Applying Appropriate Technology on Diversification of Chocolate Based Food Products in Small and Medium Enterprises of Cacao Chocolate Processing: The Case of Griya Cokelat Nglanggeran

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ABSTRACT

Nglanggeran is one of the tourist villages producing chocolate in Gunung Kidul Regency. This village is rich in raw cocoa materials, supporting the establishment of Small and Medium Enterprises (UKM) driven by the local community named Griya Chocolate Nglanggeran. They can process several cocoa derivative products, even with single-origin bean-to-bar chocolate. Further product diversification was still needed to increase the attractiveness of chocolate consumption through increased use of other local raw materials. However, these efforts were still constrained by the limited availability of production equipment and access to information regarding the diversification of other chocolatederived products. Based on the participatory rural appraisal method, this study aimed to report on the 3rd year community empowerment program using appropriate technology at Griya Coklat Nglanggeran. These activities included observing the need for tools and information, providing production equipment, assisting in using tools, and training in food product diversification using a combination of local ingredients, namely butterfly pea flower (*Clitoria ternatea*). This activity was considered essential and could bring benefits because appropriate technology and product diversification could provide more space for SMEs to operate more safely, efficiently, and creatively.

Keywords: appropriate technology, diversification, participatory rural appraisal (PRA) methods, single-origin chocolate.

1 Introduction

According to the International Cocoa Organization, in 2022, Indonesia is the 7th largest country producing cocoa after Ivory Coast, Ghana, Ecuador, Cameroon, Nigeria, and Brazil [1]. However, the abundant availability of cocoa beans as a raw material for chocolate production in Indonesia has yet to be matched by the growth of the chocolate processing industry and the consumption of local chocolate. Consumers are more familiar with European brand producers even though they do not produce their cocoa. Some chocolate SME processors are trying to survive the competition and invasion of products from well-known foreign brands. This challenge becomes even more complicated when SMEs need to adapt to processing, product quality, and marketing needs, especially after the pandemic. This challenge certainly requires the attention and collaboration of various stakeholders so that the domestic chocolate processing industry can dominate the market.

One of the SMEs that has succeeded in developing its business with support from various stakeholders, including the government, research institutions, financial institutions, and the local community, is Griya Cokelat Nglanggeran (GCN). This SME, founded in 2016, produces chocolate using 100% local raw materials from cocoa farmers in Nglanggeran village, in the Special Region of Yogyakarta, so that sustainability and availability of raw materials can be guaranteed. Currently, the cocoa plantation area in Nglanggeran village is 40 hectares cultivated by more than 200 farmer members. In addition to being a



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producer of various cocoa-based products, the GCN also plays a role as an edu-ecotourism destination for tourists in Nglanggeran Village. This chocolate processing activity at GCN is one tour activity tourists can carry out while visiting this village. At GCN, tourists can directly see the process of making various cocoachocolate products.

The team has conducted community service activities based on applying Appropriate Technology since 2020 to optimize GCN's potential as a production house for quality local chocolate and choco-edutourism. Conceptually and practically, appropriate technology is rooted in the technology selection and solutions that seek to empower individuals and communities at the local level, enabling control and efficient use of local natural resources to improve developing communities' quality and standard of living [2]. The appropriate technology introduced was selected based on the identification of the real needs of the GCN. For example, in 2020, the team presented an alternative chocolate-making method where grinding and conching were done simultaneously. This method increased time and energy efficiency in small-scale chocolate processing. Whereas in 2021, the appropriate technology chosen focused more on improving the appeal of its choco-edutourism by developing a single-origin bean-to-bar chocolate production concept by providing production equipment and assistance.

In 2022, choco-edutourism GCN experienced growth in facilities, activities, and marketing. However, competition in the cocoa-chocolate industry has become increasingly stringent after the Covid 19 pandemic regarding product variations and business models. So to maximize the potential of choco-edutourism and make it sustainable, it was necessary to create a product and business development strategy based on GCN's actual needs. Therefore, in the 3rd year of this program, the team was again implementing an appropriate technology application program to solve problems using the Participatory Rural Appraisal (PRA) method approach. In the PRA method approach, partners were invited to participate directly in program implementation.

2 Research Methodology

Based on research results and applying appropriate technology, this community service program was refocused on the GCN Farmer Group in Nglanggeran, Patuk District, Gunungkidul Regency, Special Region of Yogyakarta, Indonesia. This service program was the third-year program (2020-2022) of a series of program activities held previously to support efforts to sustain the cocoa-chocolate production business. This community service activity implemented the Participatory Rural Appraisal (PRA) approach. This method was suitable to be used to identify the existing situation in the community. The basic principles of PRA are sharing experiences, community involvement, application of the concept of triangulation, and program sustainability [3]. PRA generally has four cycles: planning, action, observation, and reflection [4]. The PRA method applied to Griya Cokelat Nglanggeran consisted of several stages, including:

- identification of problems
- needs analysis
- program planning
- program execution
- monitoring and evaluation

3 Results and Discussion

Appropriate technology was trying to be reapplied in this program to achieve program sustainability and partner business independence. Sustainability is related to the conservation of natural resources for future generations and the capacity of local people to produce and consume technology without external assistance, for example, from charitable donations, government subsidies/grants, and foreign aid projects. Several studies report the successful application of appropriate technology emphasizing market-based

innovation strategies and local supply chain development [5,6]. Technology must be culturally relevant, affordable, and perceived as modern or up-to-date to attract consumers. To be able to achieve the goal, the implementation method is used with the Participatory Rural Appraisal (PRA) approach, which is an approach that prioritizes formulation results according to the needs of program implementation [4].

