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# Prospecting postharvest processing of agricultural and social forest products at Gerlang Village, Central Java

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**Abstract.** Farmers' poverty and forest destruction are common problems in social forest areas of Central Java, Indonesia, including Gerlang Village, a rural area in Batang Regency. Major of the population of this village is members of Social Forest Farmer Group. This study aimed to study the prospect of postharvest processing of agricultural and social forest products to improve both economic level of forest farmers and preservation quality of forests at the Village. Information collection was conducted through a field survey, direct interview and literature study followed by a strength, weakness, opportunity, and thread analysis. The study had been carried out during August 2019 with sample size of 10 social forest farmers. The obtained data was then qualitatively analyzed. The study revealed that major problems of social forest farmers at the village are: Dependence of farmers' income on the selling of raw potato, falling of potato price due to overproduction, unavailability of postharvest processing of potatoes, lack of encouragement towards cultivation of Carica and Tamarillo trees as part of forest preservation, high competition in processing products of Carica and Tamarillo at present, lack of farmers' skills in financial management and marketing of agricultural products. To cope with the problems, it is necessary to process raw potatoes into flour, chips and sticks and to support diversification of Carica and Tamarillo processed products. Farmers' financial management skills including e-commerce strategies should also be increased.

## 1. Introduction

Poverty of the people and forest destruction are common problems in social forest areas of Central Java, including Gerlang Village. It is a rural area in, Batang Regency, Central Java Province of Indonesia, which major of the population of this village is members of Social Forest Farmer Group named Kelompok Tani Hutan (KTH) Gerlang Asri. The group consists of 534 farmers covering 206-Ha of social forest area, with a land management permit based on Indonesian Ministry decision letter: SK 4973/ MENLHK-PSKL/ PKPS/ PSL.0/ 7/2018. The main commodity of KTH Gerlang Asri produced from agricultural land is potato, while those from social forest (intercropping) land are Carica and Tamarillo [1].

KTH Gerlang has just received its land use rights since 2018, which is expected to be a turning point in improving the economic level of the forest farmers and improving the quality of protected forests. However, the land use permission by farmers will have important meaning when only social forest



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farmers could take immediate actions required to start improving their financial situation and forest wellness. Surveys, literature studies followed by a strength, weakness, opportunity, and thread analysis of current situation are needed by the farmers in finding clues to overcome poverty and forest destruction. This study aimed to investigate the prospect of postharvest processing of agricultural and social forest products, to improve both economic level of the forest farmers and preservation quality of forests at Gerlang Village.

## 2. Research methods

To meet research objectives, the researchers applied the qualitative method detailed as follows:

### 2.1. Research area and period

The study was carried out in August 2019 at Gerlang, one of mountainous villages in Blado District, Batang Regency, Central Java Province of Indonesia. The remote village has social forest areas with some underdeveloped facilities. In Java Island, the last could be found is in Central Java province.

### 2.2. Participants

The key informants of the study included ten respondents. The respondents included the head of village (a government officer), members and administrators of KTH Gerlang Asri, and local social forest farmers.

### 2.3. Method

Field survey, non-structured, direct interviews were applied to collect data from the key informants which included important aspects related to size and productivity of agricultural and social forest land and market of their products in Gerlang. Secondary data were obtained from local office and literatures to support results from direct field surveys and interviews.

