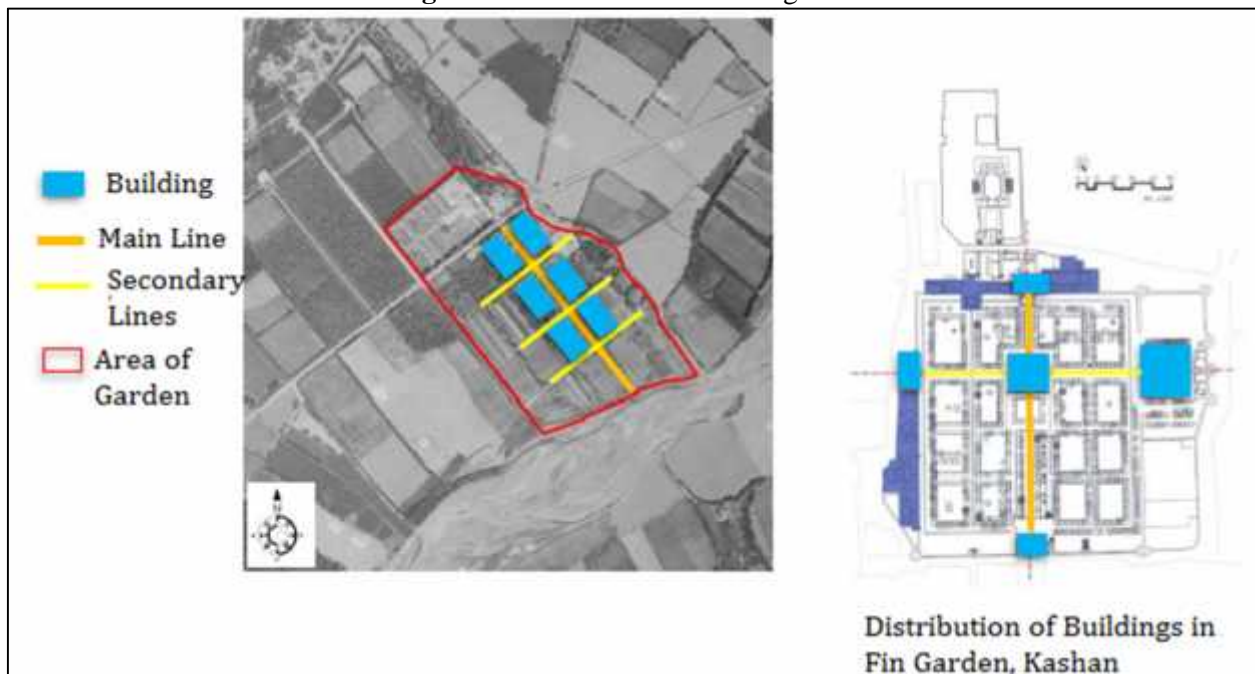

Distribution of Buildings in Fin Garden, Kashan

Figure 21. Building distribution comparison of the case study garden versus Fin Garden, Kashan.
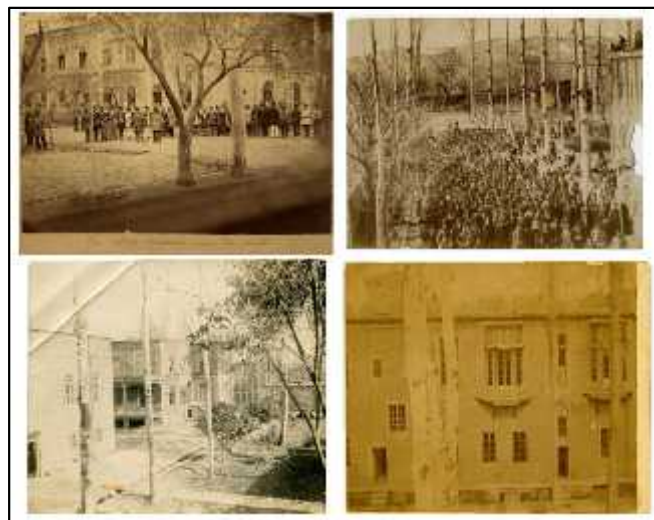

Figure 22. Photographs of Pardis Historical Garden (Ali Khan Vaali's photo album and Sina Eslam Noor's personal album)

4.2.4. Landscape

As with the late Qajar gardens, this garden has a long landscape rather than an interior short landscape, and the main line runs the sight from the beginning to the end of the garden. Perhaps this explains the lack of buildings at the intersections – i.e., in order to avoid obstructions in the long landscape. This indicates the importance of the interior and exterior landscapes of the garden.

Figure 23. Main road with two lines of plane trees defining the long landscape.

As with the late Qajar gardens, large grassed areas are observed. However, no ornamental elements such as sculptures, columns, bridges, or arbors were added for religious reasons. Metal fences around the buildings resemble American houses in the 19th century. This is not an element of Persian gardens since a primary principle of Persian gardens is the inseparability of humans and nature.

Figure 24. Historical photo of the garden of the Emarat Birooni in 1290 AH Source: Sina Islam Noor Photo Archive.

4.3. Era 3 of development

The American missionaries left the garden, and it was converted into the Urmia University. New buildings were constructed in the Mohammadreza Shah of Pahlavi and the Islamic Republic of Iran eras. The old buildings, except for the Tabib House, were destructed, the reasons of which remain unknown. The plane trees were maintained, and new ornamental trees and flowers were added to the garden. However, the historical elements and the garden are at a serious risk of damage in the absence of protection. Heterogeneous constructions have harmed the elegance of the garden. The initial design of the garden was influenced by the late Qajar garden architecture, while the garden underwent French-Italian influence and land use changes in the second era of development, gaining a new shape. It is today employed as a campus for educational purposes.

Figure 25. Area of the garden during (a) 1938-1977, (b) 1978-1993, and (c) 1994-present.
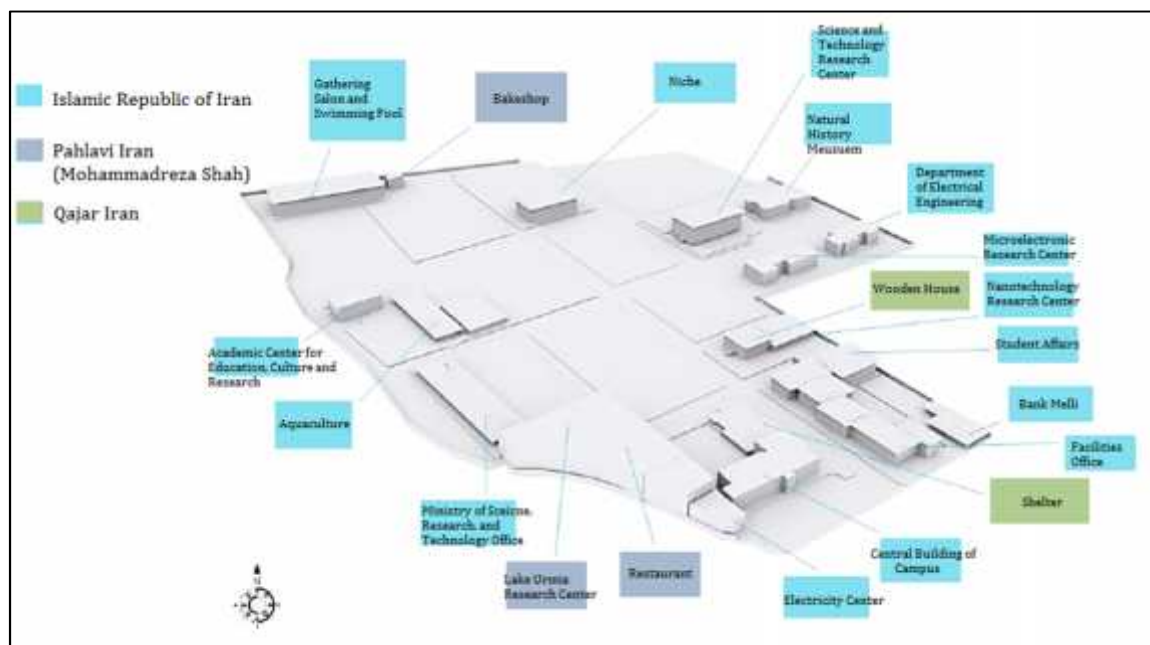

Figure 256. Buildings of the campus.

5.   Conclusion

The history of the campus of the Urmia University was divided into three eras, the investigation of which somewhat revealed the story of the garden. The garden used to be an ornamental and resort garden in late Qajar Iran. It belonged to the noble class, but there is no information on how they lived within the garden.

Based on the conservation theories, based on Bioto intuition it is possible to agree that blowing new souls into the heritage causes that the vintage, old constructions and historical gardens revive. When a construction is done, a physical phenomenon is created but after pacing one generation it gets a cultural meaning. Adding and utilizing physical, social functions of the historical gardens in Urmia which are following the main principle of the conservation's theories, is the

thing that has made such natural heritages survive until now. It is obvious, when there is no practice of such values, there would not any needs to utilize such architectural heritages and they will be deteriorated by time.

