



## Community Service-Based Innovation to Optimize Village Potential Through the Development of Dried Tomato Candy (*Solanum Lycopersicum*) as a Processed Food Product in Deram Village

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### Abstrak

Desa Deram di Sumatera Utara memiliki potensi pertanian yang belum tergarap optimal, khususnya pada komoditas tomat (*Solanum lycopersicum*), yang sering kali terbuang percuma akibat keterbatasan penanganan pascapanen. Proyek pengabdian masyarakat ini bertujuan memberdayakan warga setempat dengan memperkenalkan manisan tomat kering sebagai inovasi produk olahan pangan yang berkelanjutan. Melalui metode penelitian tindakan partisipatif (*participatory action research*), kegiatan ini melibatkan terutama ibu rumah tangga dan pemuda setempat dalam lokakarya partisipatif pada bulan Juli 2025, yang memadukan metode demonstrasi, praktik langsung, serta penggunaan kuesioner pre-test dan post-test. Hasil kegiatan menunjukkan adanya peningkatan pengetahuan dan keterampilan peserta; mereka mampu mempraktikkan kembali proses pengeringan dan pembuatan manisan secara mandiri serta menunjukkan minat untuk melakukan diversifikasi produk berbasis tomat. Inovasi ini tidak hanya memperkuat ketahanan pangan tetapi juga menumbuhkan jiwa kewirausahaan lokal, sehingga membuka peluang bagi Desa Deram untuk menjadi pusat pengolahan pangan berbasis tomat di wilayah tersebut.

**Kata Kunci:** Tomat, Inovasi Pangan, Manisan Tomat.

### Abstract

Deram Village in North Sumatra has untapped agricultural potential, particularly in tomato (*Solanum lycopersicum*) cultivation, which often goes to waste due to post-harvest handling limitations. This community service-based project aimed to empower local residents by introducing dried tomato candy as a sustainable processed food innovation. Using a participation action research method, this study engaged predominantly housewives and local youth through participatory workshops in July 2025, combining demonstration, hands-on practice, and pre-post questionnaires. The findings showed increased knowledge and skill among participants, who were able to replicate the drying and candying process independently, and expressed interest in diversifying tomato-based products. This innovation not only strengthens food security but also fosters local entrepreneurship, suggesting potential for Deram Village to become a center of tomato-based food processing in the region.

**Keywords:** Tomato, Food Innovation, Candied Tomato.

## INTRODUCTION

Indonesia as an agrarian country (Anitasari, 2019; Peluso et al., 2008), Pursuant to Rahayu et al., (2024); Ausat et al., (2023) explain that although Indonesia is widely recognized as an agrarian country, many of its natural resources remain underutilized due to persistent structural and managerial challenges at the village level. Focusing on agricultural dependence in rural areas in Sembiring et al., (2024); Sitanggang et al., (2020) highlight that communities in Desa Deram, Kecamatan Merdeka, Kabupaten Karo, rely heavily on tomato (*Solanum lycopersicum*) cultivation because of its short growing period, ease of propagation, and the favorable highland climate that supports year-round production. Owing to its relatively short cultivation cycle, ease of propagation, and the favorable climate in the highlands of Karo, tomatoes are planted extensively by local farmers throughout the year.

However, the abundance of tomato production in Desa Deram has paradoxically become a double-edged sword. During the harvest season, the oversupply of tomatoes leads to a sharp decline in market prices, as dictated by the fundamental laws of supply and demand (Wei et al., 2022; Hendricks & Singhal, 2009). The situation is further exacerbated by the limited infrastructure and distribution channels available to farmers in rural areas (Ginting et al., 2025; Tarigan, 2022). With the local market unable to absorb the entire harvest and with insufficient access to larger, more distant markets, farmers are often forced to sell their tomatoes at unsustainably low prices, frequently incurring financial losses.

