



## The Development Strategy for the Fish Skin Processing Industry: A Case Study in Karawang Regency, Indonesia

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### ABSTRACT

Efforts to develop small and medium industries (IKM) in Indonesia include the implementation of the One Village One Product (OVOP) program, with Karawang Regency being one of the regions where this program is executed. The fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, is one of the IKMs in Karawang Regency that has the potential to be developed. However, the industry still needs to face several problems, mainly production and marketing limitations. This research aimed to formulate strategies for developing the fish skin processing industry in the village. The analytical methods employed were supply chain management (SCM) and SWOT analysis. The results of the study produced several strategies needed to develop the fish skin processing industry: (1) supply and marketing networking integration, (2) product development and innovation, (3) strengthening production processes and waste processing, and (4) strengthening human resources.

### INTRODUCTION

Efforts to develop small and medium industries in Indonesia nowadays are being constructed, among others, by implementing the One Village One Product (OVOP) program. According to Regulation of the Minister of Industrial Affairs of the Republic of Indonesia Number 14 of 2021 concerning the Development of Small and Medium Industries (IKM) in IKM Centers through One Village One Product, the program is based on an approach to develop regional potential to produce a global class product that is unique and typical of a region, by utilizing local resources. The development of OVOP-based small and medium industries aims to increase the skills and independence of local communities in developing the regional economy to create jobs and increase community income and welfare (**Ministry of Industrial Affairs of the Republic of Indonesia, n.d.**).

The implementation of OVOP in developing IKM centers has been carried out in various regions in Indonesia. One of the regions that has implemented this program is Karawang Regency. Based on preliminary studies obtained from the cooperatives and small and medium enterprises office of Karawang Regency, there are eight IKM or

micro, small and medium enterprises (MSME) centers in this regency that have been developed through the OVOP program, including the fish skin processing industry, which is located in Tegalsari Village, Cilamaya Wetan Subdistrict. This industry has the potential to be developed, mainly because it is supported by helpful cooperation with the fish fillet processing industry, which produces fish skin. The fish skin is waste from processing fish fillets, becoming the primary raw material for the fish skin processing industry.

However, developing the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency, still needs some help, including production and marketing limitations. Based on initial studies, the limited production in this industry is partly due to the scanty number of firms producing in the industry; there is only one firm. According to economic theory, the limited supply of goods in the market is caused by the limited number of suppliers, in addition to decreasing prices of the goods themselves, changes in the prices of related goods, increasing prices of production factors, and others (**Rahardja & Manurung, 2008**).

Additionally, the added value of the products produced is still limited because the fish skin processing industry only produces cracker products, and there needs to be product diversification. Besides being processed into crackers (**Pangestika *et al.*, 2023**), the fish skin can be processed into other food products such as Pempek (a savory fishcake delicacy from Palembang, Indonesia). In addition, it can act as a raw material for the pharmaceutical industry (gelatin) and a raw material for the cosmetics industry (collagen) (**Suryaningrum, 2008; Pradarameswari *et al.*, 2018; Mardiyantoro *et al.*, 2019; Barmon *et al.*, 2020**)—the lack of product variety results in limited marketing efforts.

Supposedly, by setting this industry as one of the industries selected to implement the OVOP program, this industry can receive more intensive guidance from the government in improving product quality, packaging manufacturing, and marketing strategies compared to other industries not designated for this program. Therefore, a development study is needed on the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency, so that this industry can drive the local economy and can open other business opportunities and job creation. This research aimed to develop a strategy for the fish skin processing industry in the village.

## MATERIALS AND METHODS

### 1. General description of the research location

This research was conducted on the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency, for a year, from March 2022 to February 2023. This village is in the coastal area of Karawang Regency since this village is one of the villages in the Cilamaya Wetan Subdistrict, where this subdistrict has a coastline of 10km (**Fauzie, 2017**). The village is quite far from the capital of Karawang

Regency, 43km away, but only 3km from the capital of Cilamaya Wetan Subdistrict. Astronomically, this village is located at coordinates 6.26655° South Latitude and 107.5603° East Longitude. This village has the smallest area compared to other villages in Cilamaya Wetan Subdistrict, namely 2.1km<sup>2</sup>. The topography of this village area is 22.6 meters above sea level. The population of this village is 3,866 people, and it covers 1,887 households. Due to its small area, the population density level in this village is relatively high within villages in the Cilamaya Wetan Subdistrict, with as many as 1,953 people per km<sup>2</sup> (**Statistics Indonesia, 2023**).

## 2. Data collection

The research relies on primary data as the main data. The data are from observation activities and in-depth interviews with relevant expert sources who comprehend all the issues related to the industry. The resource persons are from the Karawang Regency government, such as the fisheries office, industry and trade office, and cooperatives and SMEs office. Additionally, resource persons are from industry actors (leaders and administrators of the Berkah Mandiri Women's Cooperative) and Adib Global Food Supplies Karawang, Inc. The secondary data employed to strengthen the analysis is sourced from Statistics Indonesia, Central Bank of Indonesia and literature searches, including village profile data in which the industry is located. This research equated the value of the Rupiah to the US Dollar based on the assumption that the exchange rate on August 9, 2024, would be IDR 15,949.90 per USD 1. Furthermore, the method for defining relevant expert sources is non-probability sampling based on convenience and judgment sampling.

## 3. Analysis

This research employed supply chain management (SCM) analysis and SWOT analysis to arrange the development of the fish skin processing industry in the region that is supported by the OVOP program. The two methods of analysis were presented through a descriptive approach. SCM analysis is widely applied to provide solutions in selecting procurement systems, inventory management and distribution of goods (**Irianti, 2017; Khusna & Nugraha, 2018; Suryaman et al., 2018; Darma et al., 2020; Fauziah & Sanjaya, 2020; Syamfithriani et al., 2020; Sari et al., 2021**), and suppliers in addition to distributors (**Azizah & Pramandari, 2018**).