The aerial photographs of different years and current conditions suggest that the American missionaries brought some alternations in the garden's structure and geometry since they were not familiar with Persian garden principles and intended to make new uses of the garden. These alternations harmed the space of the garden. The Americans maintained the entrance and walls of the garden unchanged and destructed the buildings to construct new ones. These alternations probably did not seem to be irrational in that period as they were aimed at making optimal use of the garden to

meet public requirements. The alternations helped the garden survive, even though domestic unrest and insecurity encouraged people to choose to live in the city, abandoning gardens in Urmia over time. For example, Delgosha Garden in Urmia was located next to one of the city gates, but it was given to the army to provide security. This destructed the structure of Delgosha Garden completely. However, the case study garden survived unrest and insecurity in light of conversion into a medical and service garden. It was able to survive in the Reza Shah era, when Americans left the garden and gave it to the Ministry of Education in the form of an educational garden. However, old buildings continued to be destructed and replaced with new ones over time, and the structure of the garden underwent large variations. As a result, the implementation of alternations to adapt to the requirements could be a solution to protect historical gardens. The initial model of the garden and the geometric, plantation, and water systems of the garden were obtained, which could be helpful in the design of green spaces and the revival of undiscovered historical gardens in Urmia. A number of general suggestions are proposed to protect this historical garden as a national heritage for future generations. These suggestions could be discussed in detail in future studies. These suggestions include designing the garden area based on the obtained model and making new uses of historical buildings, such as converting the Tabib House into the Tabib Museum, making high-level decisions to contribute to the economy of the Urmia University, creating urban oxygen places, and reviving the past lives of gardens in the minds of the public to enhance tourism. Table 1 summarizes the structural evolutions of the garden in the three eras of development.

Table 1. Evolutions of the garden

	Era 1	Era 2	Era 3	
			Pahlavi Iran	**Islamic Republic of Iran**
Function system	Recreational (private garden)	Medical and Educational (a medical college and a hospital)	Educational (Urmia University)	Educational (Urmia University)
Plantation system	Unavailable	Irrigation-based system with plane trees on the two sides of the major and minor roads	Plane trees and the addition of Indian species of trees and flowers	Maintenance of plane trees and the disappearance of valuable trees
Water system	Dehvar Creek	Dehvar Creek	Dehvar Creek	Pipelines
Building system	Private and public buildings, fences, and portal	Fences, portal, new buildings (residential, medical school, and four West Minster Hospital buildings)	Urmia University, destruction of all Qajar buildings, except for one building, construction of new buildings	Construction of heterogeneous buildings, maintenance of Pahlavi buildings, maintenance of one Qajar building
Area	50 hectares	15 hectares	15 hectares	9.5 hectares (as a part of the garden was given to the Islamic Azad University of Urmia)

5.1. Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Life Cycle Assessment of Gayo Arabica Coffee Green Bean at Aceh Province

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ABSTRACT

Indonesia's coffee production will reach 774.6 thousand tons in 2021, an increase of 2.75% from 2020, which was 753.9 thousand tons, and is the highest in the last decade and is expected to increase threefold in 2050. Hence, the evaluating environmental performance of the coffee agroindustry is essential if it is to become a more sustainable agroindustry. This paper aims to assess environmental performance (energy footprint, water footprint, and carbon footprint) in Gayo Arabica coffee green bean production with different agro-industry models. The method to evaluate environmental performance that can be used to identify indications of sustainability is Life Cycle Assessment (LCA) Method. The study was conducted on coffee production and exporter cooperatives in Central Aceh. Primary data were obtained through interviews with farmers, collectors, huller owners, and cooperative administrators. Secondary data comes from cooperative reports. The LCA study is described in two product systems, the model of 2015 and the model of 2016. The LCA model of 2015 is based on the green bean production system carried out in 2015 which includes water treatment, pulping, collecting, drying, hulling, finishing, and transportation. The LCA model of 2016 is based on the green bean production system carried out in 2016 until now which includes sub-processes for water treatment, pulping, collecting 1, hulling, collecting 2, finishing, and transportation. The results show that the energy footprint of the 2016 model (2.5128 MJ per f.u) is greater than that of the 2015 model (1.2336 MJ per f.u), the water footprint of the 2015 model is the same as the water footprint of the 2016 model product system, namely 0. 0086 m^3 per f.u., and the carbon footprint of the 2016 model (1.93 kg CO_2-eq per f.u) is greater than that of the 2015 model (1.48 kg CO_2-eq per f.u). The cooperative initiative (in the model of 2016) is for the purpose of process improvement but cannot reduce carbon emissions. To reduce emissions from the use of fossil fuels, it is necessary to optimize land transportation routes and energy efficiency.

Keywords: arabica green bean; environmental performance; energy footprint; water footprint; carbon footprint

1. Introduction

The International Coffee Organization (ICO) noted that in 2020, global coffee production was 10.521 million tons, up 6.3% from the previous year which amounted to 9.897 million tons. According to Statistics Indonesia (*Badan Pusat Statistik* – BPS) 2022, Indonesia's coffee production will reach 774.6 thousand tons in 2021, an increase of 2.75% from 2020, which was 753.9 thousand tons, and is the highest in the last decade and is expected to increase threefold in 2050.

Indonesia's coffee production is the fourth largest in the world after Brazil, Vietnam, and Colombia. Hence, the evaluating environmental performance of the coffee agroindustry is essential if it is to become a more sustainable agroindustry. According to (Nab & Maslin (2020), sustainable coffee production in Brazil and Vietnam can reduce the carbon footprint by 77% compared to conventional production based on the type of pathway and means of transportation and the reduction of agrochemical inputs. The 2008 Deutschland Pilot Project reported that 55% of the carbon footprint of coffee production is generated during on-farm cultivation and processing, 30% during consumption, and the remaining 15% is generated from transportation, processing and

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waste disposal. Several previous studies also reported that the cultivation stage (including processing on farmers), and consumption had the greatest environmental impact (Killian et al., 2013); (van Rikxoort et al., 2013); (Domínguez-Patiño et al., 2014); (Hassard et al., 2014); (Maina et al., 2015); (Arzoumanidis et al., 2017). The high carbon footprint generated during on-farm processing is the focus of future research, especially in choosing technology and the stages of the green bean production process in the scope of farmers. The method to evaluate environmental performance that can be used to identify indications of sustainability is Life Cycle Assessment (LCA) Method.

The LCA can evaluate the overall environmental performance of activities in the field, transportation, material transformation, processing, distribution, consumer presentation, and final waste treatment (Rega dan Ferranti, 2019). LCA traces the potential environmental impacts of production activities throughout or part of the life cycle. The results of the assessment determine improvements to activities that have the greatest environmental impact (hotspots). LCA helps parties improve production processes and formulate alternative production systems. The LCA method, which has become the standard for assessing the life cycle of products and services, uses carbon emission indicators known as greenhouse gas LCAs (BSI 2011) or carbon footprints (Cordero, 2013).

Calculation of carbon footprint can be used to detect waste production upstream (garden and post-harvest), assess hotspots in the production process, identify resource and energy risks in product systems, and identify farmers and collectors who are willing to improve sustainability performance so that they can be involved and help implement practices. sustainability, identify energy efficiency so that it can be expected to reduce costs and improve product energy efficiency (Bockel & Schiettecatte, 2018).

The use of energy and water in the cultivation, primary processing, and serving of coffee by consumers has been evaluated in various life cycle assessment studies in Thailand (Phrommarat, 2019) and Mexico (Giraldi-diaz et al., 2018). Concern for environmental impacts is increasing along with consumer concern for environmental sustainability throughout coffee production (Rega dan Ferranti, 2019).

The carbon footprint of a product is a measure of the potential global warming impact resulting from a production system and can be expressed in environmental labeling. The initial LCA study of coffee products used carbon footprint calculations to calculate CO_2-eq across all activities (Salomone, 2003). Carbon footprint indicators have been used to compare production models between organic and conventional cultivation (Trinh et al. 2019), variations in carbon stock and plantation management in coffee agroforestry (van Rikxoort et al. 2014), and the productivity level of coffee grounds (Maina et al. 2015). Transportation is the largest source of emissions in the imported coffee supply chain (Specification, 2008). Giraldi-diaz et al. (2018) concluded that transportation affects the sensitivity analysis because the distance between the material transformations determines the fuel consumption. LCA studies of coffee production have different assessment results and depend on the production model being evaluated. However, LCA studies comparing production models that have different stages of primary processing and transportation are still limited in Indonesia, especially on one of the main producers of Arabica coffee, namely the Gayo Highlands, Aceh Province, which includes the administrative areas of Central Aceh, Bener Meriah, and Gayo Lues. One of the largest suppliers of specialty and environmentally friendly coffee comes from a cooperative whose function is to manage the production of members of farmer groups, collectors, and huller owners. The cooperative was founded in 2010 to improve the quality of coffee beans by adopting organic coffee cultivation practices and providing added value to members through cooperation in fair trade certification and advanced primary processing technology facilities. In 2014, the importer evaluated sustainable management practices in handling hornbill waste at the cooperative location and recommended the addition of hulling processing facilities at the collector level. In 2016, all horn skin coffee beans were handled by hulling facilities located in 10 collection locations. Then the coffee beans (hulled) are transported back to the collector for drying (until they meet the moisture content accepted by the cooperative). This results in additional transportation routes and primary processing stages. The coffee beans should be sent for further processing at the cooperative location. However, due to the limitations of the drying floor facilities at the

hulling process location, the coffee beans cannot be transported directly to the cooperative. This condition causes additional transportation routes.

Therefore, this paper aims to assess environmental performance (energy footprint, water footprint, and carbon footprint) in Gayo Arabica coffee green bean production with different agro-industry models. The study was conducted on coffee production and exporter cooperatives in Central Aceh. Primary data were obtained through interviews with farmers, collectors, huller owners, and cooperative administrators. Secondary data comes from cooperative reports. The LCA study is described in two product systems, the model of 2015 and the model of 2016. The LCA model of 2015 is based on the green bean production system carried out in 2015 which includes water treatment, pulping, collecting, drying, hulling, finishing, and transportation. This study contributes as a source of literature on the sustainability of Gayo Arabica coffee on environmental aspects. There are three impact categories analyzed, namely carbon footprint, energy footprint, and water footprint. We use SimaPro software to determine the amount of value generated in each impact category in both green bean production models. Furthermore, a sensitivity analysis was carried out on green bean production as an improvement scenario in the production model with the lowest environmental impact category value. Several parameters were determined in the sensitivity analysis: reduction of distribution distance for each distribution activity, reduction of water use, reduction of electricity use, increase in yield, and losses during production.