Additionally, tomatoes are perishable goods with a relatively short shelf life (Haile & Safawo, 2018; Arah et al., 2015; Nasrin et al., 2008). Under ideal storage conditions, fresh tomatoes can only be maintained for a few days before showing signs of decay (Wulandari, 2024). Unfortunately, modern storage technologies, such as cold chain logistics, controlled-atmosphere storage, or vacuum packaging, remain inaccessible for most rural communities in North Sumatra due to financial limitations, lack of infrastructure, and inadequate technical knowledge. Consequently, a significant portion of the harvest goes to waste each year, further undermining the economic stability of the farming community (Sidabutar et al., 2025; Martauli et al., 2023).

These recurring challenges point to a critical need for innovative, community-based solutions aimed at improving the post-harvest handling, processing, and marketing of agricultural products, especially tomatoes. One promising strategy is the development of value-added processed food products (Sharif & Zahid, 2018; Coltrain et al., 2000), which can both reduce post-harvest losses and provide a more stable income stream for local farmers. The present study proposes the development of dried tomato candy as a novel food innovation that not only extends the shelf life of tomatoes but also adds commercial value through product differentiation. Dried tomato candy is a processed product made by dehydrating tomatoes and incorporating sugar, natural preservatives, and sometimes additional flavoring to create a sweet, shelf-stable snack (Jariyah et al., 2022; Hasanuzzaman et al., 2014; Buntaran et al., 2011). This product innovation responds directly to the challenges faced by Desa Deram's farming community and aligns with the broader goals of rural economic empowerment and food security enhancement.

The choice of dried tomato candy as a focal product is underpinned by several factors. Firstly, tomatoes are naturally rich in lycopene, beta-carotene, vitamin C, and antioxidants (Soytong et al., 2021; Kumar et al., 2020; Bhowmik et al., 2012), making them ideal candidates for healthy snack products. Secondly, drying tomatoes significantly increases their shelf life, facilitating easier storage, transportation, and commercialization (Zalewska, 2022; Toor & Savege, 2006; Zaroni et al., 2000). Lastly, by transforming a fresh commodity into a niche processed product, farmers and villagers potentially can command higher prices, target new market segments, and diversify their income sources.

This innovation is also supported by the relatively low technological requirements to produce dried tomato candy. The process can be carried out using simple solar drying methods or locally adapted dehydrators, both of which are accessible to rural communities with minimal training and investment. Moreover, the product has the potential to be scaled

into small and medium enterprises (SMEs), providing employment opportunities beyond farming and stimulating the local economy (Fauziyah et al., 2024; Saadillah et al., 2023).

This study is part of a community engagement initiative conducted by the Biology Education Study Program at UIN Sumatera Utara, which is dedicated to transforming academic research into tangible societal impact through community service and empowerment initiatives. Within this framework, the researchers seek not only to disseminate technical knowledge related to the production of dried tomato candy to residents of Desa Deram, but also to strengthen community capacity in key areas such as entrepreneurship, product hygiene, branding, and local marketing strategies. Furthermore, the initiative is designed to foster a sense of ownership and sustainability among community members by actively engaging them throughout all stages of product development. These stages include the identification of local challenges, participation in focus group discussions, collaborative design of the production process, and the piloting of marketing and sales strategies. Through this participatory approach, the community is positioned not merely as a beneficiary of academic intervention, but as an active co-creator of innovation.

This research addresses the global discourse on food security and sustainable agriculture. The Food and Agriculture Organization (FAO) emphasizes the importance of reducing post-harvest losses and promoting value addition in agricultural commodities to combat rural poverty and ensure sustainable food systems (Bendinelli, 2020; Kiaya, 2014; Grolleaud, 2002). The development of tomato-based processed food products directly contributes to these objectives by creating resilience against market volatility, enhancing rural food system sustainability, and supporting local agrifood innovation ecosystems.

