



Processing snakehead fish as a high-protein modern healthy food product in the snakehead fish farmers' group


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ARTICLE INFO	ABSTRACT
<p>Article history Received: 2023-11-14 Revised: 2024-01-11 Accepted: 2024-01-16 Published: 2024-01-31</p> <p>Keywords Unemployment and Poverty Community Empowerment Snakehead Fish</p>	<p><i>This activity is a response to the impact of the Covid-19 pandemic, which has led to a high unemployment rate in Gresik since March 2020. Several industries have conducted layoffs, affected 2,300 employees and led to an increase in poverty levels. The Community-Based Empowerment Program in Tenggor Balongpanggung Village was initiated as a solution. This village is rich in snakehead fish resources but requires human resource development in its distribution. Through training, the villagers will learn how to enhance the added value of snakehead fish, turning it into a high-protein modern healthy food product that can be marketed, providing economic benefits for both the commodity and UD Sumber Rejeki Lestari. The main objectives of this activity are to introduce UD Sumber Rejeki Lestari as the source of raw materials for snakehead fish, provide information about business opportunities through partnerships, create business opportunities for the community through partnerships, and improve the community's skills in processing snakehead fish.</i></p>
<p>Kata kunci Pengangguran dan Kemiskinan Pemberdayaan masyarakat Ikan Gabus</p>	<p>Pengolahan ikan gabus sebagai produk pangan sehat modern berprotein tinggi di kelompok petani ikan gabus. Kegiatan ini merupakan respon terhadap dampak pandemi Covid-19 yang menyebabkan tingginya angka pengangguran di Gresik sejak Maret 2020. Beberapa industri melakukan PHK sehingga berdampak pada 2.300 karyawan dan berujung pada peningkatan angka kemiskinan. Program Pemberdayaan Berbasis Masyarakat di Desa Tenggor Balongpanggung digagas sebagai solusi. Desa ini kaya akan sumber daya ikan gabus namun memerlukan pengembangan sumber daya manusia dalam pendistribusiannya. Melalui pelatihan, masyarakat akan belajar bagaimana meningkatkan nilai tambah ikan gabus menjadi produk makanan sehat modern berprotein tinggi yang dapat dipasarkan, memberikan manfaat ekonomi baik bagi komoditas tersebut maupun UD Sumber Rejeki Lestari. Tujuan utama dari kegiatan ini adalah untuk memperkenalkan UD Sumber Rejeki Lestari sebagai sumber bahan baku ikan gabus, memberikan informasi peluang usaha melalui kemitraan, menciptakan peluang usaha bagi masyarakat melalui kemitraan, dan meningkatkan keterampilan masyarakat dalam pengolahan ikan gabus.</p> <p style="text-align: right;">Copyright © 2024, Anjeli, et al. This is an open access article under the CC-BY-SA license</p> 

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INTRODUCTION

Gresik Regency currently boasts the largest expanse of ponds in the East Java region, with a total area spanning 62,207 hectares, constituting 63% of the total pond area in East Java. The regency has a significant fisheries sector, encompassing both marine and pond fisheries, as well as inland fisheries. In 2012, Gresik was designated as a pioneering regency in the development of aquaculture, with a primary focus on cultivating milkfish and shrimp. The catfish (*Plotosus canius*) is one of the coastal area's prominent fish species, especially within the mangrove ecosystem. Catfish serves as a vital fisheries resource for the coastal communities and belongs to the *Plotosidae* family, playing a crucial role in the local economy (Astawan, 2007; Hendri et al., 2023; Sari et al., 2023).

According to the data from the Ministry of Marine Affairs and Fisheries in 2018 (*Kementrian Kelautan Dan Perikanan (KKP)*, 2019), catfish production experienced a significant upsurge from 841,750 tons to 1.81 million tons between 2017 and 2018 (*Kementrian Kelautan Dan Perikanan (KKP)*, 2018), with an average production growth rate of 56.32% from 2015 to 2018 (*Kementrian Kelautan Dan Perikanan (KKP)*, 2020). Catfish consumption has also been on the rise, with 2021 data indicating that the average per capita consumption was 54.49 kilograms per year, expected to reach approximately 62.50 kilograms per capita by 2023. This illustrates significant year-on-year growth, making catfish cultivation a promising prospect. In addition to being easily cultivated, catfish also boasts excellent nutritional qualities (Akinpelu et al., 2021; Canti et al., 2023; Mobdy et al., 2021; Otolowo et al., 2018). Based on this data, catfish is not only straightforward to cultivate but also meets high nutritional standards. The local population has grown accustomed to consuming catfish as a staple food, positioning it as a solution for family food security alongside rice (Niko, 2020).