## 3. Results and discussion

### 3.1. Current condition of Gerlang Village

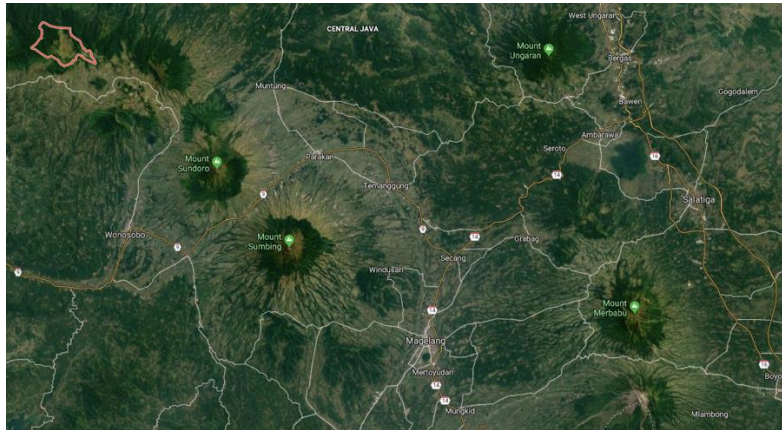
Gerlang Village (**Figure 1**) is located in the southern part of the Batang Regency area. The village has 7 hamlets: 1. Gerlang 2. Kradenan 3. Wonopriyo 4. Kayuabang 5. Sidongkal 6. Watulembu and 7. Gunungalang, consisting of 1,245 households. Gerlang Village is a center for horticultural farmers because its natural conditions are ideal for these types of plants [1]. The position and boundaries of Gerlang Village in Blado District, Batang Regency are shown in **Figure 2** [2].



**Figure 1.** Rural area of Gerlang Village.

In Batang Regency, Blado District has the largest area of state forest by 2,710 ha, followed by Bawang and Subah Districts with 2,619 and 1,894 ha, respectively [3]. In Blado District itself, the area of state forest in Gerlang Village is the second largest (838 ha) after Kalitengah Village (924 ha) [4]. The situation of Gerlang Village based on the results of a survey conducted by of community service

team in August 2019 is shown in **Figure 3**. The situation evaluated was particularly in the areas of agricultural food, economy and environmental health.



**Figure 2.** Gerlang Village boundary (red line, left-up corner) in Blado District, Batang Regency on a 3-dimensional map [2].



**Figure 3.** Overview of Gerlang Village situation. A. Interview with the social forest farmer and KTH administrator in the local village. B. KTH office. C. Local health centre's sanitation conditions. D. Potato field. E. Carica intercropped with forest trees. F. Tamarillo intercropped with forest trees. G. Potato yields. H. Carica yields. I. Tamarillo yields.

From the field survey, information was obtained that Gerlang Village was an underdeveloped area in Blado District in terms of location and transportation facilities. The data showed that the main agricultural commodity in Gerlang Village is potato while the main commodity intercropping the social forest is Carica and Tamarillo. **Figure 3** are photographs taken at the site described and confirmed the obtained information.

From an economic perspective, the dependence of the Gerlang farmers' income on potato yields is very high. Meanwhile, to support forest preservation, the planting of Carica and Tamarillo trees between

the forest trees with intercropping system is very important and needs to be encouraged to increase forest land productivity [5-7]. Plant diversification is known to be important in preserving forests [8, 9]. By providing skills in processing intercropping products, farmers are expected to be more motivated to plant tree crops in the forest that will preserve the forest while increasing their welfare.

### 3.2. *Priorities of government regency medium term development plan of batang regency*

*Regional Medium-Term Development Plan* (Rencana Pembangunan Jangka Pendek Daerah/ RPJMD) of Batang Regency falls into the third period (2017-2021). The significance of the period is the strengthening of comprehensive development in various fields with a focus on improving the quality of human resources, the quality of government services and the competitiveness of regional leading commodities [10].

Based on data from the *Indonesian Central Statistics Agency* (Biro Pusat Statistik/ BPS) of Batang Regency [3] in Batang regency, the types of vegetables most widely grown are potatoes with a harvest area of 679 ha, followed by leeks, large chillies and mustard greens each with a harvest area of, 304, 268 and 249 ha. In terms of productivity, potato plants are also superior with the ability to produce 201 quintal/ ha, followed by cucumbers, chayote and cabbage with 177, 178 and 157 quintal / ha respectively.

According to BPS (2018) the Gross Regional Domestic Product (GRDP) of the food processing industry is still the biggest contributor to the Batang Regency with a role of 34.35% of the business fields followed by agricultural, forestry and fishery business fields of 21.22%. This indicates that the processing industry has the opportunity to open up employment opportunities, which in turn contributes to increasing regional GRDP.