The present study is motivated by the urgent need to address structural vulnerabilities in the agricultural economy of Desa Deram through food innovation and community capacity development. By leveraging the village's abundant tomato production and transforming it into a value-added processed food product in the form of dried tomato candy, this initiative offers a strategic pathway toward rural development, economic empowerment, and sustainable agricultural practices. Within a community service-based innovation framework, this article examines both community responses to the implementation of locally grounded food innovation and changes in community capacity. The findings are expected to demonstrate the effectiveness of participatory, science-based interventions in enhancing economic resilience of Desa Deram and to provide a replicable model for other rural communities facing similar challenges.

## **METHOD**

This study adopted a qualitative research approach by using Participation Action Research method within the framework of community service aimed at empowering rural communities through local food innovation. The research was part of Biology Education Study Program in collaboration with local stakeholders in Desa Deram, Kecamatan Merdeka, Kabupaten Karo, North Sumatra, in June-July 2025. The study was designed to respond directly to the challenges faced by the village community, especially tomato overproduction, post-harvest losses, and limited access to food preservation technologies by introducing a practical innovation: the creation of dried tomato candy as a value-added processed food product.

The participants in this activity were selected using a purposive sampling technique, focusing on community members who expressed willingness and commitment to participate actively in the program. Most participants consisted of housewives, who play a central role in food preparation and home-based production activities, while a smaller portion included teenagers and young adults interested in entrepreneurship or skills training. C.R., S.A.H., N.A.M., M.L., A.D.L., A.Z.A., and A.Z.B.B: Activity planning, training design, field data collection, and evaluation of training results, and U.N.A.D.J: manuscript preparation. This participant composition was considered strategic, as these groups are often key drivers of household and small-scale food innovation in rural areas.

The program began with a preliminary needs assessment conducted through informal interviews with village heads, local farmers, and women's groups to understand the scale of tomato production and the common post-harvest challenges. This was followed by a focus group discussion (FGD) to map the community's prior knowledge, perceptions, and expectations regarding food processing, especially their awareness of and ability to produce dried food products from tomatoes. The FGD also served to identify local resources, such as equipment, ingredients, and drying methods that could be realistically adopted by the community.

The core of the activity consisted of a practical training and demonstration workshop on how to produce dried tomato candy using simple, low-cost techniques suitable for home-scale processing. The training covered all stages of production: starting from the selection and washing of ripe tomatoes, slicing and blanching, soaking in a sugar solution, drying using household ovens or natural sun-drying methods, and finally packaging the product in a hygienic and appealing manner. Emphasis was placed on food safety, cleanliness, and product aesthetics to increase marketability. During the sessions, participants were not only observers but were fully involved in hands-on practice, with everyone or group preparing their own batch of tomato candy under guidance.

To evaluate the initial and final competencies of the participants, this study employed a combination of qualitative observation and structured assessments. Researchers used an observation checklist during the training and a pre-post self-assessment format to understand the participants' baseline and post-intervention learning. At the beginning of the activity, participants were asked to report their prior knowledge and confidence regarding tomato preservation practices. Most participants which primarily housewives and a few adolescents, had no previous experience processing tomatoes into preserved products, although some were familiar with general dried snacks or traditional sweets. This baseline information allowed facilitators to tailor the delivery of content to match the community's practical learning needs. As the training progressed, participants were guided step-by-step in creating dried tomato candy using locally available tools and ingredients. Practical demonstrations were combined with explanations about food hygiene, preservation techniques, and the importance of value-added products for agricultural sustainability.

At the end of the intervention, a post-training evaluation was conducted to assess learning outcomes. Participants were asked to reproduce the product independently, and their performance was monitored against the original procedure. Most of them were able to complete the process confidently. Additionally, a structured questionnaire was distributed to capture participants' perceptions of the training. The questionnaire adapted from Farihah et al. (2024) contained both demographic data and Likert-scale questions designed to assess four domains: usefulness, impact, social influence, and satisfaction.

