International Review of Practical Innovation, Technology and Green Energy (IRPITAGE) | ISSN (e): 2808-8611
Volumes 6 No. 1 (2026)

ENHANCING COMMUNITY INCOME THROUGH THE PRODUCTION OF RED GINGER CANDY BASED ON LOCAL POTENTIAL AND DOWNSTREAMING STRATEGIES

Yasmin Chairunisa Muchtar[1], Muhammad Anggia Muchtar[2], Jane Melita Keliat[3], Wina Nurfitriani[4], Juli Novita Sari[5], Lailan Syafrina Hasibuan[6*]
Universitas Sumatera Utara, Medan
Fakultas Vokasi[1,3,4,5,6], Universitas Sumatera Utara, Medan
Fakultas Ilmu Komputer dan Teknologi Informasi[2], Universitas Sumatera Utara, Medan
E-mail: yasminmuchtar@usu.ac.id[1] anggi.muchtar@usu.ac.id[2], jane.melita@usu.ac.id[3], winanurfitriani@usu.ac.id[4] julinovitasari@usu.ac.id[5] lailansyafrina@usu.ac.id[6*]

Received	: 12 April 2026	Accepted	: 15 May 2026
Revised	: 25 April 2026	Published	: 24 May 2026

Abstract

Desa Dalig Raya in Simalungun Regency possesses significant potential in red ginger commodities; however, its utilization remains limited to raw product sales, resulting in low economic value added. This study aims to enhance community income through innovation in processing red ginger into value-added ginger candy based on local potential. The research employs a Participatory Action Research (PAR) approach, involving stages of situation analysis, production training, and business management assistance. The results indicate that the innovation of red ginger candy products improves community skills, increases economic value added, and creates broader market opportunities in functional food products. Furthermore, the program strengthens community economic independence through downstreaming strategies and collaborative partnerships. Overall, this initiative contributes to improving community welfare by optimizing local resources and promoting sustainable rural economic development.

Keywords: Community Empowerment; Ginger Candy; Local Potential; Red Ginger; Value Added

INTRODUCTION

Indonesia should ideally become a leading country in the agricultural sector by leveraging its abundant natural resources to support national economic growth through agribusiness. In this context, agribusiness development must be a primary focus, considering the sector's substantial potential within both macro and microeconomic structures (Utami et al., 2022).[1] Strong support for agribusiness is expected to reinforce the role of agriculture as a vital pillar of the national economy, where this sector contributes approximately 35.43% of total employment, highlighting its importance as the foundation of the community's economy (Novita et al., 2023).[1] Therefore, the government, through various strategic policies, must encourage the development of the agricultural sector by focusing on leading commodities that have high competitiveness in the global market (Utami et al., 2022).[1]

Ginger has been identified as a leading biopharmaceutical commodity in North Sumatra Province, with Simalungun Regency emerging as one of the main producers (Bangun, 2019).[1] As of 2024, ginger production in Simalungun Regency reached a total of 3,538,027 kilograms, a figure that reflects extraordinary potential for further development, especially with the increasingly open market for herbal and spice products (Muchtar et al., 2026).[1] In fact, in the same year, Simalungun Regency successfully exported approximately 30 tons of fresh ginger to Dubai, indicating that local product quality has met international standards (Muchtar et al., 2026).[1] However, despite this high production, significant challenges remain in terms of utilization and processing at the local level (Muchtar et al., 2026).[1] The utilization of red ginger (Zingiber officinale var. Rubrum) at the community level in Dalig Raya Village is still limited to the sale of raw materials. Selling in the form of fresh rhizomes results in very low economic value added for farmers and makes them highly dependent on market price fluctuations (Muchtar et al., 2026).[1] Limited knowledge regarding processing and marketing techniques, particularly in producing innovative products such as ginger candy, has become