2. Theoretical Underpinning

According to Directorate General of Estate, Ministry of Agriculture, Indonesia 2021, arabica coffee production in Aceh Province increased by 2.65% from 2017 to 2019 (Kementan, 2021) with an average productivity of $650 – 750$ kgha^{-1} (Asis et al., 2020). One of the Gayo arabica coffee advantages is that it is organic coffee which has a distinctive delicious taste and that is produced using sustainable or sustainable agricultural understanding (Sinaga & Julianti, 2021). The taste of Gayo arabica coffee has been noted as one of the best specialties one in the world since 2000. This can be the result of many factors, such as the varieties of coffee planted on the unique geographical condition (high elevation form 900 m to 1,700 m a.s.l.), unique climate condition (1,643–2,000 mm of precipitation per year), soil interaction, and special techniques applied during

post-harvesting (Sinaga & Julianti, 2021). In general, there are three main types of arabica coffee processing techniques, namely wet type (Sulaiman et al., 2021); (Abubakar et al., 2019), dry type (Sulaiman et al., 2021; Abubakar et al., 2019;); and semi-wet type (Abubakar et al., 2019; Sinaga & Julianti, 2021).

The advantages of gayo arabica coffee can be an option for coffee lovers in the world to try it as a daily stimulant booster (Machado-Fragua et al., 2019), especially in the morning or evening (Sulaiman et al., 2021). On the other hand drinking of coffee can provide health benefits (Wasim et al., 2020); (Grosso et al., 2017); (van Dam et al., 2020) such as cancer (Sartini et al., 2019; Wasim et al., 2020; Ellingjord-Dale et al., 2021; Chen et al., 2021; Nguyen et al., 2021), type 2 diabetes (Wasim et al., 2020; Jin et al., 2020; Hang et al., 2020), heart health (Bodar et al., 2020), depression (Wasim et al., 2020; Wang et al., 2016; Elstgeest et al., 2021), minimize the osteoporosis or osteopenia risk in premenopausal (Chang et al., 2017), and also keeps us healthy due to antioxidants and secondary metabolites (Loftfield et al., 2018). Therefore, drinking coffee can remain an icon of the modern lifestyle in most of the major cities around the world.

Based on several advantages of consuming coffee, making coffee as a refreshing agent that is continuously sought after by world coffee consumers. Therefore, with its unique taste and aroma, Gayo Arabica coffee has the potential to continue to be one of the coffees favored by world coffee consumers. This is a challenge for Gayo Arabica coffee farmers and producers. Strategies and innovations need to be developed to maintain and improve the quality of Gayo Arabica coffee. In addition, it is necessary to minimize the environmental impact generating from the activities of plantations and producers of Gayo Arabica coffee. This study will identify an innovative and technology management in Gayo Arabica coffee business model that is environmentally friendly towards sustainability.

Globally, LCA in agroforestry and agroindustry of coffee has been widely carried out. The goal, of course, is to identify the environmental impacts generated in one coffee life cycle towards sustainability. LCA takes into account all activities involved in product creation with a holistic approach, such as raw material handling, transportation, manufacturing, distribution, use, and disposal (Abbasi et al., 2019). The LCA study begins with determining

the goals and scope followed by quantifying all material and energy inputs used in the process of producing the product (Pryshlakivsky and Searcy 2021). All inputs, outputs, and related potential environmental impact of a product throughout its life cycle will be calculated using LCA (Pryshlakivsky and Searcy 2021). The implementation of LCA is based on the guidelines of the ISO 14040:2006 standard which states the principles and framework for LCA, and the ISO 14044:2006 standard which states the requirements and guidelines for LCA. Based on the standards of ISO 14040:2006 and ISO 14044:2006, there are four recommended phases in an LCA study, namely the purpose and scope of the definition, Life Cycle Inventory Analysis (LCI), Life Cycle Impact Assessment (LCIA), and interpretation (Figure 1).
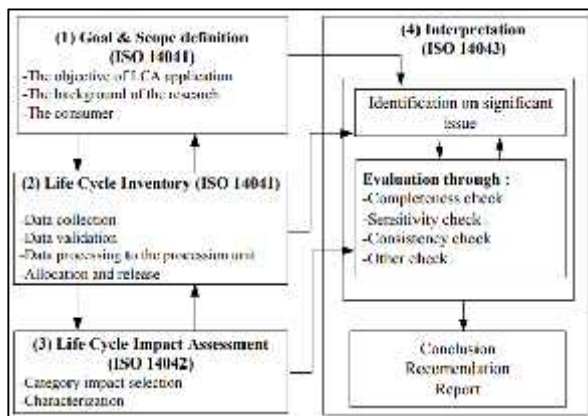

Figure 1. Stages of Life Cycle Assessment (LCA)

3.   Research Methods

The study was conducted on coffee production and exporter cooperatives in Central Aceh. Primary data were obtained through interviews with farmers, collectors, huller owners, and cooperative administrators. Secondary data comes from cooperative reports. The data and information collected from each of the Gayo arabica coffee processing actors are in the form of material and energy input data used as well as product output, co-products, and waste or emissions produced in each Gayo Arabica coffee processing activity.

The limitation of the coffee product system is cradle to gate (primary processing activities in farmers, transportation, and primary processing) with a functional unit of 1 kg green beans with SNI standards. The greenhouse gas LCA method uses the PAS 2050 (BSI 2011), IPCC 2006 (Killian *et al.* 2013), and ReCiPe 2016 (Giraldi-diaz *et al.*

2018) standards. The overall objective of the study is to evaluate the location choice policy of the hulling production process and its impact.

Life Cycle Inventory (LCI) involves the collection of environmental load data required to meet the research objectives. The environmental load is determined by the raw materials and energy used in a system as well as the emissions released by liquid waste and solid waste into the environment. The Life Cycle Impact Assessment (LCIA) aims to interpret environmental loads that have been measured in the LCI stage. In the LCA study of greenhouse gases, coffee products only use the potential impact of global warming with carbon emission indicators. The last stage, interpreting the results of the LCA study. If there are additional transportation routes, there may be an increase in emissions from fuel consumption. Improvement of overall environmental performance is expected to start from the stage of the production process which has the highest hotspots.

4.   Results and Discussion

4.1.   Production System Model

The LCA study is described in two product systems, the model of 2015 and the model of 2016. This is done to see how much change the environmental impact results from the two production system models. LCA model of 2015 is based on the green bean production system carried out in 2015 which includes water treatment, pulping, collecting, drying, hulling, and finishing processes as well as transportation that moves intermediate products from the previous process to the next process (Figure 2). LCA model of 2016 is based on the green bean production system carried out in 2016 until now which includes sub-processes for water treatment, pulping, collecting 1, hulling, collecting 2, and finishing as well as transportation that moves intermediate products from the previous process to the next process (Figure 3).

In general, the processing units in the coffee agroindustry in Indonesia, consist of pulping, washing, drying, hulling, and finishing (Mawardi et al., 2020). Appropriate technology in the post-harvest coffee production process is one of the main indicators in improving the quality of the product produced. In addition, the coffee production system model is also an indicator in minimizing the emissions produced (Basavalingaiah et al., 2022).