Table 1. Summary of the Questionnaire

| Section             | Description                                                                                                | Number of Item |
|---------------------|------------------------------------------------------------------------------------------------------------|----------------|
| Demographics        | Gender, age group, occupation, and place of residence                                                      | 4              |
| Prior Knowledge     | Awareness and previous experience related to dried tomato candy production                                 | 3              |
| Training Completion | Whether participants fully attended the training                                                           | 1              |
| Usefulness          | Perceived knowledge gained about food innovation, village potential, food security, and tomato utilization | 5              |
| Impact              | Intention to apply the knowledge personally and commercially                                               | 2              |
| Social Influence    | Willingness to collaborate with or share knowledge with others                                             | 2              |
| Satisfaction        | Perceived quality of the training delivery and facilitators                                                | 3              |

|              |                                                  |           |
|--------------|--------------------------------------------------|-----------|
| Feedback     | Open-ended section for suggestions or criticisms | 2         |
| <b>Total</b> |                                                  | <b>21</b> |

This mixed approach to data collection allowed the researchers to not only observe direct behavioral change but also gather reflective feedback to assess the community's evolving attitudes toward innovation and food processing.

Throughout the activity, data collection was conducted through participant observation, field notes, photo and video documentation, in-depth interviews, and questionnaire responses. These qualitative data sources were triangulated to ensure the validity and richness of the findings. Analysis was conducted thematically, focusing on changes in knowledge, skill acquisition, motivation, and potential barriers to future implementation.

## FINDING AND DISCUSSION

The community service activities conducted in Desa Deram, Kecamatan Merdeka, Kabupaten Karo, in July 2025, yielded significant results. Prior to the intervention, it was found that most community members especially housewives had limited or no experience in processing agricultural products. The prevailing practice in the village was to sell fresh produce, including tomatoes, directly to local markets or middlemen. This practice exposed villagers to considerable economic vulnerability, especially during the harvest season when tomato supply surges, causing prices to drop drastically. As one participant stated during the focus group discussion: "We just harvest and sell. If the price drops, we just accept it, even if it barely covers our costs."

Tomato, known locally as one of the most grown horticultural crops in Desa Deram, was seen not as a potential processed product, but merely a fresh commodity with a ticking shelf life. Spoilage was a familiar story, particularly when the harvest coincided with rainy days or market oversupply. "When the tomatoes don't sell, we throw them to the animals or it will become waste" admitted a local farmer.

These insights underscored the urgency of food innovation at the village level and validated the design of the program: introducing a simple, low-cost technique to create dried tomato candy as a processed food product that not only extended shelf life but also opened new market opportunities.

### Hands-On Training Outcomes

The hands-on training, held over two consecutive days, began with the selection and cleaning of fresh, ripe tomatoes. Participants were guided to cut the tomatoes into uniform pieces, carefully remove seeds and pulp, and then soak the slices in limewater (air kapur sirih) for 12 hours. This process new to many participants.

Using basic kitchen tools such as knives, basins, trays, and stoves, the villagers prepared sugar syrup (in a ratio of 1 kg tomatoes to 200 grams of sugar) and boiled the tomato slices for 10 to 15 minutes. Once the sweet infusion process was complete, the tomato pieces were laid out in single layers on trays and sun-dried for four to six days. This method proved manageable even with limited resources and space.



Figure 1. Hands-on training on making dried tomato candy.  
Left: Demonstrating the preparation of sweet syrup to the villagers.  
Right: Sun-drying process utilizing solar energy at no cost

After drying, the tomatoes took on a chewy, candy-like consistency, slightly translucent with a deep red hue. The pieces were sprinkled with powdered sugar and sealed in clear plastic pouches for aesthetic presentation. The sense of achievement was visible on participants' faces, even the youth participants expressed interest in packaging the product attractively for sale in local souvenir shops or online platforms.

### Community Response and Capacity Change

The post-activity evaluation revealed a positive transformation in both skills and confidence among the participants. Before the training, most reported being unsure of their ability to process tomatoes or any agricultural product into something of higher value. By the end of the session, nearly all participants were able to independently reproduce the dried tomato candy using the same method.

Based on observation during the activity, most participants were women aged between 26–60 years, consisting of housewives, farmers, and informal entrepreneurs. Many of them had never attempted to process tomatoes before for sale, which confirmed the importance of practical, hands-on training in supporting local food processing innovation.