Meanwhile, several studies of the development for business or industry of fish processing utilize the SWOT analysis method. Among others, **Cholid et al. (2020)** explained the production of local specialty fish products, which the OVOP program supports. Furthermore, **Purnomo and Murniawati (2021)** and **Yanti and Maryantina (2021)** employed SWOT analysis to develop steps or strategies for business development or the fish processing industry. However, they were not developed through the OVOP program. Moreover, **Ayu et al. (2021)** and **Siregar et al. (2019)** used the same analysis

method in preparing business or industrial development strategies in the OVOP program. However, the business or industry being developed was separate from fish processing. Previous research discussed business or industrial development by integrating SCM analysis with SWOT conducted by **Faisal (2020)**, but not in the context of the fish skin processing industry (in this case, the sweet potato chips processing industry).

Based on the literature search above, there has yet to be research combining SCM and SWOT analysis for developing the fish skin processing industry in one complete research. However, including SCM analysis in preparing business or industrial development strategies is essential, especially in the fish skin processing industry. SCM analysis is helpful for industrial development, as it increases customer satisfaction and asset utilization and reduces costs. The three factors can increase firm revenue and subsequently impact rise firm profits. Ultimately, the firm will become more extensive and potent (**Sucahyowati *et al.*, 2011**).

## RESULTS AND DISCUSSION

### 1. The industry profile and role of the OVOP program for the industry

The fish skin processing industry is located in Krasak Hamlet RT 003/001 Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency. It is managed by a business entity with the legal status of a cooperative called the "Berkah Mandiri" Women's Cooperative. This business entity was founded on August 6, 2012, by its founder, Mrs. Nunung Rusmiati. The background to the name of this business entity was inspired by the personality of the founder of the business entity, who had an independent personality. The members of this business entity are a combination of similar MSME actors in Tegalsari Village, which homemakers dominate. The total membership consists of 59 people, of whom 4 are administrators, and the rest are members. However, of the 59 members, only 12 are involved in the fish skin processing unit.

This business entity was established to improve the welfare of its members (particularly the local community) and help build the local economy, creating an advanced, just, and prosperous society. The business entity comprises several business units, including a fish skin processing unit that produces fish-based snacks such as fish skin crackers. Moreover, this business entity also produces other traditional non-fish-based snack foods. Other business units of the business entity are catering services and salt processing units. However, the research only focuses on the business unit of this business entity, which is processing fish-based snack foods, namely processing fish skin.

This goal of operationalizing the business entity aligns with the OVOP program. This business entity is one of the recipients of assistance from the government through the OVOP program. The fish skin processing industry was formed as one of the business entities supported by the OVOP program, which began on March 22, 2021.

The local government responsible for the OVOP program is the cooperatives and small and medium enterprise offices of Karawang Regency. The program is hoped to increase the potential of MSMEs in Karawang after being hit by the COVID-19 pandemic for so long. The assistance provided in this program is in the form of coaching and improving technology, which will be delivered in the form of production equipment. Through the program, the industry hopes to improve product quality, create packaging that meets standard products, and carry out appropriate marketing strategies in the digital era, so that the market and the wider community will accept these MSME products. This industry greatly benefited from government assistance through the OVOP program. The increasing quality of products proves it due to assistance with the necessary production equipment, adequate packaging according to standards, and the increasingly widening market reach.

## **2. Supply chain management in the industry**

This research discusses supply chain management analysis in the fish skin processing industry, which applies the analysis of industrial trees, supply chains, and value chains.

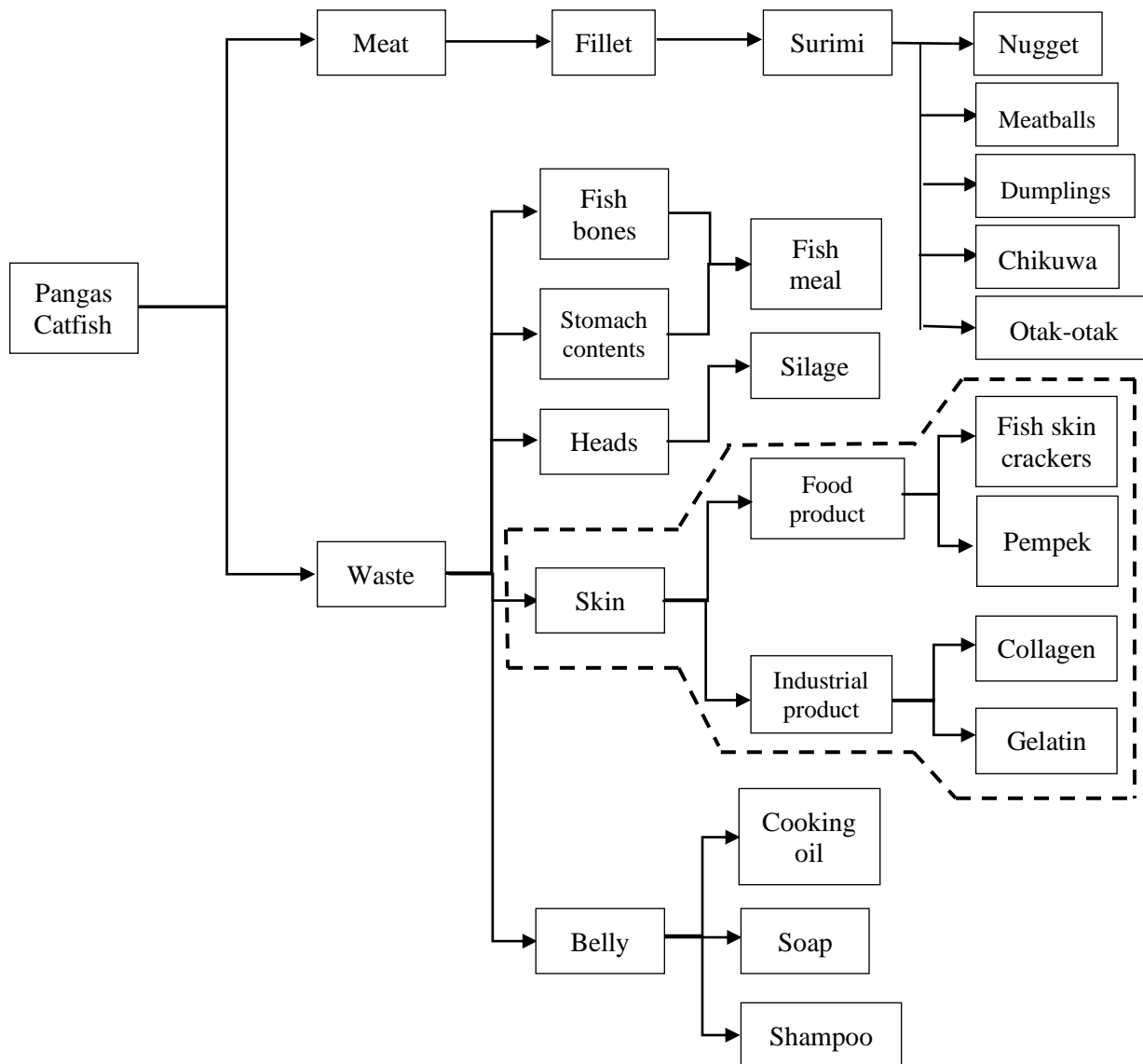
### ***2.1. Industrial trees analysis***