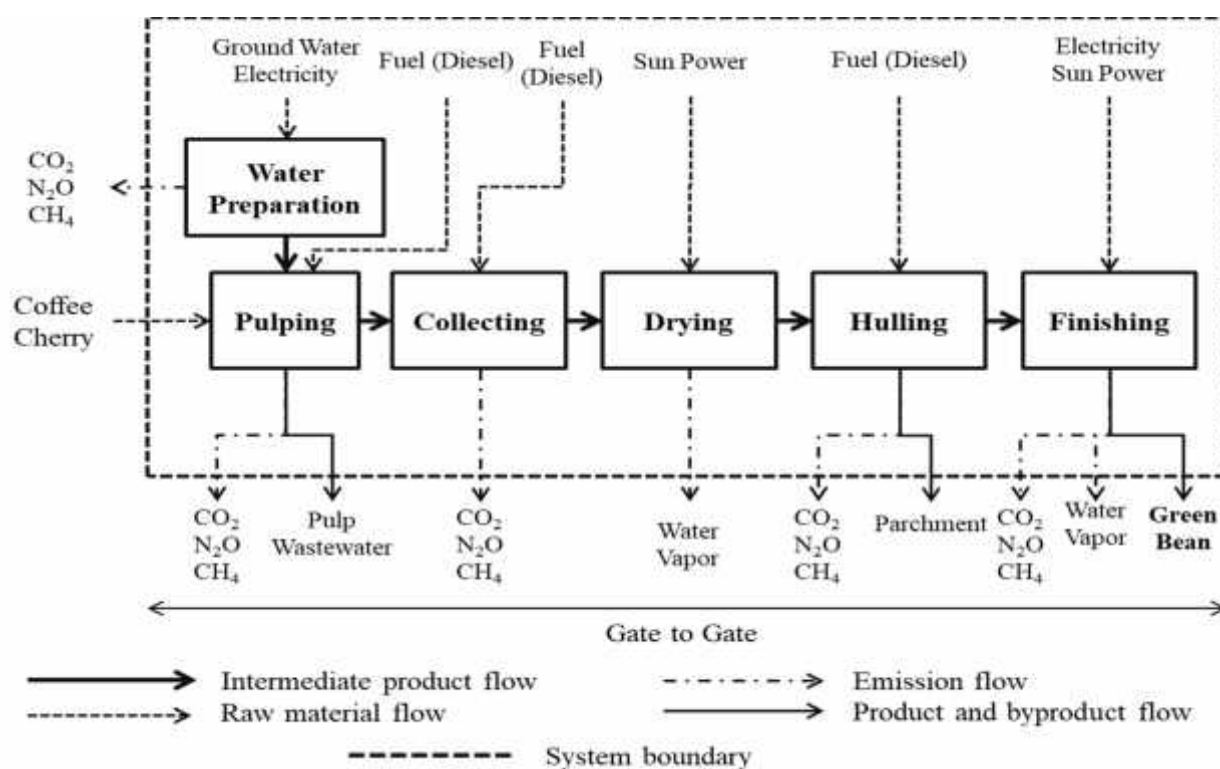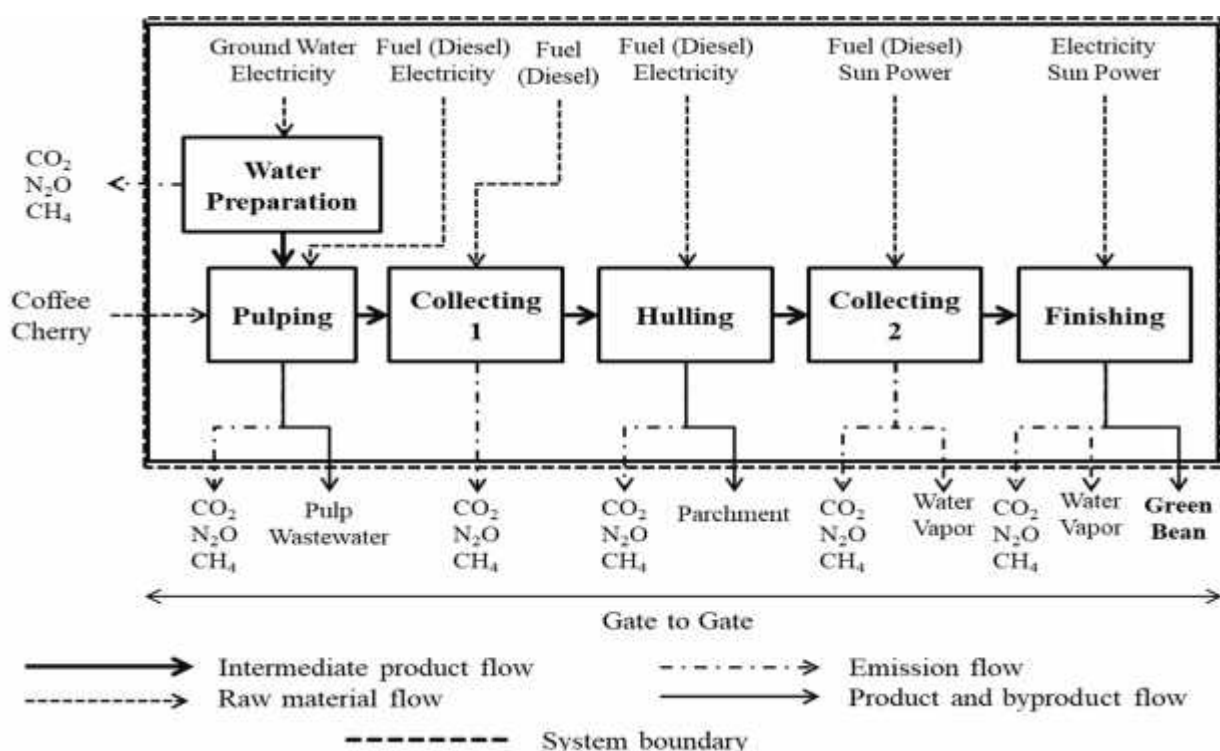**Figure 2**. System constraints Model 2015

Figure 3. System constraints Model of 2016

4.2. Inventory of Production System Model

The LCI of green bean production in wet processing shows the input and output flow for each sub-process in the green bean production system (Table 1). The number of inputs and outputs is shown based on the unit function (UF) which is 1 kg of green beans. The input of coffee

cherry in the model of 2015 is 24,017,945 kg with the number of green beans produced beings 5,554,150 kg. The input of coffee cherry in the model of 2016 is 14,693,268 kg with a total of 3,397,818 kg of green beans produced. The water requirement for each production system model is 2 times the number of coffee cherries to be processed into green beans. The amount of energy required in each model of the product system corresponds to the energy requirements of each process. Beside on each of inventory of production system model of Gayo arabica coffee, the three hotspots in the model of 2015 are the use of diesel in the pulping process (0.6070 MJ/UF or 607.0 kJ/UF), the use of diesel in collecting fot transport fuel from the collector to the cooperative (0.1649 MJ/UF or 164.9 kJ/UF), and the use of diesel in the Hulling process (0.1154 MJ /UF or 115.4 kJ/UF). In the model of 2016, three hotspots are the use of diesel in collecting for transport fuel from collector to huller ((1.0000 MJ/UF or 1000,0 kJ/UF), the use of diesel in the hulling process (0.6560 MJ/UF or 656.0 kJ/UF), and the use of diesel in the pulping process (0.6070 MJ/UF or 607.0 kJ/UF). The model of 2016 also has high electricity usage in the finishing process, which is 0.4141 MJ/UF or 414.1 kJ/UF and is the fourth-highest hotspot in this model. The water used that has the potential as wastewater in both models shows the same amount per UF, as well as co-products (pulp and parchment). In both the Model of 2015 and Model of 2016, the three highest hotspots resulted from the use of diesel fuel. According to Diyarma et al. (2019) the combustion of oil fuels results in the emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) which increase the effect of greenhouse gases from the coffee production process. The same thing was said by Giraldi-diaz et al. (2018).

Tabel 1. LCI green bean production model of 2015 and model of 2016

Model of 2015				Model of 2016			
Sub-Process	Input and Output	Value	Unit/ UF	Sub-Process	Input and Output	Value	Unit/ UF
Water preparation	Input:			Water preparation	Input:		
	1. Groundwater	0.0086	m³		1. Groundwater	0.0086	m³
	2. Electricity	0.0649	kWh		2. Electricity	0.0180	kWh
	Output:				Output:		
	1. Water	0.0086	m³		1. Water	0.0086	m³
Pulping	Input:			Pulping	Input:		
	1. Water	0.0086	m³		1. Water	0.0086	m³
	2. Coffee Cherry	4.3243	kg		2. Coffee Cherry	4.3243	Kg
	3. Fuel for pulper engine (diesel)	0.6070	MJ		3. Fuel for pulper engine (diesel)	0.6070	MJ
	4. Transport fuel from farmer to collector (gasoline)	0.0738	MJ		4. Transport fuel from farmer to collector (gasoline)	0.0757	MJ
	Output:				Output:		
	1. Washed parchment coffee	1.7632	kg		1. Washed parchment coffee	1.7297	kg
	2. Pulp	2.5611	kg		2. Pulp	2.5611	Kg
	3. Wastewater	0.0087	m³		3. Wastewater	0.0087	m³
Collecting	Input:			Collecting	Input:		
	1. Washed parchment coffee	1.7632	kg		1. Washed parchment coffee	1.7297	Kg
	2. Transport fuel from the collector to the cooperative (diesel)	0.1649	MJ		2. Transport fuel from collector to huller (diesel)	1.0000	MJ
	Output:	1.7632	kg		Output:	1.7297	Kg
	1. Washed parchment coffee				1. Washed parchment coffee		
Drying	Input:			Hulling	Input:		
	1. Washed parchment coffee	1.7632	Kg		1. Washed parchment coffee	1.7297	Kg

Model of 2015				Model of 2016			
Sub-Process	Input and Output	Value	Unit/ UF	Sub-Process	Input and Output	Value	Unit/ UF
	2. Sun power	1.6620	MJ		2. Huller engine fuel (diesel)	0.6560	MJ
	Output:				Output:		
	1. Dry parchment coffee	1.2055	kg		1. Wet Green bean	1.5135	Kg
	2. Steam	0.5578	kg		2. Parchment Coffee	0.2162	Kg
Hulling	Input:			Collecting	Input:		
	1. Dry parchment coffee	1.2055	kg		1. Wet Green bean	1.5135	Kg
	2. Huller engine fuel (diesel)	0.1154	MJ		2. Transport fuel from huller to collector (diesel)	0.0735	MJ
					3. Sun power	1.3345	MJ
	Output:				4. Transport fuel from collector to cooperative (diesel)	0.1120	MJ
	1. Dry Green bean	1.0476	kg				
					Output:		
	2. Parchment	0.1579	kg		1. Dry Green bean	1.0476	Kg
					2. Steam	0.4659	Kg
Finishing	Input:			Finishing	Input:		
	1. Dry Green bean	1.0476	kg		1. Dry Green bean	1.0476	Kg
	2. Electricity	0.0390	MJ		2. Electricity	0.4141	MJ
	3. Sun power	0.3462	MJ		3. Sun power	0.3132	MJ
	Output:				Output:		
	1. Green bean	1.0000	Kg		1. Green bean	1.0000	Kg
	2. Steam	0.0476	Kg		2. Steam	0.0476	Kg

4.3. Energy and Water Consumption

Energy use based on the unit function in each model is calculated based on the total energy from the use of fuel oil and electricity use. The footprint of energy use in the model of 2016 is greater than that of the model of 2015 (Figure 4). This is because the model of 2016 production system uses a large amount of diesel fuel when moving intermediate products from certain process sub-systems to other process sub-systems (1.2613 MJ/kg green beans), as well as very large electricity consumption (0.4789 MJ/kg green beans).

Water use based on its functional unit in each production system model is calculated based on twice the total number of coffee cherries to be processed (Figure 4). The water usage footprint in the model of 2015 product system is the same as the water usage footprint in the model of 2016 product system.