In the field of industry, BPS 2018 data shows that the number of industries that are still active and their production in Batang is dominated by processed food products [3]. However, there is no data available that utilizes processed potato products into flour. The existing flour industry is only tapioca flour and corn flour. Thus, it was agreed that the development of the potato flour industry would increase product diversification.

The existing industry of chips that have been in Batang Regency are cassava chips, breadfruit chips, spinach chips, pulmonary chips, eel chips, and taro chips. In addition, the jam making industry is not yet on the list of industries that are developing in Batang regency. Carica dried chips and preserves, as well as Tamarillo jam as the main intercropping products that support the forestry sector are also needed for diversification. This is important for the development of the food industry in villages that are producing potatoes and forest products [3].

Based on the RPJMD programs of Batang Regency and the statistical data, efforts to improve the quality of rural farmers' resources in terms of the economy while increasing the competitiveness of regional superior commodities can be achieved by postharvest processing of agricultural products, especially potatoes and social forest intercropping products, especially in Tamarillo. By involving the role of the regional government as a partner, the proposed regional partnership program is increasingly in line with the Batang Regency RPJMD in order to improve the quality of government services [9]. Common problems faced by the Regency/ City Government and CSR of the target villages included inequality of income, water scarcity to irrigate agricultural land in the dry season and extent of dry land.

### 3.3. *Current agricultural and social forest productivity*

The cultivation area, production and total production of main commodities of agriculture and social forest at Gerlang Village market per year is shown in Table 1. The price of potatoes at harvest in the Gerlang Village market is IDR 8,000 - 12,000/ kg. As a result of overproduction or harvest, this price often only reaches IDR 2,000 / kg. There has been no effort from the community to carry out postharvest processing of potatoes using a touch of technology to increase economic value while extending shelf life. In addition, the marketing pattern is still passive, namely by allowing the middlemen to come and harvest the potatoes themselves.

**Table 1.** Harvested Area, Production and Total Production per Year of Potatoes, Carica and Tamarillo in Gerlang Village<sup>a</sup>.

<i>No</i>	<i>Plant type</i>	<i>Harvest area size (Ha)</i>	<i>Production size (ton/year)</i>	<i>Production average (ton/ Ha)</i>
1	Potato	175.0	3500.0	20.0
2	Carica	2.8	5.5	2.0
3	Tamarillo	1.6	4.0	2.5

<sup>a</sup>Data from Gerlang Village Office

On the other hand, from social forest land farmers usually sell Carica fruit intercropping products at an average price of Rp. 12,000 kg while Tamarillo for IDR 22,000 kg. The postharvest processing of Carica is currently limited to produce wet sweets, which already have many competitors (Carica Dieng). As for Tamarillo [10], the processing is also only in the form of syrup and “dodol, which in general it is done with limited and less hygienic equipment. If the processed goods of Carica or Tamarillo fruits into fruit chips, dried sweets, and jam are diversified, then their economic value could be expected to increase [11]. In addition, farmers could avoid losses due to damage to fruits during storage. Hence, cultural transformation, technology introduction and food production engineering are important to do. As for Tamarillo syrup and dodol products, efforts to improve product quality through more hygienic processing need to be done through the application of the basics of Good Manufacturing Practice (GMP) and HACCP (Hazard and Critical Control Points). Based on previous research, the application of HACCP in dodol processing could improve product quality [12].

Financial management in the sale of superior and processed commodities in Gerlang Village is still not structured, the financial statements are only in the form of cash flow, and there are no administration office facilities. The marketing of superior agricultural commodities, namely potatoes, is still done conventionally, and even tends to be passive depending on middlemen who come to farmers. In this case, standard financial management accompanied by a web-based marketing strategy needs to be done. Thus, farmers can set prices that are profitable for farmers, not only middlemen. In terms of sanitation, the awareness of Gerlang villagers to dispose of waste is still low while the number of garbage bins is very limited. Even within the Puskesmas (figure 3c) as a health service center, waste still seems scattered.