the main obstacle in optimizing this potential (Muchtar et al., 2026).[1] In fact, red ginger has a spicier taste and stronger aroma compared to other types of ginger due to its high essential oil and oleoresin content, making it highly suitable for processing into health confectionery products (Muchtar et al., 2026).[1] Downstreaming efforts through processing red ginger into ginger candy aim not only to increase the economic value of the product but also to introduce the health benefits of ginger to a wider market (Muchtar et al., 2026).[1] Red ginger contains active compounds such as gingerol, shogaol, and zingerone, which have antioxidant, anti-inflammatory, and anticancer effects (Devinarahma et al., 2024; Muchtar et al., 2026).[1] In the post-pandemic era, public interest in functional foods that can enhance the immune system has increased significantly, creating substantial market opportunities for processed red ginger products (Sulastri & Suwitono, 2024).[2]

The Community Service Program (PkM) conducted by the team from the Faculty of Vocational Studies, Universitas Sumatera Utara (USU), seeks to address these challenges through a global partnership model (Muchtar et al., 2025).[1] Collaboration with Universiti Teknologi MARA (UiTM) Malaysia serves as a strategic step to transfer food technology knowledge and international quality standards to the community of Dalig Raya Village (Muchtar et al., 2026).[1] Through a comprehensive approach, ranging from technical production training to understanding business models and digital marketing, this activity is expected to create economic independence for local business groups (Sulaiman et al., 2025).[3]

The sustainability of this program heavily depends on multi-stakeholder synergy, including the role of Regional-Owned Enterprises (BUMD) of Simalungun Regency as distribution partners and market guarantors (off-takers) (Muchtar et al., 2025).[1] Integration among academics, local government, and industry players is expected to build a resilient and innovation-based rural economic ecosystem (Muchtar et al., 2026).[1] This article will examine in depth the process, results, and strategic implications of the community service activity in the context of rural economic empowerment in Simalungun (Muchtar et al., 2026).[1]

Table 1. Biopharmaceutical Production Statistics in North Sumatra (2024)

Region	**Ginger Production (Kg)**	**Turmeric Production (Kg)**	**Lemongrass Production (Kg)**
Simalungun	3,538,027	2,541,875	692,977
Toba Samosir	4,129,382	1,195,559	482,400
North Tapanuli	1,001,746	542,171	708,998
South Tapanuli	306,676	42,524	66,955
North Sumatra Province (Total)	11,167,258	4,551,901	3,929,647

Source: BPS North Sumatra, Horticultural Statistics 2024.

Table 1 presents the biopharmaceutical production statistics in North Sumatra in 2024, showing that Simalungun Regency is one of the major contributors to ginger production, reaching 3,538,027 kg, alongside significant outputs of turmeric and lemongrass. Compared to other regions such as Toba Samosir and North Tapanuli, Simalungun demonstrates strong potential in the development of biofarmaka commodities, particularly red ginger as a leading product. However, despite this high production capacity, the economic value obtained by the community remains relatively low due to limited downstream processing and product diversification. Therefore, it is necessary to promote the sustainability of ginger candy production as a value-added product in order to optimize local resources, strengthen agroindustry development, and ultimately increase community income in Simalungun.

LITERATURE REVIEW

Red ginger (Zingiber officinale var. Rubrum) is one of the most prominent ginger varieties used in traditional medicine practices in Southeast Asia, including Indonesia. Unlike white ginger or elephant ginger, red ginger has smaller rhizomes with pink to orange skin and yellowish-brown flesh (Muchtar et al., 2026).[1] The main advantage of red ginger lies in its biochemical profile; this variety contains essential oils ranging from 2.58% to 2.72%, which is significantly higher than other varieties, resulting in a spicier taste and a longer-lasting warming effect on the body (Dewi et al., 2024; Muchtar et al., 2026).[1] Pharmacologically, red ginger contains active phenolic compounds that are highly beneficial for human health, namely gingerol, shogaol, and zingerone (Devinarahma et al., 2024; Muchtar et al., 2026).[1] Gingerol is known for its strong anti-inflammatory effects by inhibiting cyclooxygenase (COX) and lipoxygenase (LOX) enzymes,