The industrial tree is knowledge-based information sourced from information search results compiled to provide an overview of the product types that can be created from a commodity (**Melina, 2016**). The application of industrial tree analysis to the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency, was carried out by comparing the products produced by the industry based on literature searches with the reality of products produced by the same industry in the village. **Suryaningrum (2008)** explains that the raw material for fish (pangas catfish, in this case) consists of meat and waste. The part of fish meat produces fillet meat, which can be made into various surimi products such as nuggets, meatballs, dumplings, chikuwa (Japanese fish cake), and otak-otak (Indonesian grilled fish cake). Meanwhile, the waste consists of fish bones, stomach contents, heads, skin, and belly. The part of fish bones mixed with fish stomach contents can create fish meal. The fish heads can be processed into silage. The fish skin can be processed into food products such as fish skin crackers and Pempek and also created into industrial raw materials like collagen and gelatin. The belly can be processed into cooking oil, soap, and shampoo (Fig. 1).

The fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency, only utilizes this fish skin to produce fish skin crackers. This industry still needs to diversify its products, as mentioned earlier. However, it has not done so yet due to a lack of initiative from the industry itself, which is still facing several obstacles such as lack of capital. The production tools still operate manually and are

straightforward. More technology is needed to produce other products. Additionally, more knowledge and innovation are needed to create new products.

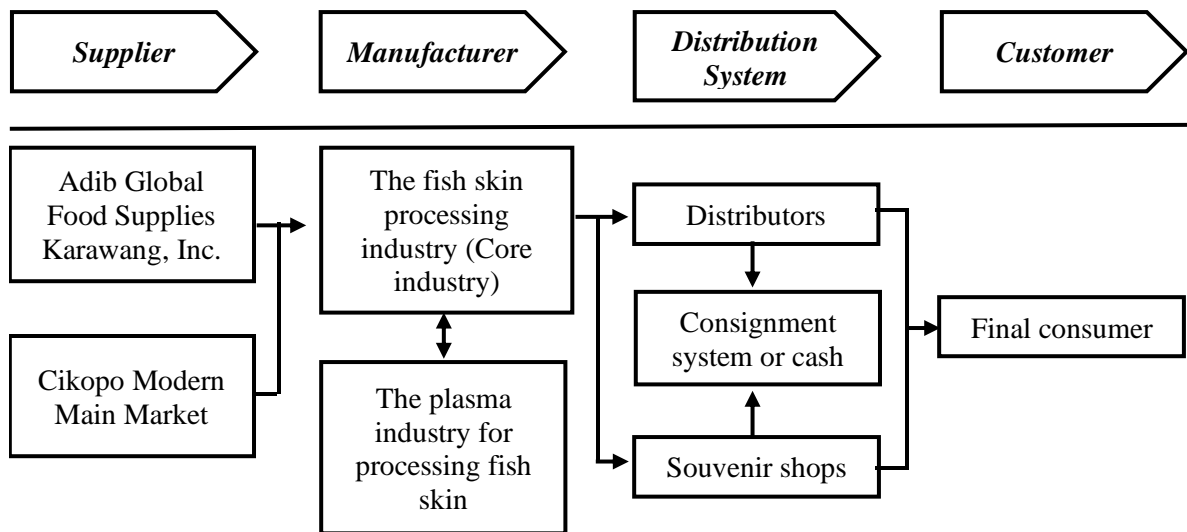
Still, apart from being processed into fish skin crackers, fish skin waste can also be processed into gelatin and collagen. However, creating the products requires high capital, special processing machines, and high-level skills. Meanwhile, industrial actor needed more capital to spend on high costs for skilled workers to produce gelatin and collagen and invest in high-cost machines.



**Fig. 1.** Pangas catfish industrial trees  
Source: Suryaningrum, 2008

## 2.2. Supply chain analysis

According to **Marimin and Maghfiroh (2018)**, supply chain analysis illustrates several parties who play a role in a product distribution chain, starting with the procurement of raw materials and product processing, so that the finished product can reach the final consumer. Fig. (2) explains the supply chain process in the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict. Adib Global Food Supplies Karawang, Inc. is the industry's primary raw material supplier. It is located in the Aquaculture Production Business Service Center (BLUPPB) area, RT 04/01, Pusakajaya Utara Village, Cilebar Subdistrict, Karawang Regency, approximately 35km from the location of the fish skin processing industry. The supplier is a fish skin supplier that comes from pangas catfish. It focuses primarily on the production of fresh fish fillets only. The raw materials from the supplier are already skin strips, making processing more efficient. The industry utilizes pangas catfish skin as a secondary product and production waste of Adib Global Food Supplies Karawang, Inc. Access obtained by the industry to purchase the primary raw materials was assisted by the Fisheries Office of Karawang Regency. The industry must have a Delivery Order (DO) to obtain these raw materials. The DO is the basis for releasing the raw materials from the supplier side. Instead, from the buyer's side, the industry must have a Maritime and Fisheries Business Actor Card (KUSUKA) to acquire the DO, the card released by the Fisheries Office of Karawang Regency. The average purchase of these raw materials, based on the DO, is usually 100kg.