The carbon footprint generated by functional units in the model of 2016 production system is larger than the model of 2015 (Figures 4 and 5). This is because the model of 2016 product system uses a large amount of diesel fuel when

moving intermediate products from certain process sub-systems to other process sub-systems (1.2613 MJ/kg green bean), as well as very large electricity consumption (0.4789 MJ/kg). green beans).
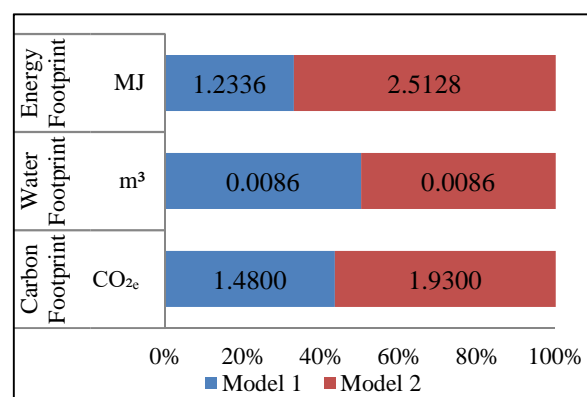

Figure 4. Comparison of water use, energy and CO_2-e emissions

This condition both on energy footprint, water footprint, and carbon footprint are quite large if compared to the research of Diyarma et al. (2019), where the energy footprint for processing 1000 kg of coffee cherry or 231,25 kg of green bean is 7.67 MJ or 0.0332 MJ/UF, produces 5953.2 kg of liquid waste, and a carbon footprint of 2.56 CO_2-e or 0,0111 CO_2-e/UF. According to several previous researchers, the primary production stage in the coffee chain is the most important contributor to the carbon footprint

(Büsser & Jungbluth, 2009); (Humbert et al., 2009); (Hicks, 2018).

Emissions of electricity use in each model are 0.374 kg CO_2-e /kg green beans in the model of 2015 and 0.536 CO_2-e/kg green beans in the model of 2016 (Figure 5). Emissions from the use of diesel fuel in each model are 0.153 kg CO_2-e/kg green beans in the model of 2015 and 0.1833 kg CO_2-e/kg green beans in the model of 2016 (Figure 5).
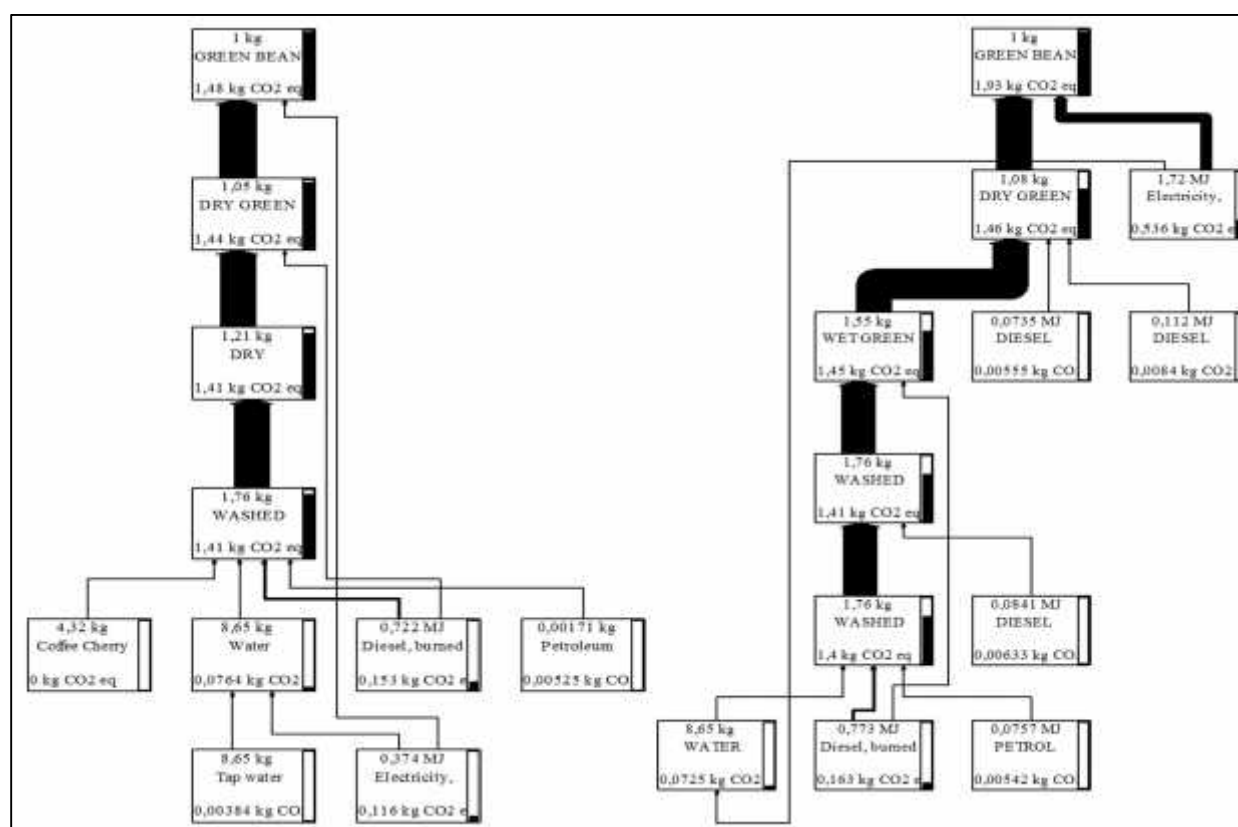

Figure 5. Hot spots of 2015 and model of 2016s of green bean production

4.4. Sensitivity Analysis

Sensitivity analysis was carried out on wet processing green bean production in the model of 2016 improvement scenario. Several parameters were determined in the sensitivity analysis, namely: (1) 10% reduction in distribution distance for each distribution activity, (2) 50% reduction in water use, (3) 50% reduction in electricity use, (4) 10% increase in yield, and (5) 10% loss during production.

From the results of the evaluation of the comparison of parameters to the New Scenario 2

model using SimaPro 08 software, it is found that if the distance is reduced by 10% it will have an impact on reducing the impact of emissions by 0.105%, if the use of water is reduced by 10% it will have an impact on reducing the impact of emissions by 0.314%, if the use of electricity is reduced by 50% it will have an impact on reducing the impact of emissions by 47.065%, if there is a loss during the process by 10% it will have an impact on increasing the impact of emissions by 10%, and if the yield is increased by 10% it will have an impact on reducing the impact of emissions by 9.219%.

Table 2. Sensitivity analysis results

Parameters	Percent Variation (%)	Carbon Emission (kg CO_2-e/kg green bean)		Percent Change from Baseline (%)
		Baseline	After Change	
Distribution distance reduction	10	0.954	0.953	0.105
Reducing water use	50	0.954	0.951	0.314
Reducing electricity usage	50	0.954	0.505	47.065
Loss during the process	10	0.954	1.060	-10.000
Yield increase	10	0.954	0.867	9.119

5. Conclusion

This paper aims to assess environmental performance *(*energy footprint, water footprint, *and* carbon footprint*)* in Gayo Arabica coffee green bean production with different agro-industry models. *The* method *to evaluate* environmental performance that can be used to identify indications of sustainability *is* Life Cycle Assessment (LCA) *Method.* The study was conducted on coffee production and exporter cooperatives in Central Aceh. Primary data were obtained through interviews with farmers, collectors, huller owners, and cooperative administrators. Secondary data comes from cooperative reports. The LCA study is described in two product systems, the model of 2015 and the model of 2016. The LCA model of 2015 is based on the green bean production system carried out in 2015 which includes water treatment, pulping, collecting, drying, hulling, finishing, and transportation. The LCA model of 2016 is based on the green bean production system carried out in 2016 until now which includes sub-processes for water treatment, pulping, collecting 1, hulling, collecting 2, finishing, and transportation. The results show that the energy footprint of the 2016 model (2.5128 MJ per f.u) is greater than that of the 2015 model (1.2336 MJ per f.u), the water footprint of the 2015 model is the same as the water footprint of the 2016 model product system, namely 0. 0086 m^3 per f.u., and the carbon footprint of the 2016 model (1.93 kg CO_2-eq per f.u) is greater than that of the 2015 model (1.48 kg CO_2-eq per f.u). The cooperative initiative (in the model of 2016) is for the purpose of process improvement but cannot reduce carbon emissions. To reduce emissions from the use of fossil fuels, it is necessary to optimize land transportation routes and energy efficiency.

To reduce carbon emissions based on sensitivity analysis, further analysis is needed of the overall transportation routes of actors, reuse of water used in primary treatment processes in farmers and management of electricity use in cooperatives. The limitations of this research are also in the scope of the study which is still limited to Gate to Gate, so the results of the study do not yet interpret overall sustainability based on the environmental performance. Therefore, further research on the scope of the Cradle to Grave study needs to be carried out.

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Consumer Perceptions of Buying Behavior of Organic Vegetables with Planned Behavior Theory Approach

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ABSTRACT

Organic vegetables are gaining popularity all over the world, and the number of consumers of organic vegetables is increasing. Developing countries like Indonesia, are still very minimal in consuming organic vegetables. Therefore, this study aims to identify the factors that drive buying behavior of organic vegetables. The research location was conducted in Malang Raya which was selected by purposive sampling and involved 128 respondents who became the research sample. The analytical method uses descriptive analysis and Structural Equation Modeling (SEM) is used to measure the effect of perceptions, preferences, attitudes, subjective norms and control of consumer behavior on purchase intentions and behavior. The results of the analysis show that the behavior of buying organic vegetables is largely determined by preferences and behavioral control through intention and there is a preference role that successfully mediates the relationship between consumer perceptions and intentions. Perceptions, attitudes and subjective norms cannot influence consumer intentions because most consumers and their environment do not have good knowledge so that consumer buying behavior of organic vegetables tends to be based on the control of the dangers. Market players and the government must cooperate with farmers and provide information and promotions regarding the advantages of organic vegetables which are expected to increase actual buying behavior of organic vegetables.