thereby helping to relieve muscle pain and joint inflammation (Aregawi et al., 2024; Muchtar et al., 2026).[4] In addition, shogaol typically formed through the heating or drying of gingerol has higher antioxidant activity and has been proven effective in inhibiting cancer cell growth as well as reducing low-density lipoprotein (LDL) cholesterol and triglyceride levels in the blood (Aregawi et al., 2024; Dewi et al., 2024; Muchtar et al., 2026).[2] In the context of modern healthcare, red ginger has been studied for its effectiveness in improving lung function and reducing the severity risk in patients with chronic diseases (Aregawi et al., 2024).[4] Recent studies indicate that regular consumption of red ginger can significantly improve the FEV1/FVC parameter (lung function), while also helping to suppress the "cytokine storm" often associated with respiratory viral infections (Aregawi et al., 2024).[4] These immunosuppressive benefits make processed red ginger products, such as ginger candy, not merely snacks but functional food products aligned with the rapidly growing "Back to Nature" health trend (Sayuti & Atikah, 2024; Sulastri & Suwitono, 2024).[2]

Processing ginger into hard candy requires appropriate confectionery technology to maintain the stability of its active compounds. The use of granulated sugar (sucrose) in traditional candy production often poses challenges for diabetic patients and children due to the risk of dental caries and increased glycemic index (Susilo et al., 2013).[6] As an innovation, the use of isomalt a sugar alcohol (polyol) derived from sucrose through enzymatic processes has become a strategic solution (Susilo et al., 2013).[6] Isomalt has a sweetness level of approximately 45–65% of sucrose but contains only half the calories and is non-cariogenic (Susilo et al., 2013; Venkatesh, 2023).[6] More importantly, from a technical perspective, isomalt has high thermal stability and very low hygroscopicity, resulting in candy with a hard texture, glossy appearance, and resistance to melting even under tropical room temperature conditions (Muchtar et al., 2026; Susilo et al., 2013).[6]

In addition to isomalt, the use of stevia leaf extract (Stevia rebaudiana) has emerged as a potential natural zero-calorie sweetener in the herbal candy industry (Hambali, 2025).[8] Stevia has a sweetness level 200 to 300 times that of sucrose and remains stable at high temperatures (Dewi et al., 2024; Hambali, 2025).[8] However, formulations using pure stevia often face challenges in texture, as the product tends to be softer and melts more easily if not combined with an appropriate bulking agent (Muchtar et al., 2026; Susilo et al., 2013).[6] Therefore, the synergy between isomalt as a texture-forming agent and stevia as a high-intensity sweetener represents an ideal food technology approach to produce healthy and high-quality red ginger candy (Hambali, 2025).[1]

Community empowerment through the downstreaming of local commodities such as red ginger can be explained through the theory of rural economic sustainability. This empowerment strategy includes three main pillars: creating an enabling environment for community development (enabling), strengthening community capacity through technical training (empowering), and protecting communities by ensuring market access (protecting). In this context, the role of universities and international partnerships is crucial in providing "global insight" that helps communities adapt their products to global market standards, including regulatory aspects such as P-IRT licensing and Halal certification (Muchtar et al., 2025).[1]

Table 2. Comparison of Sweetener Characteristics in Candy Production

Characteristics	Sucrose (Granulated Sugar)	Isomalt	Stevia
Sweetness Level	100% (Standard)	45–65% of sucrose	200–300× sucrose
Caloric Content	4 kcal/gram	2 kcal/gram	0 kcal/gram (zero calorie)
Glycemic Index	High	Low	Zero
Dental Effect	Cariogenic (causes caries)	Non-cariogenic	Non-cariogenic
Texture Stability	Easily crystallized	Highly stable & glossy	Tends to melt easily

Source: Adapted from Susilo et al. (2013) and Hambali (2025)

Based on Table 2, isomalt demonstrates superior characteristics in terms of texture stability, low glycemic index, and non-cariogenic properties compared to sucrose, making it a suitable alternative for producing healthier ginger candy. Meanwhile, stevia offers zero-calorie benefits but requires combination with bulking agents to maintain product texture. Therefore, the combination of isomalt and stevia becomes a strategic formulation in developing functional ginger candy products.