UD Sumber Rejeki Lestari, as a partner of the Community Service Program (PBM), has been actively involved in productive economic activities through catfish cultivation since 2019, obtaining a trade license in 2021. This endeavor encompasses an 800 square meter area and is supported by three employees who employ modern catfish cultivation methods with a booster system. The catfish production capacity at UD Sumber Rejeki Lestari reaches 3.5 quintals per pond. With this capacity across 25 ponds, production reaches approximately 87.5 quintals every three months. Despite effective production and a customer base, profit margins remain minimal due to the absence of added value in the sold commodity. (Purcell, et al., 2017).

Several indicators underscore the imperative for collaboration with the community at UD Sumber Rejeki Lestari. Firstly, although catfish production has permeated the market, the profitability margins remain low due to the lack of added value. Secondly, there is a continuous rise in market demand for catfish, and by providing training in catfish cultivation to the community, there is a potential increase in catfish production. Thirdly, human resource development is essential for processing catfish into value-added products. Fourthly, collaborative efforts with the community are necessary to explore opportunities in the processed catfish food industry. Finally, it is crucial to raise awareness about catfish cultivation to maximize the utilization of resources held by UD Sumber Rejeki Lestari.

The participants in this activity comprise the local PKK (Family Welfare Empowerment) groups, agricultural laborers, and Karang Taruna youth organization members in Tenggor Village. This village is renowned for its agricultural potential, particularly in watermelons and sweet potatoes. Its residents primarily work as farmers or laborers in manufacturing companies. The impact of the pandemic, including reduced purchasing power, layoffs, and economic hardship, has been felt in this area. The village government, under the leadership of Village Chief Mr. Kowianto, allocated village funds to assist the pandemic-affected residents with essential food distribution (Radar News, 2020). However, this solution was temporary in nature, and long-term efforts are required to boost the local economy (Aisyah, 2020).

This Community Service Program activity aligns strongly with several United Nations Sustainable Development Goals (SDGs) established by the international community. The following are the connections between this initiative and various SDGs: SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 8: Decent Work and Economic Growth, SDG 12: Responsible Production and Consumption and SDG 14: Life Below Water (Bappenas, 2019).

METHOD

The implementation method for the Community Service Program in addressing the issues faced by the productive partner, UD. Sumber Rejeki Lestari, revolves around the challenges of a shortage of human resources and enhancing the market value of their products. The solution proposed by the service providers is to mobilize participants from the surrounding community in the Balongpanggung District to meet the human resource needs and to offer them as business partners in processing and marketing catfish. In addressing the issues related to the catfish products, the solution offered is to increase the added value of catfish by transforming them into "smoked catfish" products, with the expectation of improving profit margins compared to selling catfish without further processing (Agustini, T.W, A.S. Fahmi, 2006). The method employed to provide these solutions to the community involves engaging the local population in the PKM, conducting simple catfish farming training to enhance their food security, offering training in preparing processed catfish products to improve their skills, and creating business opportunities for them as business partners (Amalia, 2012).

The implementation method for non-productive partners (women's community groups, youth organizations, and rural laborers from the Tenggor village) in this Community Service Program involves mobilizing participants from the surrounding community as business partners in processing and marketing snakehead fish. The community will be engaged in training on snakehead fish cultivation and the production of processed fish-based food products. Increasing the added value of snakehead fish is expected to yield higher profit margins. The method employed includes training, mentoring, and community empowerment. For non-productive partners, this program will enhance entrepreneurial literacy, offer business opportunities, and provide training on the use of vacuum devices for product packaging. In both cases, data collection and analysis will be utilized to measure the success of this program (Fauzi, 2019).



Figure 1. Implementation Method for Productive and Non-Productive Partners

RESULTS AND DISCUSSION

This community service project has resulted in some meaningful activities that empower community in improving a modern healthy food product of snakehead fish. Some programs held are described as follows.