Identifying problems was done by gathering information through interviews/discussion methods and evaluating activities in the previous period. This discussion sought to determine the marketing conditions of chocolate products from GCN after the Covid-19 pandemic, evaluate existing chocolate products, and measure the capacity of existing machines and equipment. Coordination was also held to discuss opportunities for diversification of chocolate products as a form of variation in processed cocoa products. This discussion has been successfully carried out as an early stage of the program.

During the recovery period for Covid-19, sales of chocolate products at GCN started to increase, especially chocolate bar products. In addition, they also have a passion for continuously innovating to develop the variability of existing products. On the other hand, there needs to be more information about opportunities for developing chocolate by utilizing other local ingredients. Consumers also realized the importance of accessing information about the nutritional content of the food they consume, especially for functional food. However, the production machine capacity owned by GCN so far was considered too small to keep up with the need to meet product demand. Based on this information, the community service team determined the needs of the GCN so that the program can optimize its potential and solve existing problems, including:

- a. the need for small-scale chocolate processing machines;
- b. the need for tools that can support diversification;
- c. the need for access to increased skills in diversification;
- d. the need for access to nutritional content testing;
- e. the need for access to choco-edutourism publications through digital media channels.

The program was designed to solve problems of technological resources and human resources that utilize this technology to ensure the program's sustainability. Therefore, the program was designed to meet the needs of production machines and equipment and information related to product diversification through training and mentoring. The program was implemented in several activities, including the delivery of alternative chocolate processing machines, training and assistance in the use of chocolate production equipment in the small and medium-scale cocoa-chocolate industry, training and assistance in the formulation of ingredients for new products, training, and assistance in the production of processed butterfly pea flower chocolate, counseling on the benefits and procedures for administering the test for the nutritional value of chocolate products and making publications.

Machinery and equipment to support chocolate-based product diversification, including melanger machines as alternative chocolate processing machines and mixers, two-door gas-fired ovens, and chocolate molds, have been provided to partners (Figure 1). Training related to machine operation and education on maintaining it has also been carried out. In addition, it was to ensure that the resulting chocolate diversification products are of the best quality and minimize equipment damage due to misuse.

The formulation of the materials used was a must in manufacturing new products to diversify products. Products only be made successfully if the correct formulation is known. Formulation training has been successfully carried out with representatives of the GCN women's group, one of which was through chocolate-dodol making formulations. In addition, GCN has successfully produced diversified chocolate products in the form of a new variant of Chocolate Bar, namely Durian Chocolate. This product was evaluated for quality, including hardness, color, taste, texture, and aroma.

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Figure 1: Handover of equipment to support chocolate product diversification and training on its operation

Activities to develop chocolate product diversification have also been carried out through education and training on using local ingredients, namely butterfly pea flower (*Clitoria ternatea*), as a mixture of natural ingredients that can be added to a variety of chocolates (Figure 2). In this training, partner members, primarily women, were assisted in making healthy chocolate products from butterfly pea flowers. Butterfly pea flowers have a high value as necessary germplasm in Indonesia which can be used as animal feed, natural dyes for clothing and food, and a source of bioactive compounds. What's more, the climate in Indonesia is suitable for butterfly pea flower cultivation, thus ensuring its availability as a product raw material [7]. The making of chocolate combined with purplish blue butterfly pea flowers has aroused farmer women's group of GCN's enthusiasm because it makes chocolate look more attractive and nutritious. With the training, more creative ideas emerged from the participants in developing chocolate-derived products that were not only delicious but also healthy.



Figure 2: Training on the development of product diversification and the manufacture of butterfly pea flower healthy chocolate

Based on the monitoring of the activities that have been carried out, it was known that the machines that have been donated could be used intensively to produce various variants of chocolate preparations. In

addition, armed with tools and machines, Griya Coklat Nglanggeran has also started to become a chocolate processing service that accepts orders from other parties, especially at the mixing stage, which indicates the development of skills and independence in the production process. In addition, Griya Nglanggeran became more active in helping local cocoa farmers, especially at the grinding stage.

The implementation of the Community Service program based on the utilization of research results and the application of appropriate technology at Griya Coklat Nglanggeran has been completed until the third year. In the future, assistance to partners of Griya Coklat Nglanggeran will continue to be carried out, including in the form of consulting on the development of SMEs for chocolate products.

4 Conclusions

Product diversification was an aspect that needed to be developed by Griya Coklat Nglanggeran. Team support was carried out through information dissemination and skills improvement through training activities, including formulating and using other local raw materials in producing new products. Moreover, Griya Coklat Ngalenggeran has been able to independently apply appropriate technology in the form of a melanger, which functions as an alternative chocolate processing machine, as well as a mixing machine with an oven machine and chocolate molds, which can support product diversification.

5 Declarations

5.1 Funding Source

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5.2 Competing Interests

The author declares that no conflicts of interest exist in this work.

5.3 Publisher's Note

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