Keywords: consumer behavior; organic farming; organic vegetables; perception; preferences

1. Introduction

The demand for organic food continues to increase. The increasing demand for organic food in the world is one of the impacts of changes in people's lifestyles that have paid attention to health and environmental sustainability (Lee & Hwang, 2016;Fleseriu et al., 2020). In 2016-2017 the area of Indonesian organic agricultural land increased by around 39.4% and in 2017-2018 it increased by about 17.3% (AOI, 2019). Indonesian organic agriculture has a total market share of only 0.2%, when compared to other countries, China is 0.3%, India is 0.7%, and European countries are more than 5%, such as Germany 6.5% (Rezha, 2021). The development of organic food consumption in Indonesia is still very limited, as can be seen from the differences in production and consumption levels, high spending and low consumption are signs of the problem of affordability in the provinces with the lowest consumption, one of which is East Java (BPS et al., 2017)

One of the problems is the price, the price comparison of organic and inorganic vegetables reaches Rp. 5,000 to Rp. 10,000 (Dewi et al., 2019). Reinforced by the findings Lee & Hwang (2016), it is stated that the high price of organic food can reduce the perceived value. This results in the consumption of organic vegetables being only segmented on consumers who have a high income level. In addition, the tendency of consumer perceptions and preferences that have not followed the actual characteristics of organic products is one of the reasons why consumers do not consume organic products. The increase in people's income has an impact on changes in food consumption patterns, namely by reducing food

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sources of carbohydrates and increasing food sources of protein, vitamins and minerals (Pusat Kebijakan Perdagangan Dalam Negeri, 2013). Although consumers show different levels of price sensitivity, they perceive the price of organic food to be related to product quality (Melovic et al., 2020). Several studies reveal that the majority of consumers have positive attitudes towards organic food, but the share of people who buy organic food regularly is still low (Slamet et al., 2016).

Consumers in determining a product to be consumed are influenced by several different factors. This study refers to the concept of Ajzen's Theory of Planned Behavior (2005) which states that consumer buying interest is influenced by attitudes, subjective norms, and perceptions of behavioral control. TPB is used in this study because the use of TPB is very suitable to explain individual interest in carrying out a certain behavior so that researchers can find out what factors influence consumers in buying organic vegetables. According to Fleseriu et al., (2020) explaining purchase intentions and behavior are expected to increase the consumption of a product or service. In the findings (Zhang et al., 2018; Najib et al., 2021) perceptions and preferences have a major influence on purchase intention. By adding the construction of perception and preference, it is hoped that it can strengthen the core construction of TPB and clarify real intentions and behaviors to increase consumption of organic vegetable products. This study uses Structural Equation Modeling (SEM) analysis to determine the effect of purchasing behavior variables which can later become the basis of information in making strategies to increase demand for organic food in East Java, especially Malang City by using the Theory Planned Behavior approach.

2. Theoretical Underpinning

Consumer behavior is defined by Peter & Olson (2010), a process to choose, use, find, and a product or service. Customer behavior is a way of trading something significant worth for a good product or service. Meanwhile, Sumarwan (2017), states that the decision to buy or consume a product with a certain brand will begin with the steps of recognizing needs, searching for data or information, choice of choices, steps of purchasing decisions, consumption and consumer satisfaction.

Most of the studies in examining consumer behavior of organic vegetables by looking at customer values such as perceptions and preferences. Najib et al., (2021), Perception is defined as a personal phenomenon, in which the reception of stimuli and the individual's initial experience consists of the individual's interpretation of his environment. Organic food produces stimuli through the senses of sight, smell, and taste that can be accepted by consumers (Peter & Olson, 2010). In this way the sensory test properties of foods form the basis of consumer preferences. Najib et al., (2021), in his research found that perception had a significant and positive effect on preferences. The consumer perception that is formed assumes that organic food is healthy, inexpensive, nutritious and environmentally friendly food. Furthermore, location, product quality, price and customer value such as health awareness are factors that can influence consumer perceptions.

H1: Perception has a positive effect on preferences

According to Schiffman & Wisenblit, (2019), consumer preference shows a person's choice of likes or dislikes for the products consumed. Najib et al., (2021), examined the factors that influence consumers' intentions towards organically produced foods. The final result in his research shows that there is a significant level of perception variable on the preference variable and has a positive effect, consumer intentions are significantly influenced by perceptions and preferences and have a positive effect. Previous findings state that consumer perceptions of the superiority of organically produced food produce food perceptions that can shape consumer perceptions (Singh & Verma, 2017;Zhang et al., 2018;Fleseriu et al., 2020;Melovic et al., 2020). Preference is one of the important factors of consumer purchase intention (Yadav & Pathak, 2016). Preference was found to have a large influence on the purchase intention of consumers of organic vegetables (Zhang et al., 2018). Consumer preferences in the form of a healthy lifestyle, food safety issues, environmental concerns and health awareness (Fleseriu et al., 2020;Najib et al., 2021).

H2: Perception has a positive effect on purchase intention

Perception was found to have a positive and significant influence in influencing consumer purchase intentions, this has been proven by several researchers (Singh & Verma, 2017;Zhang et al., 2018;Najib et al., 2021). High consumer purchase intention is formed from a good

perception of organic vegetables. Barriers to organic vegetables in emerging markets often lie in price and location (Lee & Hwang, 2016;Melovic et al., 2020).

H3: Attitude has a positive effect on purchase intention

According to Ajzen Theory of Planned Behavior can predict consumer behavioral intentions with a high degree of accuracy with three factors: attitudes, subjective norms and perceived behavioral control (Ajzen, 2005).The theory of planned behavior is an influential model in knowing social behavior (Fleseriu et al., 2020). The evaluation of consumer behavior carried out in social and psychological research has received a broad and useful theory of planned behavior. The food retail market certainly needs to understand consumer intentions, the theory that is consolidated is the theory of planned behavior (Asif et al., 2017). Its wide applicability makes it an important model for understanding buyer understanding and tendencies in the food business (Asif et al., 2017;Wang et al., 2020). So that in its implementation, planned behavior can include several constructs and explain food purchase intentions in detail. Attitude is the first construct contained in the theory of planned behavior, the attitude itself is defined as "an individual's evaluative feeling to perform certain behaviors, both positive and negative feelings"(Ajzen, 2005). Several researchers have found that purchase intention of organic food can be shaped by attitude predictors and is considered important by (Asif et al., 2017;Shin et al., 2018;Zhang et al., 2018;Fleseriu et al., 2020).

H4: Subjective norms have a positive effect on purchase intention

Subjective norm as a second construct according to Ajzen (Ajzen, 2005), is defined as "a

person's impression of the possibility that a potential reference set or an individual supports or opposes a particular effort". Subjective norm was found to be a construct that can influence purchase intention of organic food (Asif et al., 2017;Shin et al., 2018).

H5: Behavioral control has a positive effect on purchase intention

Behavioral control is the third construct and can be defined as "Feelings easy and difficult to perform a behavior, and describes unwanted barriers based on experience (Ajzen, 2005). Behavioral control has an important role in shaping consumer intentions to buy organic food. (Singh & Verma, 2017;Fleseriu et al., 2020).

H6: Behavioral control has a positive effect on purchasing behavior

According to (Ajzen, 2005), states that behavioral control has an important role in purchasing behavior through intention and even behavioral control can play an important role directly on consumer buying behavior without going through intentions.

H7: Preference has a positive effect on purchase intention

Consumer preferences form a feeling of liking for organic vegetables can increase their purchase intention. A significant and positive influence between consumer preferences has also been found by several researchers (Zhang et al., 2018;Najib et al., 2021).

H8: Purchase intention has a positive effect on buying behavior

Intention has been assumed to be a strong predictor of behavior. Several researchers analyzed and found intention to have a positive and significant influence on buying behavior of organic food (Fleseriu et al., 2020).
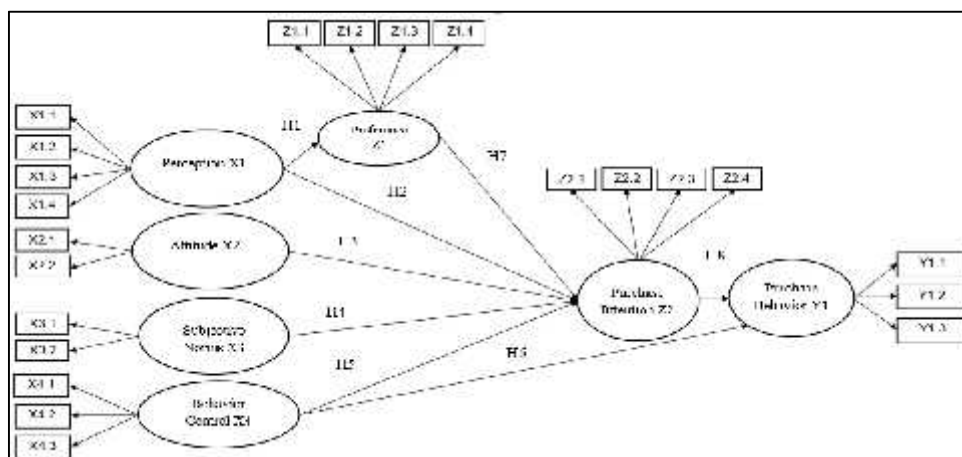

Figure 1. Conceptual Model

3. Research Methods

Judging from the type of research, this is explanatory research, namely research that tries to explain the influence between variables by testing hypotheses and using a quantitative approach between variables that have been determined before going out in the field. This study specifically seeks to examine and analyze the relationship between variables (Hardani et al., 2020).