For Productive Partners (UD Sumber Rejeki Lestari)

Increased Profit Margins

One of the challenges faced by UD Sumber Rejeki Lestari was the low profit margin from snakehead fish sales due to the lack of added value in the commodity. However, through training and mentoring, UD Sumber Rejeki Lestari successfully improved the profit margins from snakehead fish sales. By introducing added value to the commodity, they were able to achieve more lucrative results. This outcome demonstrates that the community engagement approach has effectively provided a solution for productive partners to enhance their economic well-being.

Meeting Market Demand: Before the implementation of this program, UD Sumber Rejeki Lestari encountered difficulties in meeting the increasing market demand, which could negatively affect business sustainability. Through the guidance provided in the training, UD Sumber Rejeki Lestari can now meet the rising market demand (Table 1). Increased productivity in snakehead fish cultivation through best practices has resulted in a sufficient supply to meet market demand. This indicates that the community engagement activities have successfully addressed this challenge and assisted productive partners in optimizing their potential.

Tabel 1. Production results of snakehead fish

Before (July 5 th , 2023)		After (October 3 rd , 2023)		Improvement
1 Pond	25 Ponds	1 Pond	25 Ponds	
±3,5 quintal	±87,5 quintal	±3,9 quintal	±97,5	±10 quintal

Data Source: (UD. Sumber Rejeki Lestari, 2020)

Competent Human Resources

Previously, UD Sumber Rejeki Lestari lacked competent human resources (HR) who could assist in processing snakehead fish into value-added products. Competent HR is the key to the success of business development and product quality enhancement. Through the technical training provided in the community service activities (Figure 2), UD Sumber Rejeki Lestari now possesses competent human resources for processing catfish. They have gained an understanding of breeding techniques, pond management, disease control, and the utilization of technology in snakehead fish farming. These competent HR have greatly contributed to UD Sumber Rejeki Lestari's increased productivity and the improved quality of snakehead fish produced. This outcome serves as evidence that the training provided in community service activities has successfully enhanced the productive partners' capacity and aided them in optimizing their available resources (Haryanti, H., Iskandar, I., Rizal, A., Aliah, R. S., & Sachoemar, 2023).



Figure 2. Effective and efficient technical training and snakehead fish farming assistance

Formed Partnerships

Prior to this activity, UD Sumber Rejeki Lestari had not established partnerships with the local community. Partnerships are a key factor in the success of developing a business and optimizing its potential. In this activity, partnerships with the local community have been formed. Through training and mentoring, the community is encouraged to create and strengthen community networks, share experiences, and establish mutually beneficial partnerships. These partnerships create a win-win solution between UD Sumber Rejeki Lestari and the community in developing opportunities for processed fish snack businesses. This partnership benefits UD Sumber Rejeki Lestari by improving the distribution of catfish and providing additional income to the community. This outcome is a tangible example of how a collaborative approach in community service activities can create mutually beneficial partnerships (Winarno, 2014).

For Non-Productive Partners (Tenggor Balongpanggang Village Community)

Socialization and snakehead fish farming literacies

Before this activity was carried out, the community in Tenggor Balongpanggang Village had limited understanding of catfish farming. They were not aware of the economic potential that could be generated through snakehead fish farming. However, through entrepreneurship socialization and literacy (Figure 3), the community has gained a better understanding of snakehead fish farming. They now have knowledge about the economic potential of snakehead fish farming and how to utilize it. Socialization about snakehead fish farming by UD Sumber Rejeki Lestari and direct visits to snakehead fish farming sites have inspired the community. They now realize that through snakehead fish farming, they can improve individual and community economic scales. Snakehead fish farming can be a source of income for families, especially since it can be done with relatively simple means. This outcome demonstrates that community service activities have successfully increased entrepreneurial literacy and raised awareness among the community about the economic potential around them.



Figure 3. Socialization of UD Sumber Rejeki Lestari to the Tanggor Village Community

Business Opportunity Offer

In addition to literacy about catfish farming, the community now also has knowledge about business opportunities and how to establish partnerships with UD Sumber Rejeki Lestari (Figure 4). They understand that entrepreneurship can be pursued and how to become competent marketers. The community has been encouraged to offer business opportunities and ignite interest and entrepreneurial spirit. Offering business opportunities requires access and information obtained through networking and business cooperation. In this activity, a business partnership between the community and UD Sumber Rejeki Lestari has been established as a win-win solution for both parties. In this partnership, snakehead fish distribution has increased, and the community has generated income from this partnership. This outcome is a real example of how community service activities have successfully stimulated the entrepreneurial spirit of the community and provided them with knowledge on how to develop their businesses (Ubadillah.A & Hersoelistyorini.W, 2010).