**Fig. 2.** The supply chain of the fish skin processing industry

In addition to local markets, the industry's supplier of auxiliary raw materials is the Cikopo Modern Main Market, located at Cikopo Village, Bungursari Subdistrict,

Purwakarta Regency. The auxiliary raw materials consist of garlic and salt, which are utilized to flavor the fish skin. Moreover, whiting was employed to soak the fish skin to reduce the fishy smell and cause the texture of the crackers to be crispy. The industry obtains other auxiliary raw materials, such as gas, cooking oil, and plastic packaging, from local markets around the industry site.

The availability of primary raw materials around the industry area in the Cilamaya Wetan Subdistrict still needs to be improved. However, it will be difficult when Adib Global Food Supplies Karawang, Inc. no longer wants to provide the DO of the fish skin since there is only one alternative source of raw materials apart from the supplier. This indicates that the industry faces risks concerning the sustainability of the main raw material supply. Moreover, auxiliary raw materials often experience price fluctuations, which can decline the industry's profits.

The production of the fish skin processing industry is assisted by the plasma industry located in the same village, processing fish skin raw materials obtained from suppliers. They serve as producers who process it to become the finished product. As a core industry, the fish skin processing industry accepts the result of the plasma industry production through a cash purchase system. The industry buys it at IDR 125,000.00 per kg (equivalent to USD 7.84 per kg). Each 1kg comprises ten-pack fish skin crackers weighing 100 grams per pack. The purchases usually reach six bales weighing 5kg per bale or a total purchase of 30kg.

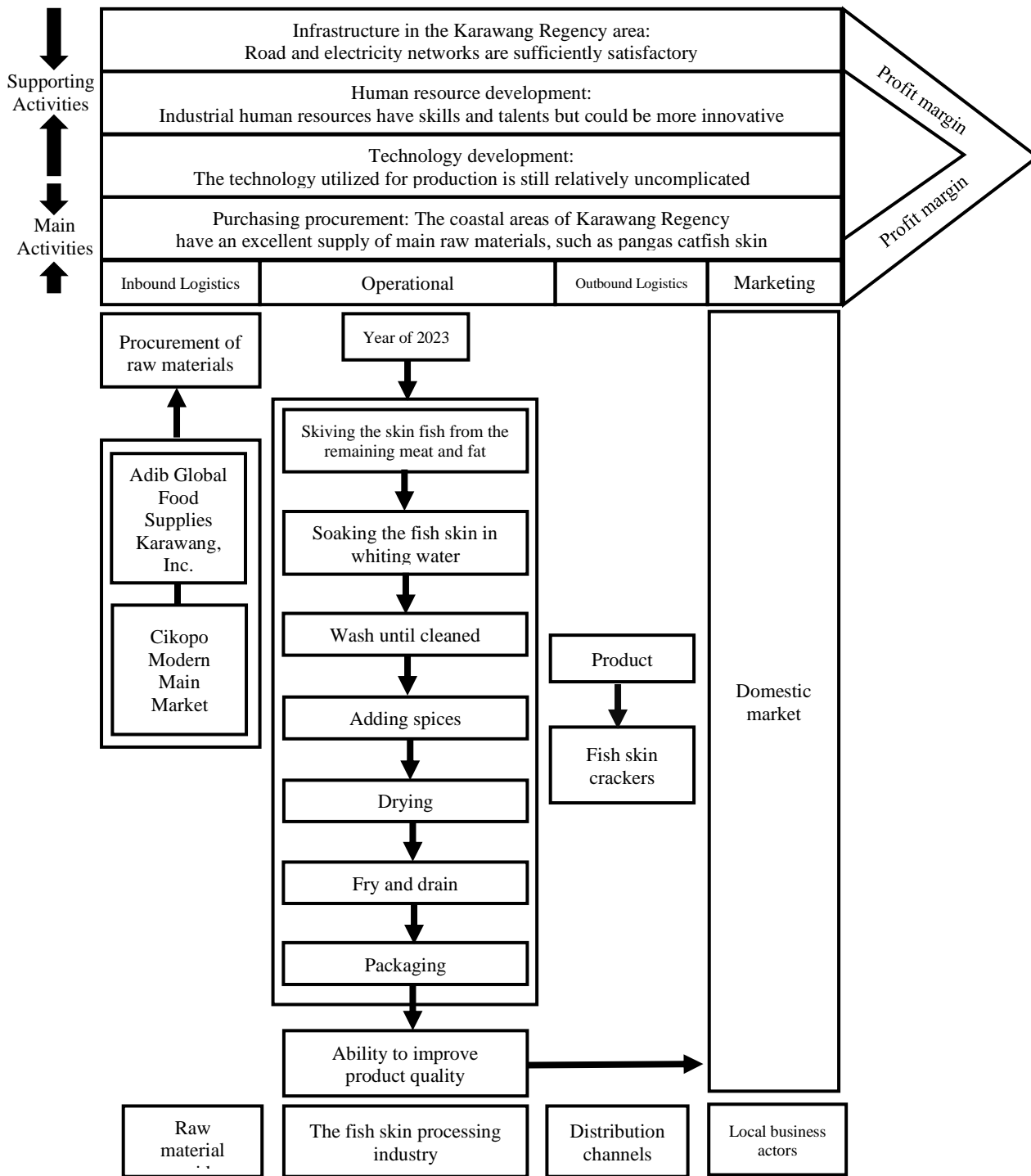
The industry's marketability is quite good, and the products have reached a relatively broad market so far, even though the marketing is still conventional. This industry has carried out marketing collaboration with strategic partners, including several large distributors in Bandung City and souvenir shops in the cities of Cianjur and Purwakarta. These cities are tourist destination areas visited by many visitors from various cities, especially people from Jakarta and its surroundings. Several souvenir shops in the Purwakarta and Bandung area are located in the rest area of the toll road crossing between Jakarta and Bandung, especially the Cipularang toll road at 97, 72, 62km, which is often a stopping place for people traveling between the regions, mainly for tour trip purpose. This industry has also supplied its products to partners or large distributors in the Bandung area, namely Sari Milo, Pancasari, and Indosari. These partners usually place orders ranging from 100 to 200 packs, which they then supply to Yogya Group Supermarket (Yogya and Griya Supermarkets).