East Java Province ranks third in organic food consumption (AOI, 2019), So that the research location is determined purposively, namely in the city of Malang. The reasons for choosing the location were based on various considerations, namely (1); Malang City is one of the economically strategic cities in Indonesia with an economic growth of 4.2 percent (2) Malang City is one of the largest cities in East Java Province with a high population density with a population of 843,840 people (BPS, 2021).

The samples used in this study were people who had bought organic vegetables in Malang City. Non-probability sampling and purposive sampling were used as sampling methods. Determination of the sample size of the rules proposed by (Solimun et al., 2017) revealed that in determining the sample in SEM-PLS it is necessary to use the rule of the thumb, namely (1); Ten times the number of variables. (2) Ten times the number of indicators. (3) Ten times the number of structural lines. Referring to the third rule of thumb, the calculation is done by multiplying 10 the number of arrow directions in the model by 8, the result is 80 respondents. However, at the end of the study, there were 128 respondents. Socio-demographic information such as: gender, age, monthly income, education level, marital status, number of families and employment status were also collected.

To measure the latent variables used a number of observation variables. The preparation of the questionnaire items refers to research conducted previously and was revised to suit the conditions of this study before the questionnaire was distributed online using google surveys. All questions regarding research variables used a 5-point Likert scale (1: Strongly disagree, 2: Disagree; 3: Neutral; 4: Agree, 5: Strongly Agree). Respondents rated the items using a Likert scale with a 5-point scale where 1 means very disagree

and 5 means strongly agree. Data processing using descriptive analysis techniques and Structural Equation Modeling (SEM) analysis using the SmartPLS 7.0 application has been used by many researchers to expand the model of perception, preferences, and the core constructs of Theory Planned Behavior (TPB). According to Isaskar et al., (2019), SEM can determine the effect between variables whether there is a direct effect or not, which is often known as multivariate statistical analysis techniques. Measurement and structural models are 2 types of measurements to measure recursive variables or not, so as to produce a comprehensive model.

The measurement model in this study uses reflective measurement. By looking at the load factor value of 0.5 to 0.7. The next process is to test the validity and reliability of the instrument so that the data can be analyzed further. The standard value of Cronbach's alpha is 0.7, Composite reliability is 0.6 and the AVE value is with a standard of 0.5 which will later be tested for data and model suitability (Goodness of Fit) as recommended by (Hair et al., 2017;Solimun et al., 2017).

4. Result and Discussions

4.1. Characteristics of Respondents

Judging from the respondent's attributes in Table 1, it can be seen that most of the buyers of organically produced vegetables in this review have a place with the classification of middle-class and lower-middle class shoppers. This result can be seen from the very good level of education for the majority of consumers; that is, 72% are undergraduate graduates. Good formal education does not go hand in hand with income. Around 47% of them have an income level of <Rp 2,000,000/month. Buyers of organically produced vegetables are dominated by women (60%), unmarried (60%) with an age range of 30-49 years (63%). In accordance with the findings found by Najib et al., (2021) Regarding the behavior of middle class buyers who will generally have a decent view of natural foods, vegetables are consumed more by the public because vegetables are one of the fundamental wellsprings of nourishment that give medical advantages. Consumers of organic vegetables who are of productive age and have a college background so that consumers are easy to buy organic vegetables.

Table 1. Recapitulation of Respondents Characteristics

Characteristics	Frequency	Percentage
Gender		
- Man	51	40%
- Woman	77	60%
Age		
- 18-29	93	73%
- 30-39	12	9%
- 40-49	12	9%
- >50	11	9%
Level of education		
- Diploma	6	5%
- Undergraduate	92	72%
- Graduate	12	9%
- Senior High School	16	13%
- No School	2	2%
Marital Status		
- Single	77	60%
- Marry	51	40%
Job status		
- Laborer/Employee	51	40%
- Taking care of household	10	8%
- Businessman	16	13%
- Government employees	7	5%
- Other	34	27%
Number of Family		
- 5 person	26	20%
- 3-4 person	70	55%
- 1-2 person	32	25%
Income Level		
- <Rp.2.000.000	60	47%
- Rp.2.000.000-Rp.5.000.000	50	39%
- Rp.5.000.000-Rp.8.000.000	7	5%
- >Rp.8.000.000	11	9%

4.2.   Research Model Evaluation

This model is built with reflective judgment. Variable indicators and have a loading value factor that meets usually the recommended criteria, which is >0.5 (Solimun et al., 2017). In the development research model, it is permissible for indicators with a loading factor value between 0.5 - 0.6 (Solimun et al., 2017). Isaskar et al., (2019) states that to validate sufficient internal consistency, Cronbach's alpha value must be more than 0.70. The value of Composite reliability (CR) exceeds the threshold of 0.6. Furthermore, the extracted mean variance (AVE) across all constructs should exceed the 0.5 benchmark value suggested by (Hair et al., 2017;Solimun et al., 2017).

Table 2. Validity and Reliability Test

Variables and Indicators	Loading Factor	CR	Cronbach's Alpha	AVE
Percaption (X1)				
Location (X1.1)	(0.634)			
Product (X1.2)	(0.770)	0.835	0.735	0.560
Price (X1.3)	(0.776)			

Variables and Indicators	Loading Factor	CR	Cronbach's Alpha	AVE
food safety (X1.4)	(0.802)			
Attitude (X2)				
Hedonistic Attitude (X2.1)	(0.892)	0.886	0.742	0.795
Utilitarian attitude (X2.2)	(0.892)			
Subjective Norms (X3)				
Family Norms (X3.1)	(0.919)	0.916	0.816	0.844
Environmental Norms (X3.2)	(0.919)			
Behavior Control (X4)				
Buying Behavior Control (X4.1)	(0.856)			
Easy behavior control buy X4.2)	(0.907)	0,915	0,861	0.783
Authority in determining behavior (X4.3)	(0.891)			
Preferences (Z1)				
Healthy Lifestyle (Z1.1)	(0.825)			
Food safety concerns (Z1.2)	(0.870)	0.912	0.870	0.721
Environmental Concern (Z1.3)	(0.817)			
Health Awareness (Z1.4)	(0.881)			
Intention (Z2)				
Willing to Buy (Z2.1)	(0.929)			
Intention to repurchase (Z2.2)	(0.955)	0.970	0.958	0.889
Consumption plan (Z2.3)	(0.957)			
Try consumption (Z2.4)	(0.930)			
Purchase Behavior (Y1)				
Regular buyers (Y1.1)	(0.922)			
Buy organic or conventional (Y1.2)	(0.913)	0,914	0,858	0,781
Willingness to Pay (Y1.3)	(0.812)			

Furthermore, the data and model suitability test was carried out. At this level the researcher can assess the level of conformity between the data and the model, such as conducting observational research, an expert is not supposed to meet all the standards of conformity that have been set, but the assessor is returned to each researcher to adjust the necessary needs.

Goodness of Fit (GoF) is an index and order of goodness of the relationship between latent variables (inner model) and assumptions. As for the cri.teria used, they are not rigid and absolute, so if there are 1 or 2 criteria that are not appropriate, the model can still be used. After going through several series of trials, the accuracy of the model shown in table 3 shows that all of the models have met the standard values.

Table 3. Hasil Goodnes of FIt

Criteria	Criteria Fit	Analysis Results	Information
APC	p < 0.05	0.281, P<0.001	Qualify model fit
ARS	p < 0.05	0.463, P<0.001	Qualify model fit
AARS	p < 0.05	0.451, P<0.001	Qualify model fit
AVIF	Accepted if 5, ideal 3.3	2.125	Ideal
AFVIF	Accepted if 5, ideal 3.3	2.383	Ideal
GoF	Small 0.1, Medium 0.25, Big 0.36	0.596	Big
SPR	Accepted if 0.7, ideal 1	0.875	Accepted
RSCR	Accepted if 0.9, ideal 1	0.990	Accepted
SSR	Accepted if 0.7	1.000	Accepted
NLBCDR	Accepted if 0.7	1.000	Accepted

4.3. Hypothesis test

To determine the effect of each variable on the other variables, it is necessary to do a causality test on SEM. The criteria for the "*p* value" and the probability are with a standard of 0.001 and do not exceed the highest value of 0.05 (<0.001 *p*-value < 0.05) so it can be said to have an effect. Based on value R^2, The model explained 67% variance for preference, 49% variance for intention and 23% variance for behavior. See Figure 2.
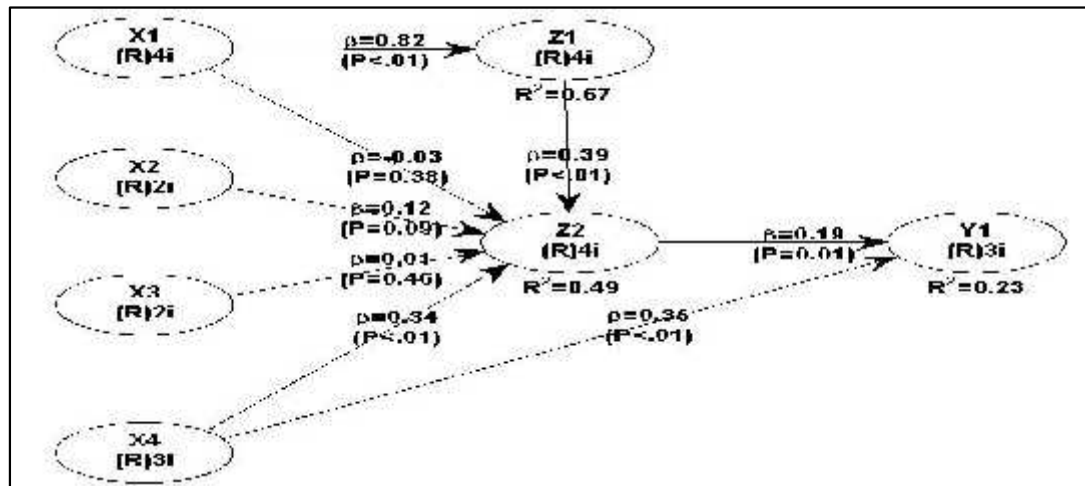

Figure 2. Path Model

Table 4. show a summary of the structural model determining the relationship between the various factors in the model. The theoretical model was tested using path coefficients, standard errors and *p*-values. The lower the *p*-value, the more significant the influence of a variable on other variables. The tested hypothesis has a positive influence on perceptions of preferences, behavioral control on intentions, behavioral control on purchasing behavior and preferences on purchases and there is a level of significance. While the perception variable has a negative influence on intentions, attitudes and subjective norms have a positive influence on intentions but no significant level was found in the test indicated by the *p*-value (> 0.05), the preference variable managed to mediate the relationship between perception and intention positively and significantly, for the effect mediation of intention to the relationship between perception variables, attitudes, subjective norms, behavioral control on purchasing behavior was not found to be significant in the test indicated by the *p*-value (> 0.05).