Figure 4. Entrepreneurship Training

Training in Snakehead Fish Processing

One of the significant outcomes of this activity is the training and mentoring in processing snakehead fish into high-protein modern health foods (Sofyan & Karim, 2014). The community has been trained in various Sembilang fish processing techniques, including smoking, deep-frying, grilling, and product innovation. (Rahmawati, 2012). They have also learned various methods of processing snakehead fish, such as making snakehead fish nuggets (Bliss Bites), meatballs, fish floss (Crisps), katsu, and smoked fish. This training also includes guidance on presentation and product promotion. With this knowledge, the community can now process snakehead fish into various high-quality, healthy food products (Fona & Kurniasih, 2017). This outcome demonstrates that the training and skill development approach in community service activities have provided tangible benefits to the community and helped them develop processed snakehead fish food businesses (Haris & Nafsiyah, 2019).

The Use of Vacuum Machines

One crucial step in adding value to snakehead fish products is by utilizing vacuum devices in product packaging (Figure 5). However, the proper use of this equipment requires specific knowledge and skills. Through training, the community has been educated in the operation of vacuum machines (Martuti et al., 2014). They can now operate these devices correctly, enhancing the efficiency of the snakehead fish processing process and achieving a significant increase in added value. With a comprehensive understanding of the use of this high-tech equipment, they can improve product quality and reach a broader market. This outcome is a tangible example of how technical training in community service activities can benefit the community and assist them in increasing the added value of their products (Gozali et al., 2001).

Training and Marketing Product Assistance

Marketing processed snakehead fish products is a crucial step in developing the economic potential of the community. The community has received training and assistance in marketing processed snakehead fish products (Figure 6). They can now market their products more effectively, expand their access to a broader market, add value to their products, and increase economic income at the village level. Through this training, they have learned how to market products effectively, establish collaborations with various parties, and utilize various distribution channels. This outcome is evidence that community service activities have successfully enhanced the marketing skills of the community and provided them with opportunities to reach a broader market (Mairizal, 2010).



Figure 5. Training in Vacuum Machine Utilization



Figure 6. Product Marketing Training

Impact and Changes that Occurred

Economic Improvement: One of the most significant impacts of this activity is the economic improvement for productive partners (UD Sumber Rejeki Lestari). Through increased profit margins and meeting market demand, UD Sumber Rejeki Lestari now has a more profitable and sustainable business. This improvement has a positive impact on their income and helps them overcome economic constraints. **Attitude and Entrepreneurial Spirit Change:** Non-productive members of the Tenggor Balongpanggung Village have undergone a significant change in their attitude toward entrepreneurship. They now have a high entrepreneurial spirit and realize the economic potential around them. This change provides them with opportunities to create additional income and improve their well-being.

Successful Partnerships

The partnership formed between UD Sumber Rejeki Lestari and the local community is an example of a successful partnership. This partnership benefits both parties, improves the distribution of snakehead fish, and provides additional income to the community. It also creates a partnership model that can be adopted in other regions.

Improved Food Security

This activity has contributed to increased food security in the area. Higher quality and value-added processed snakehead fish products have helped the community meet their food needs. This has a positive impact on family health and nutrition, especially for children.

Reduced Unemployment

One of the serious issues faced by the local community is unemployment due to job layoffs in industries and other economic sectors. This activity has provided a solution for some members of the community to create new sources of income through snakehead fish farming and processing. **Contribution to the "Eat Fish Movement":** This activity also

supports the "Eat Fish Movement," which aims to prevent stunting. High-protein processed snakehead fish products have contributed to efforts to improve children's nutrition and prevent stunting in the region.