In the local market in Karawang City, the industry supplies several souvenir shops, such as the Kopi Dewi shop and the Jakarta-Cikampek toll road rest area at 42km. Retail orders are usually ten packs to 50 packs. The payment system used by distributors is usually a consignment system and product returns, while souvenir shops usually use cash. Ultimately, this fish skin product reaches the buyer, who is the final consumer, mainly through purchases from supermarkets or souvenir shops.



### ***2.3. Analysis of value chain***

The value chain analysis describes a series of activities within a firm to produce value-added products and achieve sustainable product competitiveness in facing competitors (**M4P, 2012**). The analysis of the fish skin processing industry consists of two activities: the main and supporting activities. Fig. (3) illustrates the value chain created in the fish skin processing industry in the following two activities.



**Fig. 3.** The value chain of fish skin crackers

### 2.3.1. Main activities

**Inbound logistics:** The primary raw material for fish skin supplied by Adib Global Food Supplies Karawang, Inc. is relatively affordable at around IDR 1,300.00 per kg (equivalent to USD 0.082 per kg). The industry must obtain the DO by paying it in cash for the primary raw material. Therefore, the industry must have sufficient initial capital to start its business activities, primarily to fulfill the purchase of the primary raw materials. Increasing demand from various regions impacts increasing capital requirements, especially working capital. Limited capital makes it difficult for the industry to meet market demand.

Tegalsari Village's government must still expand to support the industry's obstacles since the village government does not provide financial assistance. Whereas, every year, the village government receives a high budget from the central government, called the Dana Desa, to finance development and community empowerment, including empowering industries in the village area. The village government only delivers facilitation through the ease of obtaining business permits and providing village government office facilities for coaching activities for this industry. Meanwhile, through the Karawang Regency Cooperatives and SMEs Office, the regional government has provided adequate support (by implementing the OVOP program) by assisting industry in the form of capital goods such as production equipment.

Limited financial capital support for this industry has caused the industry to apply for assistance from banking institutions. The industry applied for a loan from the state-owned bank of Bank Rakyat Indonesia (BRI) through the Micro Credit Program (KUR) scheme. However, the credit application proposed by this industry cannot be accepted by the bank since the industry does not meet banking requirements (not bankable), mainly because the industry needs adequate collateral.

**Operational:** The operational process for producing fish skin crackers product is not complicated since it only involves a few activities. The activities are described as follows:

- The first step in production activity was to begin skiving the skin fish from the remaining meat and fat still attached to the skin fish (Fig. 4).



**Fig. 4.** Skiving process applied to the fish skin

- The second step was soaking the fish skin in whitening water, which eliminated the fishy smell and made the crackers crispier. Then, the fish skin was washed and recleaned with pristine water (Fig. 5).



**Fig. 5.** Soaking process applied to the fish skin

- Season basic spices, such as garlic and broth, in the third step until they percolate the fish skin (Fig. 6).



**Fig. 6.** Providing basic spices

- In the fourth step, fish skin was soaked in the sun to completely dry, since this affects the durability and crunch of the crackers (Fig. 7). The durability of the fish skin cracker product was conducted only for a short time, around 1-2 months.



**Fig. 7.** Drying process applied to the fish skin

- In the fifth step, the fish skin was cut into 4-5 parts from each piece of skin to make it easier to fry and pack later (Fig. 8).



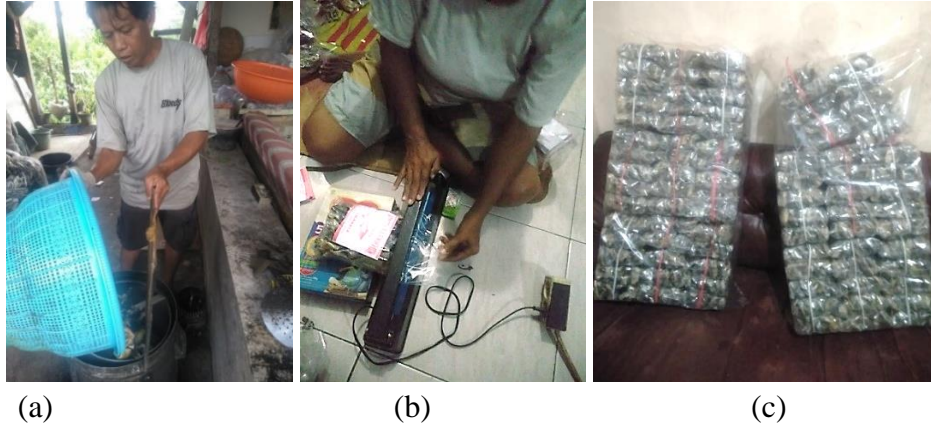
**Fig. 8.** Cutting process applied to the fish skin

- In the sixth step, the fish skin was fried using hot cooking oil until cooked (Fig. 9).



**Fig. 9.** Frying process applied to the fish skin

- Ultimately, the fish skin crackers were removed from the frying pan and drained from the cooking oil using a spinner machine. Furthermore, they were packaged in plastic, glued using a hand sealer, and were ready to be marketed (Fig. 10). The industry usually carries out the production cycle above.