### 3.4. Priority issues

Priority issues in line with the regency government plan to be handled covering 3 main aspects are:

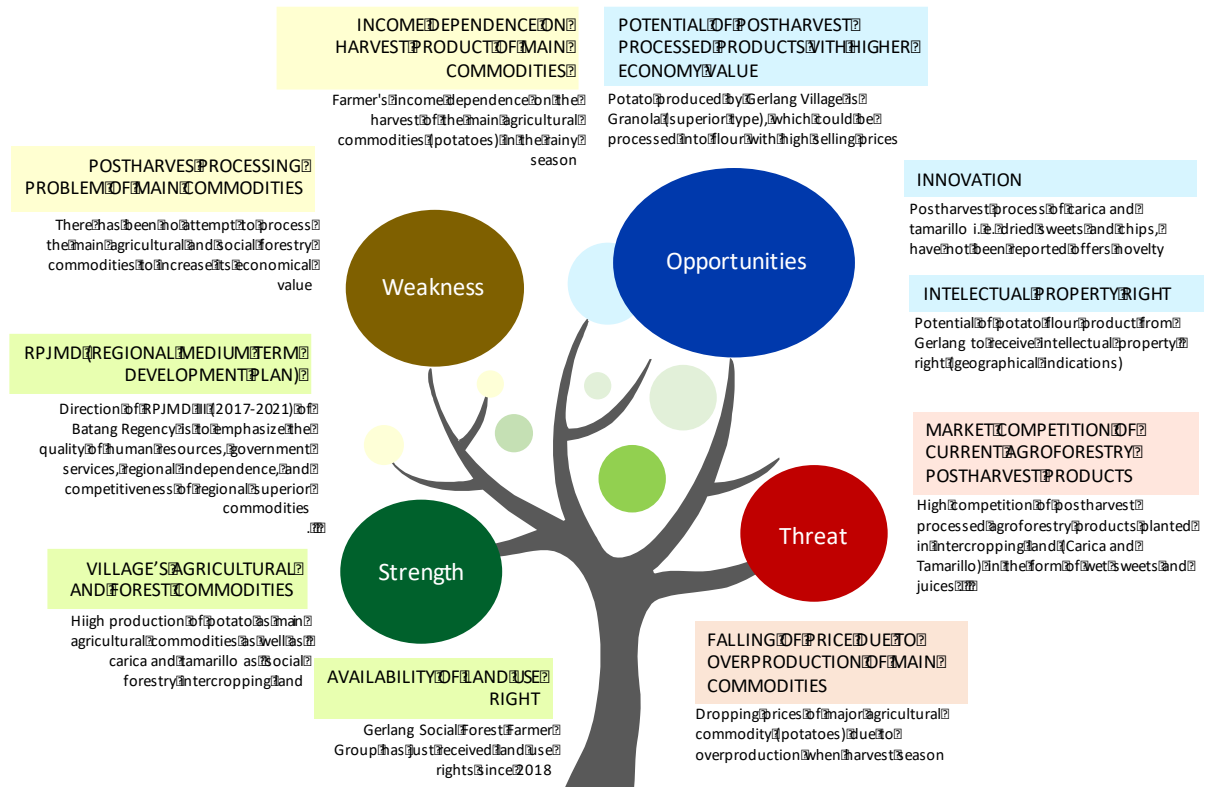
**3.4.1. Agricultural food aspects.** Potato farmers in Gerlang Village are not yet skilled in processing potato yields into higher economic value products such as flour, chips or sticks. There is no introduction of potato processing technology. On the other hand, the community has also not been able to diversify its processed food products from superior intercropping products, namely Carica and Tamarillo. There are no superior products from Gerlang Village in the form of special food.

**3.4.2. Business economic aspects.** The ability of village farmers in managing financial management and marketing of agricultural and social forest superior commodities and their preparations is still low. Financial management is still done traditionally and does not know or utilize information technology (e-commerce). Though the internet network is already available in Gerlang Village.