METHOD

The implementation of this international community service program is designed using a systematic and participatory approach, applying the Participatory Action Research (PAR) model. The activity is centered in Dalig Raya Village, Simalungun Regency, North Sumatra, located approximately 163 km from the Universitas Sumatera Utara campus in Medan (Muchtar et al., 2025). The program is planned to run for eight months. The implementation team consists of multidisciplinary experts, including specialists in human resource management, information technology, pharmaceutical science and food analysis, as well as international partners from Universiti Teknologi MARA (UiTM), Malaysia (Muchtar et al., 2025). The main target of the program is 25 to 30 local residents, consisting of PKK members, farmer groups, and members of the Joint Business Group (KUB) Simalungun Food Mandiri. The implementation procedures are divided into several main stages: (1) Situation Analysis and Initial Coordination, involving in-depth discussions with the Village Head of Dalig Raya and community leaders to identify priority issues; (2) Technology Transfer and Production Training, including hands-on demonstrations of red ginger candy production using isomalt and stevia as sugar substitutes, with cooking temperatures strictly maintained between 140–150°C for 20 minutes; (3) Management and Digital Marketing Training using the Business Model Canvas (BMC); (4) Focus Group Discussions (FGD) and Dissemination conducted on February 6, 2026, and May 5, 2026; (5) Assistance in Legalization and Certification for obtaining a Business Identification Number (NIB), P-IRT license, and Halal Self-Declare certification. Data were collected through participatory observation, in-depth interviews, multimedia documentation, as well as pre-test and post-test results to measure community capacity improvement. Data analysis was conducted using descriptive qualitative methods to evaluate the effectiveness of the implemented empowerment model (Muchtar et al., 2026).

Table 3. Implementation Schedule of the EQUITY Program Activities (2025–2026)

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Preparation & Technical Coordination								
Production Training & Pre-FGD								
Routine Production Assistance								
Main FGD & International Dissemination								
Policy Brief Development								
Publication & Media Coverage								
Evaluation & Monitoring								

RESULTS AND DISCUSSION

Program Implementation, Product Innovation, and Socioeconomic Impact

The implementation of the community service program in Dalig Raya Village has successfully transformed the local community's perception of red ginger as a commodity. A tangible outcome of this initiative is the establishment of a local ginger candy brand named **"Poger Candy,"** produced by the Simalungun Food Mandiri Joint Business Group (KUB) (Muchtar et al., 2025). The product was developed by integrating local wisdom in the utilization of red ginger, lemongrass, and lemon with modern confectionery technology. A Focus Group Discussion (FGD) was conducted as part of the international community service program in collaboration with Universiti Teknologi MARA (UiTM), Pulau Pinang, Malaysia, held at Hotel Grand Dhika on May 5, 2026. The FGD was attended by key stakeholders, including the Dean of the Vocational Faculty, Prof. Dr. Isfenti Sadalia, S.E., M.E.; Vice Dean I, Dr. Solahuddin Nasution, S.E., M.SP; Vice Dean II and Head of the Program, Dr. Yasmin Chairunisa Muchtar, S.P., M.B.A.; Vice Dean III, Junedi Ginting, S.Si., M.Si.; Associate Professor Dr. Azila Azmi and Siti Anis Adilah Tarmazi from UiTM Pulau Pinang; agricultural extension officer of Simalungun Regency, Jupri Sukamtar Banurea, S.TP., M.Si.; representative of the Simalungun Regional-Owned Enterprise (BUMD), Tri Dharma Sipayung, S.E., M.Si.; representative of the Simalungun Department of Industry and Trade, Jahartap Yustin Pasaribu; the Village Head of Dalig Raya represented by Kepling Pangalbuan,

Sardo Hotbi Saragih; Managing Director of PT. Sultan Aren Indonesia, Ilham Syahputra, S.E.; and media representative from Analisadaily.com, Mahjijah Chair.