**Fig. 10.** (a) Slicing process of the product; (b) Packaging process of the product; (c) The product is prepared to be marketed

The industry spends IDR 135,000.00/person (equivalent to USD 8.46/person) for freelance labor costs, including meals and working hours from 08.00 am to 05.00 pm. The existence of this industry in Tegalsari Village, Cilamaya Wetan Subdistrict, has created employment opportunities because it provides income for residents, especially homemakers.

The industry has yet to innovate by diversification products nowadays due to the limited knowledge of the industry actors who have to process fish skin into other products, apart from skin crackers. In carrying out the product manufacturing process, this industry still needs to implement Sanitation Standard Operating Procedures (SSOP) and Good Manufacturing Practices (GMP). The fact was that a processing area was in an open space attached to a house's parking area. Moreover, the laborers do not employ plastic gloves during the packing process.

**Outbound logistics:** The fish skin cracker products produced by this industry are supplied to the market utilizing transportation land through cars owned by this industry (Fig. 11). The transportation costs required are approximately IDR 750,000.00 (equivalent to USD 47.02) for one delivery, including toll fees, fuel purchases, driver and salesman fees, and food allowance. The industry actors deliver the product directly. Road access to the destination city for the delivery process is sufficient, thus supporting the continuity of product distribution, including the supply of raw materials.



**Fig. 11.** The fish skin cracker products

The industry's product sales still depend on orders from distributors, including existing distributors in Karawang, Purwakarta, Bandung, and Cianjur. Additionally, the sale is still on consignment; that is, the industry can receive money when the products supplied to distributors have been sold. If the product entrusted is expired or damaged, the distributors will return it to the industry. It will cause losses for the industry because total sales will decline, thus affecting decreased capital turnover and the industry's profit.

**Marketing and sales:** Some marketing and sales patterns in the industry are direct through customers and some use collectors. They are achieved through collaboration with several established business actors, including distributors. The role of the industry owners is significant in company operational activities, particularly sales. The industry owners explore orders, drive sales, serve customers, and even deliver products. It indicates that this industry still relies on traditional management. However, the Karawang Regency Cooperatives and SMEs Office has supported promotions through product exhibitions.

**Services:** This activity concerns the provision of services to strengthen or maintain product value. This industry has provided relatively satisfactory product quality. Industry actors try to maintain product quality by participating in various training, technical guidance, and seminars, including following training for packaging improvements conducted by the Cooperatives and SMEs Office of Karawang Regency. The training activity has encouraged the industry to use excellent and standard product packaging nowadays. Moreover, industry actors have also trained in producing and improving the quality of fish skin cracker products, which was held in collaboration between the Karawang Regency Fisheries Office and the Karawang Marine and Fisheries Polytechnic.

### 2.3.2. Supporting activities

**Procurement:** Adib Global Food Supplies Karawang, Inc., which supplies the industry's primary raw material, has abundant stock. The excess pangas catfish skin waste is usually delivered to the company's head office in Jakarta.

**Technology development:** In general, the production technology operated by the industry processing fish skin in Tegalsari village, Cilamaya Wetan Subdistrict, still needs to be completed to process fish skin. For example, the skiving process of the fish skin is still done manually using a spoon and knife. This activity is time-consuming since it requires precise and careful work to ensure the fish's skin is clean from its meat and fat. This is because it will affect the quality of the product. The product quality maintained as the skiving process results is due to the workers' skills being sufficient because they are used to it. The availability of technology for other production equipment is complete and adequate because this industry also receives assistance from the government through the OVOP program, which is implemented by the Karawang Regency Cooperatives and SMEs Office.

**Human resource management:** The availability of human resources working in the industry is sufficient, but knowledge of product innovation in this industry still needs to be improved. In addition to being made into fish skin crackers, the fish skin can also be processed into other food products, such as Pempek. Moreover, their knowledge regarding the application or use of technology still needs to be improved, including information and communication technology in the marketing area through digital marketing, which has recently become popular. This lack of knowledge about digital marketing is due to the low willingness and the mindset of industry actors who have yet to change, causing this industry to lag in following technological service developments. This industry used to implement online marketing before. However, because their knowledge of carrying out promotions and placing advertisements in the marketplace still needed improvement, they did not provide online marketing services. This industry continues to focus on conventional marketing methods, such as making sales based on direct orders from distributors and retailers. They consider that their products are not for daily consumption but are more suitable as souvenir products, so they must be conventionally distributed or marketed to distributors or shops. In addition, online marketing will further raise the industry's budget for distributing and marketing their products.

**Infrastructure:** The availability of infrastructure in the industry's area is satisfactory, which can ensure continuity during production activities. Road access to this industrial location is in suitable condition. Various vehicles can pass through the relatively broad and smooth access road. The electricity network and availability of sanitary water in the village are also sufficient for the continuity of the production process in the industry.

However, this industry still needs to manage its waste, particularly from the skiving process, which is removed and placed on land near the production site, causing a pungent



odor. The residents around the production site were disturbed by the smell, which made industry actors reluctant to produce and develop the industry's products on a larger scale.

The industrial production area still merges with the industry actor's house. Hence, when the skiving process is accomplished, the waste's smell pastes on the house's floor, making the floor sticky, smelly, and difficult to clean. It causes the industry (in this case, the core industry) to outsource the production of fish skin crackers to the plasma industry in the area around the industry.

The industry should be concerned about waste processing. Additionally, the industry should have a particular production area separate from the industry actor's house, so that the impact of production activities does not disturb residential areas due to waste pollution.

However, the industry has insufficient capital to rent or purchase separate land for production and cannot yet manage waste well. The Karawang Regency Fisheries Office offers the industry a renovation program for the Fish Processing Unit (Bedah UPI) to solve the obstacle. According to the government's budget availability, the program accommodates rising fishery production facilities and infrastructure, including the fish skin processing industry. Industry actors only need to provide the land to participate in this program. Unfortunately, industry actors cannot apply because there is no separate land for production.