Therefore, the "Processing of Snakehead Fish as a High-Protein Modern Health Food Product in the Snakehead Fish Farmer Group of Balongpanggang District, Gresik" activity has successfully achieved its goals in providing solutions for both productive and non-productive partners. Through a holistic and collaborative community engagement approach, this activity has had a positive impact on the community and helped them optimize their economic potential. The success of this activity also contributes to social and economic development in the region and enhances the reputation of the university as an educational institution that cares and plays a role in social transformation. Thus, this community engagement activity is a tangible example of how universities can contribute to community advancement and create sustainable changes (Sunarma, 2004).

CONCLUSION

The community engagement activity, "Processing Snakehead Fish as High-Protein Modern Health Food Products," conducted in Balongpanggang District, Gresik, serves as a practical solution for productive partner UD Sumber Rejeki Lestari, enhancing profit margins through value addition to products. Simultaneously, the program successfully addresses the growing market demand for snakehead fish by improving aquaculture productivity. Non-productive partners, including Family Welfare Empowerment, Karang Taruna (Youth organization), and rural laborers, benefit from entrepreneurship training, business opportunities, and skills in processing snakehead fish into high-protein modern health food products. This initiative not only elevates the welfare of both productive and non-productive partners but also supports the government's anti-stunting efforts by improving community access to nutritious food. The community engagement approach, coupled with collaboration among universities, government entities, and business partners, holds the potential to contribute significantly to social and economic development in the region.

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REFERENCES

- Agustini, T. W., & Fahmi, U. A. (2006). Diversification of fisheries products. Penerbit Universitas Diponegoro.
- Aisyah, I. (2020). Ketahanan pangan keluarga di masa pandemi Covid 19. *Jurnal Kesehatan Komunitas Indonesia*, 16(2), 179-189. <https://doi.org/10.37058/jkki.v16i2.2576>.
- Akinpelu, A. T., Akinloye, O. M., Olumuyiwa, A. O., Afolabi, O. O., & Stephen, O. A. (2021). Comparative assessment of the nutritional fitness of wild and cultured african catfish (*Clarias gariepinus*). *Annual Research & Review in Biology*, 96–106. <https://doi.org/10.9734/arrb/2021/v36i230345>
- Amalia, U. (2012). Pendugaan umur simpan produk nugget ikan dengan merk dagang fish nugget "So Lite." *Jurnal Saintek Perikanan*, 8(1), 27–31.
- Astawan, M. (2007). Ikan air tawar kaya protein dan vitamin. Swadaya.
- Bappenas. (2019). Roadmap of SDGs Indonesia: A highlight. BAPPENAS.
- Canti, M., Kurniady, F., Hutagalung, R. A., & Prasetya, W. (2023). Nutritional, physical, and sensory properties of fish crackers produced from the head of catfish (*Clarias gariepinus*). *Food Research*, 7(Supplementary 1), 51–63. [https://doi.org/10.26656/fr.2017.7\(S1\).17](https://doi.org/10.26656/fr.2017.7(S1).17)
- Fauzi, A. (2019). Fish processing innovation based on food security product variations for bay fishermen, Labuan District, Pandeglang Regency, Banten Province. *Journal of Indonesian Community Empowerment*, 1(2), 401–411. <https://journal.prasetiyamulya.ac.id/journal/index.php/JPM/article/view/307>
- Fona, Z., Kurniasih, E., & Raudah, R. (2017). Pengembangan unit usaha nugget sehat di Politeknik Negeri Lhokseumawe. *Agrokreatif, Jurnal Ilmiah Pengabdian Kepada Masyarakat*, 3(2), 115–122.
- Gozali, T., Sutrisno, A. D. & Ernida, D. (2001). Pengaruh waktu pengukusan dan perbandingan jamur tiram terhadap karakteristik nugget jamur tiram putih (*Pleurotus florida*). *Makalah Seminar Nasional Teknologi Pangan Semarang. 9-10 Oktober 2001. Buku A. Perhimpunan Teknologi Pangan dan Rekayasa*. Semarang.
- Haris, H., & Nafsiyah, I. (2019). Formulation of a mixture of fish waste and trash fish on the protein content and digestibility of fish meal. *BIAM Magazine*, 15(2), 82–93. <https://doi.org/10.29360/mb.v15i2.5606>
- Haryanti, H., Iskandar, I., Rizal, A., Aliah, R. S., & Sachoemar, S. I. (2023). Urban farming aquaculture as an alternative business for food and economic security during the COVID-19 pandemic – Case study in the sub-urban area of Jakarta, Indonesia. *Polish Journal of Environmental Studies*, 32(5), 4023–4036. <https://doi.org/10.15244/pjoes/166362>