Figure 1. Group Photo of FGD Participants Involving Local Stakeholders and UiTM Malaysia Partners in Dalig Raya Village International Community Service Program

During the production process, it was found that precise control of mixing techniques and temperature plays a critical role in determining the physical quality of the candy. Based on Focus Group Discussion (FGD) findings, inconsistent stirring during cooking results in a darker or blackish color due to uneven caramelization. In contrast, continuous and intensive stirring produces a brighter yellowish candy with a more visually appealing appearance. The use of isomalt as a sugar substitute significantly affects the product's characteristics. Candies produced with isomalt exhibit a hard texture (hard candy), a glossy appearance, and longer shelf life due to their low hygroscopic properties (Muchtar et al., 2026). These characteristics are particularly important for commercialization in tropical regions. Moreover, the use of alternative sweeteners enhances the product's suitability for individuals with diabetes and contributes to dental health benefits (Muchtar et al., 2026; Susilo et al., 2013).

Global Partnership Synergy: UiTM Malaysia Perspective

The involvement of international partners from Universiti Teknologi MARA (UiTM), Malaysia, adds a significant dimension to this empowerment program. Panel discussions emphasized the importance of sensory and visual standards in penetrating international markets (Muchtar et al., 2026). Global consumers place strong emphasis on sensory attributes; therefore, attractive color, informative packaging, ingredient transparency, and halal labeling are considered essential requirements (Muchtar et al., 2026). The introduction of stevia as an alternative sweetener emerged as a key technical discussion point. Stevia was proposed due to its high sweetness intensity approximately 300 times sweeter than sucrose and its potential health benefits, particularly for gastric health (Hambali, 2025). However, pure stevia may reduce product stability, making the candy more prone to melting compared to isomalt-based formulations (Muchtar et al., 2026). As a mitigation strategy, improved packaging standards were recommended, including the use of rice paper coating to enhance structural stability (Muchtar et al., 2026). This cross-border academic dialogue demonstrates how academic diplomacy can provide practical solutions for small-scale industrial challenges (Muchtar et al., 2026).

Legal Challenges and Government Support

One of the key findings from the FGD stage was the urgency of fulfilling legal requirements for the "Poger Candy" product. Although the product received positive market responses, the absence of P-IRT certification and Halal certification remains a major barrier to wider commercialization (Muchtar et al., 2025; Muchtar et al., 2026). Mandatory requirements include obtaining a Business Identification Number (NIB) and ensuring proper separation of production facilities from household kitchens (Muchtar et al., 2026). The Simalungun Department of Industry and Trade (Disperindag) emphasized that production kitchens and equipment must be fully separated from domestic household facilities to ensure food safety standards. The local government expressed its readiness to support small and medium enterprises (SMEs) through production equipment assistance and packaging design training, provided that community groups clearly specify their technical requirements.

Industrial Integration Strategy and Economic Sustainability

The empowerment program in Dalig Raya Village is directed toward developing a sustainable circular economy model. An agroforestry-based intercropping strategy is proposed, in which palm trees are cultivated as shade plants for red ginger and turmeric (Muchtar et al., 2026). This approach optimizes land use efficiency while diversifying farmers' income sources. The downstream processing of red ginger into hard candy provides significantly higher added value compared to raw rhizome sales. Higher profit margins are achieved through the commercialization of functional food products positioned within the premium health market segment (Muchtar et al., 2026). This strategy is supported by the growing trend of herbal functional food consumption in Indonesia, which is projected to remain strong through 2025, particularly for products that enhance immune system function (Eko, 2025; Sulastri & Suwitono, 2024).