Meanwhile, demographic data based on the voluntary questionnaire responses from seven participants are summarized in Table 2. All seven respondents were female farmers aged 41–60 years and residents of the village. None had prior experience making dried tomato candy, although two had at least heard of it. All participants reported having successfully completed the training. This demographic snapshot highlights the potential of engaging rural women farmers in food innovation-based community empowerment programs.

Table 2. Participant Demographics of the Dried Tomato Candy Training in Deram Village

| Demographic Variable                  | Category              | Number of Participants (n=7) |
|---------------------------------------|-----------------------|------------------------------|
| Gender                                | Female                | 7                            |
|                                       | Male                  | 0                            |
| Age Range                             | 41–60 years           | 7                            |
|                                       | Other age ranges      | 0                            |
| Occupation                            | Farmer/Livestock      | 7                            |
|                                       | Other occupations     | 0                            |
| Residence Location                    | Village               | 7                            |
|                                       | Suburban/Urban        | 0                            |
| Prior Knowledge of Dried Tomato Candy | Had heard of it       | 2                            |
|                                       | Had never heard of it | 5                            |
| Training Completion Status            | Completed             | 7                            |
|                                       | Not Completed         | 0                            |

The post-training evaluation revealed significant improvements. Participants successfully replicated the dried tomato candy using the correct techniques, hygiene practices, and drying durations. Observationally, they appeared more confident and engaged, often helping each other troubleshoot issues such as sun-drying consistency and sugar concentration. Several commented positively on the usefulness of the training: "I never thought tomatoes could become sweets. Now I know how to make it and I want to try selling them," said one participant, 43-year-old women. "Usually we throw away excess tomatoes or sell them cheap. This is better, we can keep it longer and maybe open a stall," noted another participant.

The results of the questionnaire (Figure 2-5) indicate a highly positive response to the hands-on training on making dried tomato candy. All participants (100%) either Strongly Agree or Agree that the training delivered new and relevant knowledge especially in optimizing local agricultural potential, such as using tomatoes for value-added products. The

majority expressed intent to apply what they learned for personal consumption, and several showed interest in turning it into an income-generating activity. Participants also rated their satisfaction with the facilitators and clarity of instruction very highly. However, social collaboration (e.g., joint production efforts with neighbors) showed slightly lower enthusiasm, suggesting a potential area for fostering community-based production in the future.