- Hendri, H., Chalid, I., Meliza, R., Ameliany, N., & Yunanda, R. (2023). Development of catfish cultivation fishermen to support the economy of coastal communities. *Malikussaleh Governance and Policy Reviews*, 1(1), Article 1. <https://ojs.unimal.ac.id/mgpr/article/view/33-38>
- Kementrian Kelautan dan Perikanan (KKP). (2019).
- Kementrian Kelautan dan Perikanan (KKP). (2020).
- Kementrian Kelautan dan Perikanan (KKP). (2018). Industrialisasi dalam menekan pengangguran di Gresik. <https://jatimnet.com/industrialisasi-dalam-menekan-pengangguran-di-gresik>
- Mairizal, M. (2010). Pengaruh penggantian tepung ikan dengan tepung silase limbah udang dalam ransum ayam pedaging terhadap retensi bahan kering dan protein kasar. *Jurnal Peternakan*, 7(1), 35–40.
- Martuti, N., Rosidah, K. T., & Saputro, D. D. (2014). Oven panggang sebagai solusi pengolahan ikan higienis dan ramah lingkungan. *Rekayasa*, 12(2), 1–9.
- Mobdy, H. E. A., Abdel-Aal, H. A., Souzan, S. L., & Nassar, A. G. (2021). Nutritional value of african catfish (*Clarias gariepinus*) meat. *Asian Journal of Applied Chemistry Research*, 31–39. <https://doi.org/10.9734/ajacr/2021/v8i230190>
- Niko, N. (2020). Persoalan kerawanan pangan pada masyarakat miskin di wilayah perbatasan Entikong (Indonesia-Malaysia Kalimantan Barat. *Jurnal Surya Masyarakat*, 2(2), 94–104.
- Otolowo, D. T., Olapade, A. A., & Makanjuola, S. A. (2018). Predicting the nutritional and rancidity properties of dehydrated catfish (*Clarias gariepinus*) using response surface methodology. *Preventive Nutrition and Food Science*, 23(4), 347–355. <https://doi.org/10.3746/pnf.2018.23.4.347>
- Purcell, S. W., Crona, B. I., Lalavanua, W., & Eriksson, H. (2017). Distribution of economic returns in small-scale fisheries for international markets: A value-chain analysis. *Marine Policy*, 86, 9–16. <https://doi.org/10.1016/j.marpol.2017.09.001>
- Radar News. (2020). *Pemdes Balongpanggang beri bantuan dana desa kepada warga terdampak pandemi*. Radar News.
- Rahmawati, F. (2012). Aneka ragam pengolahan ikan: Pemberdayaan sosial untuk kegiatan pendidikan alternatif dalam pengolahan potensi lokal. *Kerjasama Kementerian Pembangunan Daerah Tertinggal Dengan Fakultas Pertanian UGM Yogyakarta*.
- Sari, P. D. W., Nindarwi, D. D., Aji, L. A. K., & Dewantara, M. (2023). Catfish culture techniques with aquaponic systems in the elderly group as an effort to increase productivity and economic independence of the community in Pakal District, Surabaya. *Kontribusi : Research Dissemination for Community Development*, 6(1), Article 1. <https://doi.org/10.30587/kontribusi.v6i1.4932>
- Sofyan, J. S. dan Karim, M. (2014). (2014). Perbandingan nutrisi otak-otak berbahan baku ikan tenggiri, ikan bandeng dan ikan gabus. *Jurnal Balik Diwa*, 5(2), 58–63.
- Sunarma, A. (2004). *Peningkatan produktifitas usaha Sembilang Sangkuriang*. Departemen Kelautan dan Perikanan.
- Ubadillah, A & Hersoelistyorini, W. (2010). Kadar protein dan sifat organoleptik nugget rajungan dengan substitusi ikan sembilang (*Clarias gariepinus*). *Jurnal Pangan Dan Gizi*, 1(2).
- UD. Sumber Rejeki Lestari. (2020). *Production results of catfish*. UD. Sumber Rejeki Lestari.
- Winarno, B. (2014). *Dinamika Isu-Isu Global Kontemporer*. CAPS.