**Profit margin analysis:** To obtain a profit margin from business activities in the industry, the following describes the cost of production calculation of fish skin cracker products in one production cycle:

- Main raw materials:
  - Pangas catfish skin = 100 kg x IDR 1,300.00/kg (equivalent to USD 0.082/kg) = IDR 130,000.00 (equivalent to USD 8.15)
- Auxiliary materials:
  - Betel lime = 1kg x IDR 10,000.00 (equivalent to USD 0.63) = IDR 10,000.00 (equivalent to USD 0.63)
  - Garlic = 9.5kg x IDR 30,000.00 (equivalent to USD 1.88) = IDR 285,000.00 (equivalent to USD 17.87)
  - Salt = 2kg x IDR 10,000.00 (equivalent to USD 0.63) = IDR 20,000.00 (equivalent to USD 1.25)
  - Cooking oil = 10kg x IDR 15,000.00 (equivalent to USD 0.94) = IDR 150,000.00 (equivalent to USD 9.40)
  - Gas fuel = 2 pcs x IDR 23,000.00 (equivalent to USD 1.44) = IDR 46,000.00 (equivalent to USD 2.88)
  - Packaging = 500 packs x IDR 800.00 (equivalent to USD 0.050) = IDR 425,000.00 (equivalent to USD 26.65)

- Logo printing of packaging = 125 sheets x IDR 500.00 (equivalent to USD 0.031) = IDR 62,500.00 (equivalent to USD 3.92)
  - Operational costs:
    - Labor cost = 4 people x 5 days x IDR 135,000.00 (equivalent to USD 8.46) = IDR 2,700,000.00 (equivalent to USD 169.28)
    - Delivery cost = 2 trips x IDR 750,000.00 (equivalent to USD 47.02) = IDR 1,500,000.00 (equivalent to USD 94.04)
    - Electricity and water cost = IDR 50,000.00 (equivalent to USD 3.13)
- Total of production and distribution cost = IDR 5,378,500.00 (equivalent to USD 337.21)

The industry produces 500 packs weighing 100g/ pack in one production cycle. Thus, the cost of goods sold (COGS) per pack of fish skin crackers is IDR 10,757.00 (equivalent to USD 0.67). Meanwhile, this industry sells to buyers for IDR 16,000.00/pack (equivalent to USD 1.00). According to the formulation of Widyastrianti and Indrawati (2023), this industry conveys a profit margin percentage of 32.77% at sales of 500 packs of fish skin crackers through the following calculation:

$$M = \frac{SP - COGS}{SP} \times 100\%$$

where,

M = margin, SP = selling price, COGS = Cost of Goods Sold

$$M = \frac{16,000.00 - 10,757.00}{16,000.00} \times 100\%$$

$$M = 32.77\%$$

### 3. SWOT analysis

The SCM analysis discussed above can provide the essence of the problems faced by the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency. Furthermore, the various problems can be mapped into the strengths, weaknesses, opportunities, and threats this industry faces, corresponding to a SWOT analysis.

#### **Strengths (S)**

- S1. The market reach of industry actors has expanded.
- S2. The industry has entirely satisfactory skills in processing fish skin.
- S3. The product quality produced is entirely suitable.
- S4. The packaging used meets standards.
- S5. Access to finished product delivery and raw material supply are adequate.
- S6. The industry actors have the ability to market their products, especially to the big customers (distributors).

**Weaknesses (W)**

- W1. The industry actors still need to have the desire to diversify their products due to a need for more technology availability, capital, and human resources skills.
- W2. The industry is not yet implementing SSOP and GMP in production.
- W3. The industry faced significant risks of loss due to returns from the consignment sales system.
- W4. The industry still needs to have its production area.
- W5. The production process at the drying stage is still very dependent on the hot sun to produce the best quality products.
- W6. The industry is too focused on conventional marketing; thus, online marketing must be explored.

**Opportunities (O)**

- O1. The raw materials of fish skin are abundantly available at affordable prices.
- O2. There is policy support from the Karawang Regency government to develop the fish skin processing industry.
- O3. Open employment opportunities for the local community.
- O4. Availability of electricity networks and pristine water in the village.

**Threats (T)**

- T1. There is no alternative source of raw materials besides Adib Global Supplies Karawang, Inc.
- T2. Fluctuations in the prices of auxiliary materials affect the profits obtained by the industry.
- T3. The industry cannot yet manage waste properly, thus disrupting the health and comfort of the community around it.

The SWOT analysis ultimately conveys the development direction for the fish skin processing industry located in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency, through constructing the strategic plans to pursue opportunities with existing strengths (S-O strategies), improve weaknesses to obtain opportunities (W-O strategies), prevent weaknesses from external threats (W-T strategies), and utilize strengths to reduce threats (S-T strategies) (**Rangkuti 2008; Hakim *et al.* 2022**).

**S-O strategies**

- The strategy for supply and marketing networking integration
  - Utilize abundant raw materials at affordable prices to meet the demand for skin cracker products and thus reach a broader domestic and international market (S1, O1, O4).

- Increasing the cooperative marketing relationship between the industry and distributors through a rewarding system (S5, S6, O1, O4).
- Build branding for the product, which includes participating in bazaar exhibitions, actively interacting on social media, and starting to place advertisements on websites (S3, S4, S6, O2, O3).
- The strategy for product development and innovation
  - Provide coaching and assistance for the industry actors to improve the quality of highly competitive products, which is expected to increase sales and thus drive the village economy (S2, S3, S4, O2, O3).

### **W-O strategies**

- The strategy for product development and innovation
  - Utilize the potential of available raw materials through collaboration with the regency government to provide coaching to produce new products employing similar raw materials (W1, O1, O2).
- Strategy for strengthening production processes and waste processing
  - Guiding industry actors to raise awareness of cleaner production (W2, W4, O4).
  - Supply semi-finished products for needs during the rainy season, even though it can result in a slight decline in product quality (W5, O1).
  - Facilitate the industry actors to the companies of guarantee by the regency government to obtain solutions to collateral constraints to resolve capital limitations, particularly for constructing the small wastewater treatment plant (IPAL) and procurement industry land (W1, O2).
- Strategy for strengthening human resources
  - Guide digital marketing so the industry can reach a broad market by penetrating modern markets, including the online market (W3, W6, O2, O3).