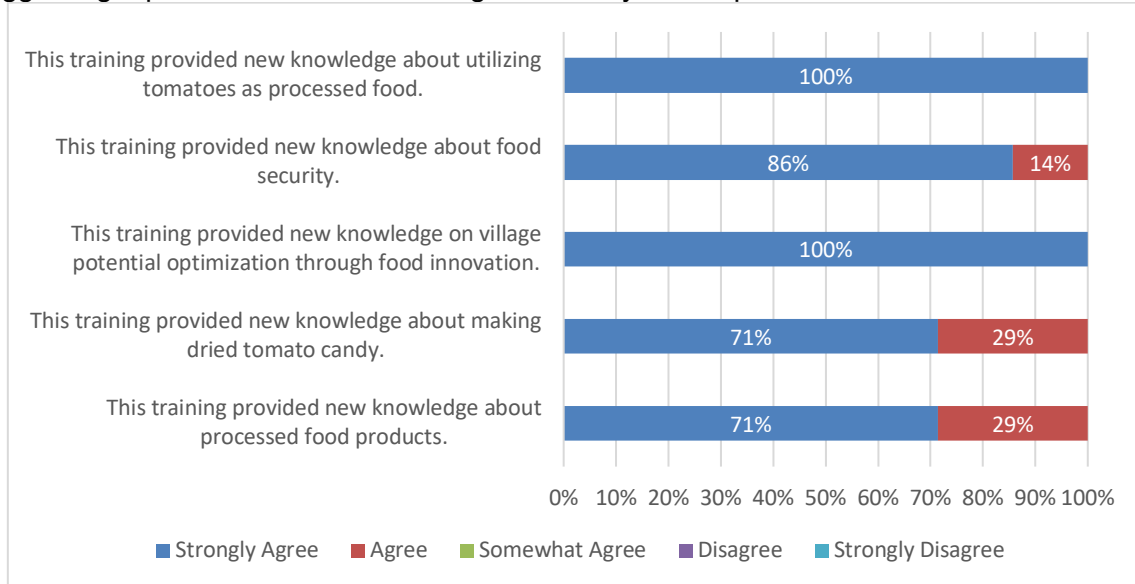


Figure 2. Charts showing respondents' perceptions of the training's usefulness related to dried tomato candy production.

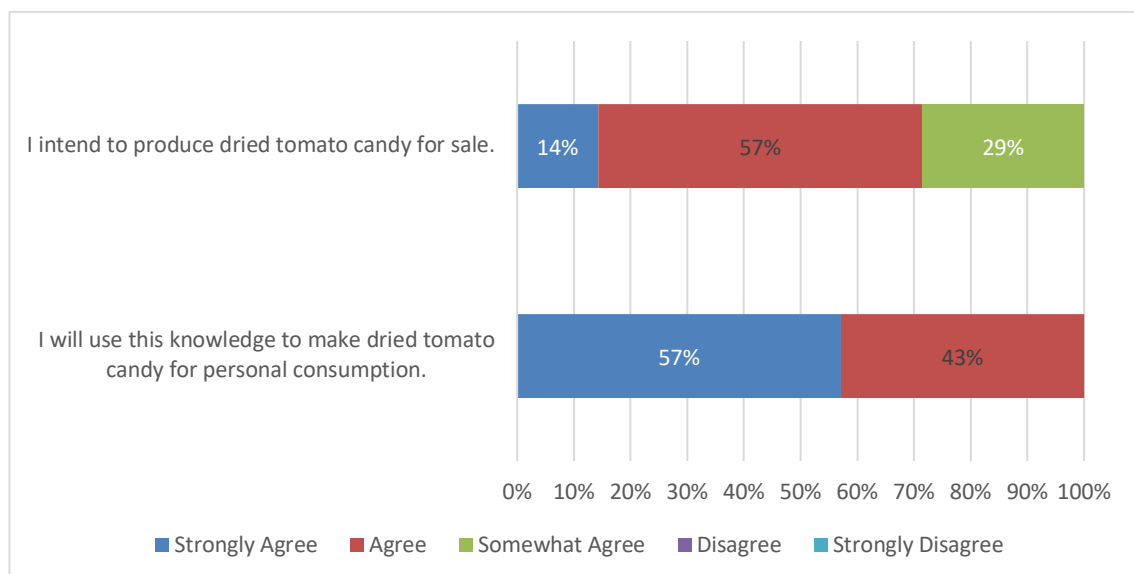


Figure 3. Charts showing respondents' perceptions of the training's impact related to dried tomato candy production.