**3.4.3. Sanitation Health Aspects.** The sanitation conditions of food processing facilities that support food hygiene and safety standards are inadequate. Waste management is still inadequate due to the lack of trash facilities and drainage channels. In addition, it is necessary to socialize the importance of environmental health and improved sanitation to meet health standards.

Results of analysis of strengths, weakness, opportunities and threats (SWOT) of Gerlang Village leading to the importance of postharvest processing of agricultural and social forest products in the location are shown in figure 4. Based on figure 4, the importance of the postharvest processing is mainly

because farmers in Gerlang tend to sell their crops products as raw goods (without significant processing), which cause them have low sale values. Therefore, efforts to help the community process their crops to become higher economic value products supported by food processing technology are vital. These efforts could be achieved through various providing Socialization and guidance related to food processing, financial management and improved sanitation supporting food process facilities.



**Figure 4.** Analysis of strengths, weakness, opportunities and threats (SWOT) leading to the importance of postharvest processing of agricultural and social forest products

### 3.5. Proposed Solutions

**3.5.1 Partner problems and immediate solutions offered.** Referring to the partner's problem in accordance with the priority problems that were handled for three years, then a solution was made for each of the partner's problems to be carried out for three years as shown in Table 2.

**Table 2.** Problems and solutions offered related with postharvest at Gerlang Village.

Problems	Solutions
<i>Food and Agricultural Aspects</i>	
No postharvest processing of the agricultural prime commodity, namely potatoes, to cope with falling prices during the harvest season due to overproduction.	Socialization, training, technical guidance and assistance to process potatoes into quality potato flour for higher selling prices
Lack of knowledge about diversification of postharvest intercropping products of Carica and Tamarillo fruits to overcome product competition in the form of wet sweets and syrups	Socialization about diversification of Carica and Tamarillo processing and technical guidance of processing innovation of Carica into dried sweets and vacuum chips and Tamarillo into jam
No postharvest processing of the agricultural main commodity, namely potatoes, to cope with falling	Making awareness program, training, technical guidance and assistance in processing potatoes into quality potato flour in order

prices during the harvest season due to overproduction.	to have high selling price
There is a need for production and supporting equipment for the manufacture of flour and stick processed products from the leading agricultural commodity, namely potatoes	Providing assistance in the form of production and support tools for the manufacture of flour and potato sticks: Heavy scales, automatic cutting tools, automatic dryers, millers, deep fryers, spinners, spinners, sieves, and packers
There is a need for production and supporting equipment for the diversification of postharvest products from intercropping land in the form of Carica chips and dried sweets, potatoes chips, and Tamarillo jam	Providing assistance in the form of production and support equipment for product diversification in the form of crisps and dried sweets, as well as jams: Automatic slicer, stove, jam skillet, vacuum fryer, oil slicer, and vacuum sealer packer
Lack of knowledge and skills in hygienic packaging and labeling of processed food products	Packaging assistance technology (primary and secondary) vacuum sealing and boxes or cardboard, digital weighing devices, and labelling of locally processed food products
<i>Business Economy Aspects</i>	
Lack of knowledge and motivation to increase the added value of agricultural products and social forest through postharvest management.	Entrepreneurship training provision so that the community has adequate entrepreneurship knowledge and information and increases motivation to conduct postharvest management of the main agricultural and social forest commodities to increase the added value of yields.
Lack of financial management and commercial administration capabilities	Training and technical guidance on financial management and simple commercial administration
Lack of knowledge about marketing management including strategies to expand marketing networks	Assistance in the process of strengthening and expanding the marketing network of processed postharvest products from Gerlang
Not yet familiar with internet marketing strategies and systems	Technical guidance on creating and managing a simple e-commerce website
<i>Sanitation Health Aspects</i>	
Lack of public understanding of food processing according to GMP and HACCP	Socialization on the importance of food processing according to GMP and HACCP
Lack of community understanding of the importance of sanitation (adequate waste disposal and drainage facilities)	Socialization about the importance of sanitation to health, how to wash hands properly, and the provision of trash bins and garbage transporters

In the aspect of food and agriculture, results of literature studies [13-18] showed that in Indonesia, flour could be made from various types of raw materials with high starch content such as yam (*Dioscorea hispida* Dennst), cassava, even banana peels, eggshells, and sprouts. Based on the results of these studies, a superior type of potato material with high starch content such as Granola varieties from Gerlang Village is certainly very suitable for flour. This is supported by research by Wibowo *et al.* [19] stating that raw Granola potato could be processed into flour. With innovative preliminary treatments in the form of blanching and soaking in a solution of citric acid, the color of potato flour becomes brighter, while the water content and reducing sugar can be reduced. This will further increase the selling value of Granola potato flour and provide a longer shelf life.