Table 3 Regulatory Pathway for SMEs Ginger Candy Industry (Disperindag Framework)

Stage	Requirement	Description
Business Registration	NIB (Business Identification Number)	Registered through OSS (Online Single Submission) system
Production License	P-IRT	Submission of production flow and facility inspection
Facility Compliance	Hygiene Standards	Separation of production kitchen from household kitchen
Halal Certification	Halal Self-Declare	100% halal ingredients and P3H verification
Packaging Compliance	Labeling & Nutrition Test	Inclusion of halal logo and transparent ingredient information

CONCLUSION

The community service activities conducted in Dalig Raya Village have successfully provided a downstreaming model for agricultural products based on red ginger. Through international collaboration between Universitas Sumatera Utara (USU) and Universiti Teknologi MARA (UiTM) Malaysia, a red ginger candy product, "Poger Candy," has been developed that meets commercial standards. The use of isomalt and stevia improves the product's texture quality and health profile, making it competitive in the functional food market. The sustainability of this program depends on fulfilling legal aspects (P-IRT and Halal certification) as well as synergy with local governments as market guarantors. Policy recommendations in the form of a policy brief are directed toward strengthening a village economic ecosystem based on herbal innovation and inclusive international partnerships.

REFERENCES

Bangun, R. H. B. (2019). Identifikasi Komoditas Unggulan Untuk Peningkatan Daya Saing. Jurnal Agrica, 12(1), 25-40.

Devinarahma, Z., Permatasari, N. A., & Hardjomidjo, H. (2024). Ginger Leather Candy Formulation at CV Sari Sehat Bogor. ITAMSA.

Dewi, R. S., Choiriyah, F. N., Al-baroqah, V. R., Wiranto., & Priskila, E. (2024). Penyuluhan Pembuatan Permen Jelly Jahe Merah (Zingiber officinale var rubrum) Sebagai Peningkat Kekebalan Tubuh Pada Kelompok Tani di Kelurahan Lempake. Jurnal Pengabdian Kepada Masyarakat, 9(3).

Hambali, A. (2025). Pemanfaatan Ekstrak Daun Stevia (Stevia Rebaudiana) Sebagai Pemanis Tanpa Kalori pada Permen Jahe. Jurnal Pendidikan Teknologi Pertanian, 11(1), 55-64.

Muchtar, Y. C., et al. (2025). Laporan kemajuan Program EQUITY: FGD dan Diseminasi Hasil Pengabdian Kepada Masyarakat di Desa Dalig Raya. Medan: Lembaga Pengabdian Pada Masyarakat USU.

Muchtar, Y. C., Muchtar, M. A., Keliat, J. M., Nurfitriani, W., & Azmi, A. (2026). Enhancing Community Income through Ginger Candy Production from Red Ginger in Dalig Raya Village. International Review of Practical Innovation, Technology and Green Energy (IRPITAGE), 5(3), 445-450.

Novita, D., Riyadh, M. I., Mhd. Asaad, & Rinanda, T. (2023). Potensi Dan Pengembangan Komoditas Unggulan Sektor Pertanian Di Provinsi Sumatera Utara. Jurnal Agrica, 16(1), 102-113.

Sayuti, N. A., & Atikah. (2024). Community Empowerment in Making Galactagogue Herbal for Breastfeeding Mothers. International Journal of Community Service Learning, 8(3), 331-343.

Susilo, I., et al. (2013). Pengaruh Proporsi Sukrosa-Isomalt terhadap Sifat Fisikokimia dan Organoleptik Permen Jelly Anggur Bali. Jurnal Teknologi Pangan dan Gizi, 12(1), 39-46.

Utami, N., Puspitasari, D., Belani, T. G., Marita, H. S., Andriani, Y., & Dessy, I. (2022). Pengolahan Jahe Merah Untuk Tingkatkan Imunitas Tubuh Di Desa Jimbung, Klaten. Diseminasi: Jurnal Pengabdian Kepada Masyarakat, 4(1), 93-98.