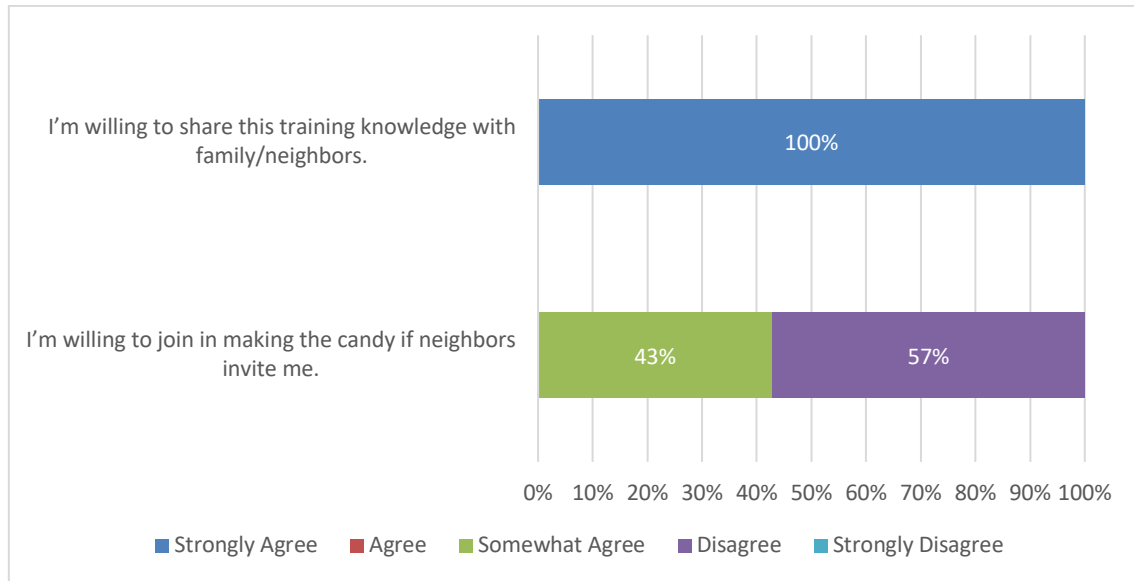


Figure 4. Charts showing respondents' perceptions of the training's social influence related to dried tomato candy production

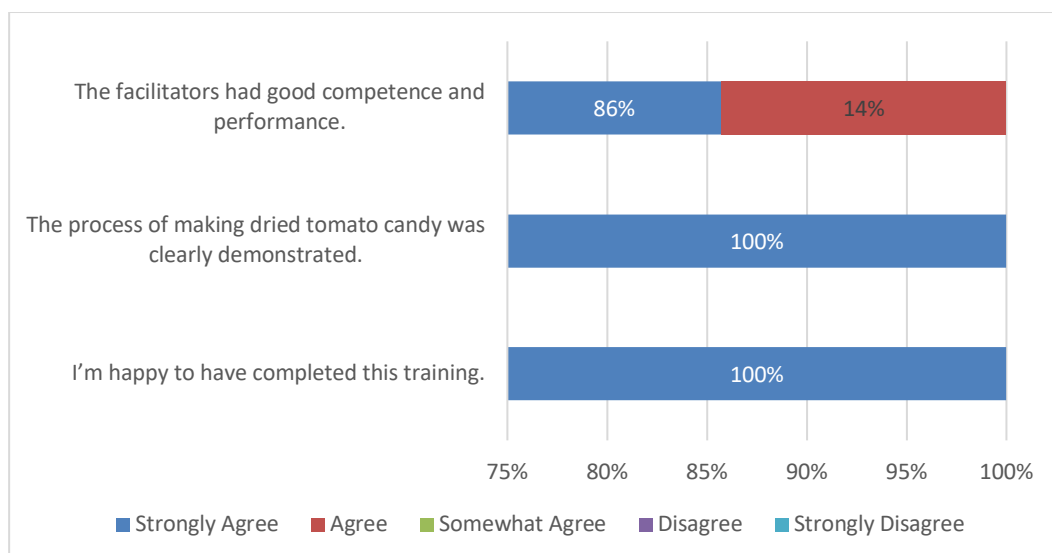


Figure 5. Charts showing respondents' perceptions of the training's satisfaction related to dried tomato candy production

These responses indicate a shift in mindset from passive agricultural reliance to active food innovation. More importantly, participants began to see the potential of food processing as a viable livelihood strategy. While numerical analysis will be completed in the final stage of reporting, early review of the responses reflects a strong community appetite for practical, economically empowering programs like this.

Several participants expressed gratitude for the activity, which they saw as practical, relevant, and empowering: "Now we know what to do when tomatoes flood the market." said one of the participants. "I felt like I can start a home business even if it's small, I often go to Medan for selling the harvest product" shared a teenage participant who expressed interest in marketing the product on social media.

The sense of ownership also emerged with participants suggesting flavor variations and packaging designs featuring "Made in Desa Deram" as a local brand.