### **S-T strategies**

- Strategy for supply and marketing network integration
  - Encourage industry actors to obtain alternative suppliers of primary raw materials; thus, the continuity of the production process can be maintained (S2, S3, S4, T1).
- Strategy for strengthening production processes and waste processing
  - Reducing operational costs in production and distribution to obtain still maximum profits (S1, S5, S6, T2).
  - Assisting with sound waste processing to industry actors to avoid environmental pollution by creating value-added products from its waste (S2, T3).
  - Provide a small wastewater treatment plant (IPAL) (S2, T3).

### **W-T strategies**

- Strategy for strengthening human resources

- Increase processing and marketing capabilities supported by the availability of raw materials and stable prices of auxiliary materials (W1, W2, W3, W4, W5, W6, T1, T2, T3).

For the strategies to be implemented effectively, it is necessary to identify the responsible stakeholders (Table 1).

**Table 1.** Recommendations of the stakeholders who are responsible for implementing the strategies

No.	Strategies	The stakeholders that are responsible
<b>S-O strategies</b>		
<b>The strategy for supply and marketing networking integration</b>		
1.	Utilize abundant raw materials at affordable prices to meet the demand for skin cracker products and thus reach a broader domestic and international market (S1, O1, O4)	The industrial actors, leading raw material suppliers, Karawang Regency Fisheries Office, Industry and Trade Office, and Cooperatives and SMEs Office
2.	Increasing the cooperative marketing relationship between the industry and distributors through a rewarding system (S5, S6, O1, O4)	The industrial actors and distributors
3.	Build branding for the product, which includes participating in bazaar exhibitions, actively interacting on social media, and starting to place advertisements on websites (S3, S4, S6, O2, O3)	The industrial actors, Karawang Regency Cooperatives and SMEs Office, and universities
<b>The strategy for product development and innovation</b>		
1.	Provide coaching and assistance for the industry actors to improve the quality of highly competitive products, which is expected to increase sales and thus drive the village economy (S2, S3, S4, O2, O3)	Karawang Regency Fisheries Office, the industrial actors, private companies, and universities
<b>W-O Strategies</b>		
<b>The strategy for product development and innovation</b>		
1.	Utilize the potential of available raw materials through collaboration with the regency government to provide coaching	Karawang Regency Fisheries Office, the industrial actors, private companies, and universities

No.	Strategies	The stakeholders that are responsible
	to produce new products employing similar raw materials (W1, O1, O2)	
<b>Strategy for strengthening production processes and waste processing</b>		
1.	Guiding industry actors to raise awareness of cleaner production (W2, W4, O4)	The industrial actors, Karawang Regency Industry and Trade Office, Environment and Hygiene Office, Tegalsari village government, and universities
2.	Supply semi-finished products for needs during the rainy season, even though it can result in a slight decline in product quality (W5, O1)	The industrial actors, Karawang Regency Industry and Trade Office, and Cooperatives and SMEs Office
3.	Facilitate the industry actors to the companies of guarantee by the regency government to obtain solutions to collateral constraints to resolve capital limitations, particularly for constructing the small wastewater treatment plant (IPAL) and procurement industry land. (W1, O2)	The industrial actors, Karawang Regency Industry and Trade Office, Cooperatives and SMEs Office, the companies of guarantee, and universities
<b>Strategy for strengthening human resources</b>		
1.	Guide digital marketing so the industry can reach a broad market by penetrating modern markets, including the online market (W3, W6, O2, O3)	The industrial actors, Karawang Regency Industry and Trade Office, Cooperatives and SMEs Office, and universities
<b>S-T Strategies</b>		
<b>Strategy for supply and marketing network integration</b>		
1.	Encourage industry actors to obtain alternative suppliers of primary raw materials; thus, the continuity of the production process can be maintained (S2, S3, S4, T1)	Karawang Regency Fisheries Office, Industry and Trade Office, and the industrial actors
<b>Strategy for strengthening production processes and waste processing</b>		
1.	Reducing operational costs in production and distribution to obtain still maximum profits (S1, S5, S6, T2)	The industrial actors, and universities
2.	Assisting with sound waste processing to industry actors to avoid environmental	The industrial actors, Karawang Regency Industry and Trade Office,

No.	Strategies	The stakeholders that are responsible
	pollution by creating value-added products from its waste (S2, T3)	Environment and Hygiene Office, and universities
3.	Provide a small wastewater treatment plant (IPAL) (S2, T3)	The industrial actors, Karawang Regency Industry and Trade Office, Environment and Hygiene Office, Tegalsari village government and universities

### W-T Strategies

#### Strategy for strengthening human resources

- |    |   |   |
|----|---|---|
| 1. | Increase processing and marketing capabilities supported by the availability of raw materials and stable prices of auxiliary materials (W1, W2, W3, W4, W5, W6, T1, T2, T3) | The industrial actors, Karawang Regency Industry and Trade Office, Cooperatives and SMEs Office, and universities |
|----|---|---|

## CONCLUSION

The research provides strategies for developing the fish skin processing industry in Tegalsari Village, Cilamaya Wetan Subdistrict, Karawang Regency. The strategies are (1) supply and marketing networking integration, (2) product development and innovation, (3) strengthening production processes and waste processing, and (4) strengthening human resources. Suggestions for the government as the results of this research, it is necessary for the Karawang Regency government effort to relocate the government-owned souvenir outlets to more strategic areas, both within the city of Karawang and outside the city of Karawang (such as in KM 57 Rest Area of Toll Road Jakarta-Cikampek), so that it can accommodate and market more massively the iconic merchandise of Karawang Regency, including the fish skin cracker products. In addition to private companies, the Karawang Regency government must encourage the partiality of the Tegalsari village government to participate in developing and empowering this industry.

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