Table 4. Direct Effect Hypothesis Test Results

Hypothesis (H1-H8)	Coefficient	Std Eror	*p* Value	Information
Perception → Preference	0.821	0.073	<0.001	Accepted
Perception → Intention	-0.026	0.088	0.383	Rejected
Attitude → Intention	0.117	0.086	0.089	Rejected
Subjective Norm → Intention	0.010	0.088	0.457	Rejected
Behavior Control → Intention	0.344	0.081	<0.001	Accepted
Behavior Control → Buying Behavior	0.346	0.081	<0.001	Accepted
Preference → Intention	0.392	0.080	<0.001	Accepted
Intention → Buying Behavior	0.189	0.084	0.013	Accepted

4.4. Discussion

The focus of this study was to determine the variables that influence buying behavior of organic vegetables. This study tries to expand the theory of planned behavior by analyzing how customers' understanding and tendencies towards organic vegetables work and their influence on buying behavior in Indonesia, especially in Malang.

Perceptions and preferences have a strong influence that has been found by previous researchers Najib et al., (2021) and also found in this study that justifies **H1** being accepted (estimation value 0.821; *p*-value <0.05). Food safety concern is one of the elements with the greatest influence value, followed by product quality, price and location. Reflecting that the majority of buyers accept that organic food is usually free of chemicals making it possible to manufacture safe products. Vegetables that are produced organically are considered as products that do not damage the ecosystem, look fresh and have good texture, to support environmental sustainability due to their natural production methods (Yadav & Pathak, 2016;Najib et al., 2021). These results also support the theoretical framework Schiffman & Wisenblit, (2019) Perception is thought to occur with consumer engagement, but memory influences information processing and generates appropriate preferential responses.

In the planned behavior theory model, intention and buying behavior have a positive and significant influence justifying **H8** being accepted (Fleseriu et al., 2020). Purchase intention is significantly influenced by preference and behavioral control with confirmation that **H5** and **H7** are accepted, however, only preference can influence purchase behavior through intention while behavioral control does not. Other findings from this study indicate that intentions cannot be influenced by perceptions, attitudes and subjective norms so that **H2**, **H3** and **H4** are rejected.

Location and price are the lowest perceptual elements, this is thought to be the reason perception hinders the formation of intention. Vegetable prices that are considered too expensive and sales locations that do not guarantee consumers that they are truly organic. In contrast to the investigation conducted by (Melovic et al., 2020;Najib et al., 2021), assumes that intentions appear together based on consumer perceptions of the attributes of organically produced food products.

Elements of hedonic and utilitarian attitudes have balanced values, however, there is no significant attitude towards the intention. The reason behind this is that most consumers have low awareness and knowledge about the importance of consuming organic vegetables. H. Lee & Yun, (2015), in their study finally found that hedonic and utilitarian attitudes had a positive and significant effect on intentions influenced by

these two attitudes. Asif et al., (2017) revealed that attitudes in forming organic food intentions in each country are different which are influenced by culture and culture.

Elements of family norms and environmental norms have a balanced value in forming subjective norms but no significant level is found in forming intentions. This result is different from previous findings (Asif et al., 2017;Fleseriu et al., 2020) in their research results reveal that intentions can be influenced subjective norms directly. Insignificant subjective norms are suspected because the subjective norms of the respondents are still abstract and have not been internalized from within due to the lack of awareness, understanding, and value of organic vegetables in the social environment and when viewed descriptively the dominant consumers know organic vegetables from the media.

Easy behavioral control to buy organic vegetables in terms of descriptive analysis of consumer behavior control variables shows that individuals have greater control in purchasing behavior so that behavioral control can influence buying behavior through intention or directly confirmed **H5** and **H6** are accepted. Similar findings have also been obtained by several previous researchers (Asif et al., 2017;Lim & An, 2020; ;Fleseriu et al., 2020) in which intention can be influenced by direct behavioral control. The reason behind the significance level of buying behavior and intentions that are directly influenced by behavioral control is thought to be due to the individual's household or family system so that consumers in buying organic vegetables have greater control.

The element of health awareness is one of the biggest elements forming consumer preferences. Similar findings have also been obtained by previous researchers according to Tri, (2020) and Najib et al., (2021), in a study that finally found a positive and significant effect on intention. This finding also contradicts the findings of previous researchers, for example (Pham et al., 2018). According to a recent study, there was no significant impact of perceived product attributes (sensory aspects) on preferences for organic food in Vietnam. The results of this study imply that the higher the level of consumer preference, the greater the intention to make a purchase.

4.5. Theoretical Implications

Some of the hypotheses in this study have an impact on buying behavior through intention.

Consumer preferences and control behavior have encouraged consumers to form buying behavior of organic vegetables directly or through intention, attitude constructs and subjective norms in planned behavior itself cannot encourage consumers to form intentions which indirectly cannot influence buying behavior. These results also support the theoretical framework Schiffman & Wisenblit (2019), Perception is thought to occur with consumer involvement, but memory influences information processing and generates appropriate preferential responses. This means that the higher the consumer's perception, the higher the consumer's preference, which in turn can encourage the intention to buy organic vegetables.

The reasons behind attitudes and subjective norms cannot affect intentions because the elements of hedonic attitudes and utilitarian attitudes in this study are balanced so that most consumers in this study do not have good knowledge of organic vegetables, the subjective norms of the respondents are still abstract and have not been internalized from within. as a result of the lack of awareness, understanding, and value of organic vegetables in the social environment.

The results of this study have tested the direct influence between behavioral control and buying behavior where the results are positive and significant which have never been tested by previous researchers, this also supports the theoretical framework of planned behavior put forward by Ajzen (2005), stating that in some cases behavior control is sometimes more important for explaining the influence on intention than other determinants. This result implies that the respondent made a more in-depth effort to consume organic vegetables, it means that the consumer's decision to consume organic vegetables is determined by himself and not others. In addition, they also show strong belief in buying organic vegetables.

4.6. Practical Implication

The findings of this study can be translated into several important insights that can be used in marketing organic vegetables. First, to justify the theory of planned behavior on a sample of organic vegetable consumers in Malang City.

Although the problems of perception, attitude and subjective norms are important in determining purchase behavior through intention, there is no significant level of significance for the three. In general, premium products such as organic vegetables must have a balance with the

superior value offered. Lee & Hwang (2016), in their research stated that the high price of organic food can reduce the perceived value. Melovic et al., (2020), unfavorable distribution of organic food in developing markets, although consumers show differences in the level of price sensitivity, they consider the price of organic food related to product quality.

Efforts that have implications for increasing the purchasing power of organic vegetables can be carried out through standardization, certification, communication, labeling and information related to the distribution of organic vegetables which are still very minimal. Aspects of standardization can be done by providing added value or additional benefits compared to conventional food. Thus, consumers and the environment will be increasingly convinced that organic food has its own competitiveness and advantages. Certification is needed to ensure that consumers get guaranteed quality products from marketers. Thus, the impact of price on perceptions, attitudes and subjective norms as an obstacle in the formation of intentions and buying behavior of organic vegetables in developing markets, especially Malang City will disappear, or at least be reduced.

4.7. Research Limitations

Although the results of this study are reliable in explaining the relationship between variables that influence the intention to buy organic vegetables in Malang City, these results can be generalized through caution, with some limitations in this study. The first limitation is the sample size of 128 respondents and it was only carried out by Malang City when compared to the total population.

The second limitation is the distribution of questionnaires conducted online to reach certain people from people who have consumed organic vegetables, this is an easy sampling method which means it often results in selection bias so that further researchers in taking the questionnaire can be done offline. Suggestions for future researchers to be able to add several variables such as promotions and willingness to pay.

5. Conclusion

In general, the characteristics of consumers of organic vegetables belonging to the middle class segment are seen from their income level at a young age and the average level of education has graduated from college, the majority of

respondents who are female in the category of marital status are dominated by unmarried respondents. Although most of the respondents stated that they liked organic vegetables, it turns out that shopping for organic vegetables has not become a routine for consumers.

In this study it is known that the indicators of intention and behavioral control have a significant effect on buying behavior, while consumer intentions in buying organic vegetables are influenced by preference indicators and behavioral control. Unfortunately, the variables of perception, attitude and subjective norm do not have a significant effect on intention. However, these results support a theoretical framework of planned behavior in which behavioral control is sometimes more important in influencing intentions or directly on buying behavior.

This shows that in realizing the behavior of buying organic vegetables, business actors and the government must work together to invite farmers to grow organic vegetables to promote to the wider community the advantages of organic vegetables over non-organic ones and also consider aspects of product price, location, quality. products and consumer normative beliefs that are in accordance with consumer expectations as the dominant aspect of consumers in purchasing organic vegetables.

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