Figure 6. Left: Group photo of the researchers with the community after the training session. Right: Community service activity, with active participation from local residents.

### Discussion

The results of this study support the assertion that simple food innovation can drive meaningful change in rural communities (Devi & Sucahyo, 2023; Sihombing, 2022; Fatchiya & Amanah, 2016). The success of the dried tomato candy initiative lies not only in the final product but also in the process of skill transfer and empowerment that accompanied it. This aligns with community service models that emphasize participatory learning, local capacity building, and context-sensitive interventions as seen in previous studies such as Fariyah et al. (2024) and Rahmadi et al. (2024) where community's empowerment through food processing similarly led to entrepreneurial enthusiasm.

The transformation observed in Desa Deram reflects how knowledge gaps often hinder rural innovation. Before the training, the villagers' limited knowledge in food processing confined them to the lowest rung of the agricultural value chain. This project disrupted that cycle by demonstrating that food preservation is not exclusively the domain of factories or urban entrepreneurs, it is something villages can do with the right guidance and minimal tools. The choice of tomatoes as the focal commodity was also strategic. Tomatoes are perishable, abundant, and underutilized in processed forms in rural Sumatra. Tomato commodity ranks fifth regarding vegetable export volume and value in Indonesia (Saptana et al., 2023). By converting them into shelf-stable, high-sugar-content dried snacks, the project not only reduced waste but created a new economic narrative for a common crop. The community began to view tomatoes not as surplus or waste but as raw materials for creativity and commerce.

This intervention provided an alternative solution to the infrastructure limitations that often cripple rural agricultural economies. Without access to cold storage or stable distribution networks, fresh produce in villages like Desa Deram decays quickly and loses market value. Sun-drying, which uses free and renewable solar energy, proved to be a culturally and economically appropriate technology. It allowed villagers to extend shelf life without relying on expensive, unsustainable solutions. The inclusion of women and youth in the training sessions further contributed to the community's overall resilience. Studies (Khiftiyah & Nilamsari, 2022; Sitepu & Utami, 2019; Setyawati & Ningrum, 2018; Nurdiwati et al., 2017) have shown that empowering women in rural economies has ripple effects on family income, education, and nutrition. The confidence expressed by housewives after the training and the entrepreneurial enthusiasm of teenagers reflect intergenerational potential for sustainability.

The use of pre-post questionnaires and observations strengthened the study's findings, confirming that participatory methods can be both qualitative and evidence-driven. The villagers' ability to describe the process, replicate it, and adapt it creatively indicates deep learning rather than surface-level engagement. This approach aligns with community-based participatory research (CBPR) principles, which emphasize mutual learning and co-

creation of knowledge between researchers and participants (Madsen & O'Mullan, 2018; Jull et al., 2017; Greenhalgh et al., 2016).

The community's suggestions for product expansion such as creating tomato jam, savory tomato chips, or spicy-sweet tomato snacks indicate a budding innovation culture. If supported further, these ideas could lead to the formation of a village-based food cooperative, generating sustainable employment and branding Desa Deram as a center of tomato-based food innovation. Nevertheless, challenges remain. Weather variability can affect the drying process; packaging materials and food-safe labels still depend on external sources; and access to wider markets requires strategic support. These limitations underscore the importance of follow-up assistance, continued mentorship, and institutional collaboration between universities, local governments, and cooperatives.

## CONCLUSION

This study concludes that a community service-based food innovation program can significantly increase the capacity of villagers particularly housewives and youth in developing processed food products from locally abundant yet underutilized agricultural commodities. The participatory method proved effective in both skills transfer and creative engagement, as seen in the ability of participants to produce dried tomato candy and suggest alternative products like jam and savory snacks. The program strengthened community pride and showcased how food innovation can serve as an entry point for broader village development.

To sustain and expand this effort, it is recommended that continuous mentoring, packaging support, and market access strategies be developed in collaboration with universities, cooperatives, and local authorities. With adequate support, Deram Village has the potential to become a regional model for agro-based entrepreneurship rooted in community participation and innovation.

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