In the business aspect stated that processed foods are among the leading export commodities of Central Java [20-21]. In general, the leading commodity SMEs (small- and medium-sized enterprises) in Central Java from 2009 to 2010 experienced a 10% increase but still has weaknesses, especially from the managerial aspect which includes [22]:

1. Low quality of human resources, including competence, enthusiasm and entrepreneurial spirit.
2. Aspects of mastery of technology and fulfillment of business facilities and infrastructure.
3. Management of the organization that has not separated the ownership and management of the company, and does not yet have administrative governance.
4. Market access, in the form of the ability to innovate promotions, exhibitions, partnerships, and business networks as well as intense global market competition
5. Aspects of sources of capital, generally own capital or borrow from relatives and family so that the amount is not large and does not rapidly develop, the inability to prepare a feasibility study to obtain bank credit while credit interest is still relatively high.
6. Only 400 SMEs in Central Java have trademarks, due to the old and expensive management processes.



Based on the description, the quality and quantity of processed food products in Gerlang Village need to be improved in order to become one of the leading commodities in Central Java Province that meets export requirements.

The results of other publications [21] can be used as a reference for the introduction of technology and product marketing assistance that will be applied in Gerlang Village [23-24]. Based on these results the introduction and technical guidance of the use of spinner machines, vacuum sealers and industrial mixers can increase the understanding of small food entrepreneurs about recognizing the types and quality of raw materials and provide adequate technical capabilities and hygienic food production skills. As a result, the products obtained can meet the eligibility standards and vary more according to community trends. In addition, efforts to improve the ability to manage business from the organizational side were successfully carried out with the management of licensing and bookkeeping (basic accounting) and product marketing by increasing product quality/ quantity and labeled packaging.

### 3.6. Proposed goals and targets

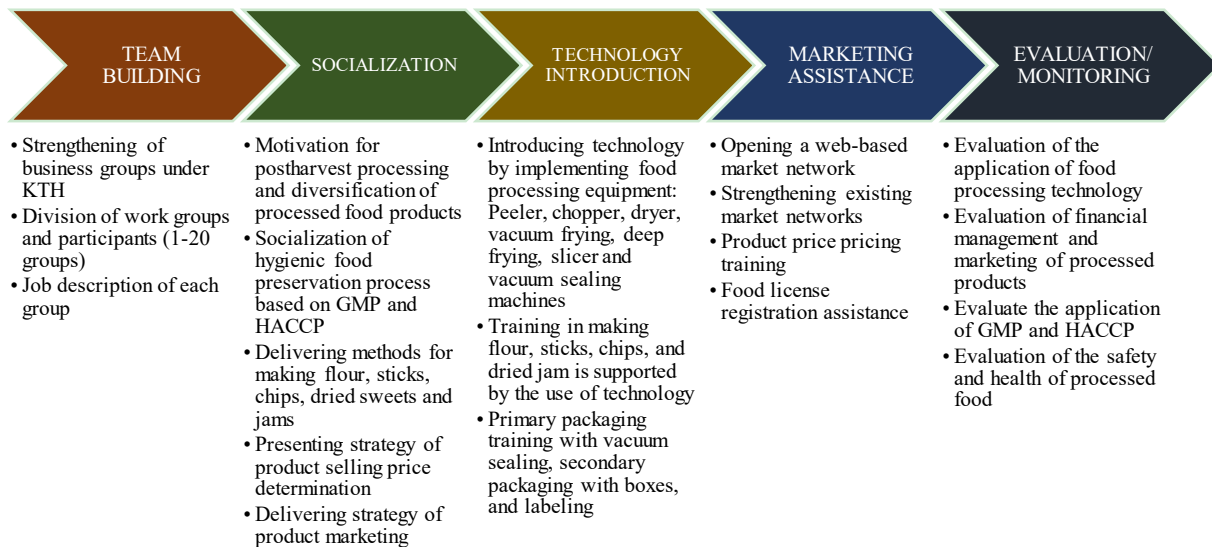
In general, the methods to be implemented immediately (in 3 years) to achieve the proposed goals and targets set are as follows:

*3.6.1. First-Year Program offered.* The implementation of the first-year program could be started with the division of the implementing groups of farmers and target participants of the PKW activities into 20 groups based on their harvested products, namely potatoes (group 1-10), Carica (group 11-15) and Tamarillo (group 16-20). Next to the group participants group 1-10 was given socialization, training and technical guidance for processing yields through the introduction and use of various machines needed to convert potatoes into flour (with the main tool disk mill), chips and sticks (with the main tool deep fryer) to primary and secondary packaging [25]. Improvement of higher quality food processing is carried out in accordance with applicable GMP and HACCP. Financial management assistance and technical guidance for marketing network expansion and marketing of web-based processed potato products will be carried out by bringing in resource persons, bookkeeping practices, web-making practices and their management according to the method of Rahmawati and Mulyono [26]. Improvement of sanitation facilities is carried out by repairing waterways and procuring trash bins in the potato harvest processing area. At the end of first year, was monitoring to evaluate the success of the program.

*3.6.2. Second-Year Program offered.* The implementation of second-year could be carried out by considering the results of the evaluation of the implementation of first year. Furthermore, participants in the group 11-15 were given Socialization, training and technical guidance on crop yields followed by the introduction of the Carica converting machine into chips (with the main device a vacuum fryer) [27] and dried sweets (with primary automatic slicer) [28] to primary and secondary packaging [25]. The next stage was in the form of financial management assistance to improve sanitation, and ended with monitoring carried out as in the first year but with the theme of processing Carica products into dried chips and sweets.

*3.6.3. Third-Year Program offered.* The implementation of third-year program is carried out by considering the results of the evaluation of the implementation of year II. Next to the group of 16-20 participants were given Socialization, training and technical guidance on the application of crop processing technology followed by the introduction of a Tamarillo conversion machine into jam with the primary blender [29] to primary and secondary packaging [25, 30]. The next stage was in the form of financial management assistance to improve sanitation as in the first year but with the theme of processing Tamarillo products to jam. Thus, as an accumulation, at the end of third year, a total of 20 Gerlang Village community groups are expected to have improved human resource quality. At the end of 3rd year, monitoring was carried out thoroughly as an accumulation of the evaluation process of program implementation for 3 years.

A series of steps are carried out at each stage of the year (from group division, Socialization to the importance of postharvest processing of social forest agricultural products, assistance to safe food production processes, introduction and technical guidance on the application of food preservation technology, vacuum, drying, blanching, deep frying, spinning, entrepreneurship Socialization, marketing network expansion, to the creation and management of e-commerce webs as well as program sustainability monitoring are shown in figure 5. The implementers for each stage in accordance with their expertise and knowledge are described in figure 5.



**Figure 5.** Schematic of implementation method every year (a 3-year cycle).

#### 4. Conclusion

Postharvest processing of agricultural and social forest products at Gerlang Village, Central Java is prospective based on the strength, weakness, opportunity and threat analysis conducted in this study. To cope with the poverty, it is necessary for social forest farmers at Gerlang Village to process raw potatoes as main agricultural commodity into flour, chips and sticks. Farmers' financial management skills involving e-commerce strategies should also be increased. To support forestation, it is also important for them also to apply diversification of Carica and Tamarillo processed products. Aside of improving economy, such effort could encourage farmers to intensify Carica and Tamarillo plantation, which help in preserving forest trees through agroforestry.

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