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The Impact of the Externality of Tofu Manufacturing Business on the Social, Economic, and Environmental Aspects of the Community

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Abstract: The tofu industry is growing because it is a cheap and nutritious food, but the production process produces liquid and solid waste that is harmful to the environment. The research aims to describe the community's perception of the social, economic, and environmental conditions of the tofu-making business and calculate the value of community losses to maintain ecosystem value. This research uses survey and interview methods with communities in tofu production centers. Data analysis using the CVM method (*Contingent Valuation Method*) to estimate the costs that the community will pay. The research results show that the community's response around the tofu-making business to the social environment is in the category of not providing employment opportunities and children's education. The community's response to economic aspects is in the disagree category, meaning that the tofu-making business has no impact on increasing people's income and purchasing power. Respondents disagreed that tofu liquid waste disturbed the surrounding environment. Before being discharged into waterways, liquid waste goes through a processing process in a wastewater treatment plant (IPAL) so that liquid waste discharged into rivers is free from chemicals and odor. Meanwhile, solid waste is sold for animal feed. Value of willingness to pay (*willingness to pay*) community to maintain ecosystem value of IDR 80,450/year/KK.

Keywords: Know the business; Negative externalities; Positive externalities

Introduction

Criteria for Micro, Small, and Medium Enterprises (MSMEs), according to Law Number 20 of 2008, are classified based on the number of assets and turnover owned by a business. Makassar City is the capital of South Sulawesi Province, which has quite a large number of MSMEs. There are 2,683 business units spread across 15 sub-districts (BPS, 2023).

One type of Micro Business (UM) developing is processing agricultural products, namely making tofu. Tofu is known as a typical Indonesian food. Tofu-making businesses are spread throughout Indonesia, including Makassar City and South Sulawesi, outside Java. The tofu-making business is increasing because people's need for tofu products is also growing. Tofu is a cheap food rich in nutrition and a basic need for society, especially for people with limited purchasing power (Sudaryantingsih & Pambudi, 2021). The tofu manufacturing industry has a somewhat important role in the economy regarding labor absorption and equal distribution of business opportunities (Hasyim et al., 2023).

Problems that hinder the development of tofu-making businesses are lack of business capital, rising raw material prices, and marketing factors to distribute tofu from producers to consumers (Sadarudin et al., 2023). The increase in the cost of soybean raw materials

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impacts the price of tofu. Market demand for tofu products exceeds the capacity that can be provided (Nurlina & Lamusa, 2018). Research by Mukti et al (2022) shows that the tempe-making business still has the opportunity to develop; the results of the SWOT matrix are based on the SO (Strengths-Opportunities) strategy, namely expanding product variants by making quality yellow tofu and tempeh at affordable prices.

The tofu production process by SMEs will produce waste and pollutants. Waste generated during the production process is liquid waste and solid waste. Liquid waste is water from washing, soaking, and cooking soybeans, while solid waste is in the form of tofu dregs (Khumaeroh & Puspitasari, 2019). Generally, waste in the tofu and tempe industry has yet to be utilized optimally. It is thrown directly into the environment which can cause environmental impacts such as unpleasant odors and water and environmental pollution. Implementing the circular economy concept can reduce the environmental impact of the tofu and tempeh production process (Yulistika et al., 2023).

Externalities are positive or negative impacts arising from the production process. Positive externalities are the beneficial impact of an action taken by one party on another person without compensation from the party who benefits, while negative externalities are when the effect on other people who do not receive compensation is detrimental (Mankiw et al., 2012). Externalities are costs or benefits from an activity imposed on another party (Karl & Fair, 2012). There are 2 (two) conditions for externalities to occur, namely that there is influence from an action, and no compensation is paid or received.

According to (Citra et al., 2022), the social impacts experienced by communities around industrial locations provide benefits and advantages, including increasing community knowledge, creating new jobs, creating a professional workforce, forming new values and norms, and improving work efficiency and productivity. Meanwhile, the economic impact is reducing unemployment and increasing income. Before the tofu industry, the average community income was < IDR 1 million, whereas after the existence of the tofu industry, the average community income was IDR 1-5 million(Virdausya et al., 2020). Furthermore, Rochgiyanti et al (2023) stated that people living around the factory can send their children to college. The negative impact of the tofu factory is liquid waste with high BOD and COD levels, which will cause an unpleasant odor (Fatmawati et al., 2023). Besides that, people are disturbed by using soybean milling equipment, which continues to operate daily (Fatmawati et al., 2023).

According to the Minister of Environment Regulation No. 13 of 2011, the person in charge of a business and activity that commits an unlawful act in the form of pollution and damage to the environment which causes harm to other people or society and the environment or the state is obliged to take specific actions and pay compensation. Calculating compensation for losses due to environmental pollution and damage provides monetary value for environmental pollution and damage. The Contingent Valuation Method (CVM) measures an individual's willingness to pay due to changes in the quantity or quality of ecological goods and services (Matondang & Suseno, 2020).

The existence of a tofu-making business does not only have a positive impact on the surrounding community environment. However, during the tofu production process, liquid and solid waste is produced, causing a negative impact on health. For this reason, business owners are responsible for pollution that harms the surrounding community. The purpose of the study was to describe the community's perception of the social, economic and environmental conditions of the tofu-making business, and to calculate the value of community losses to maintain the value of the ecosystem

Method

This research was carried out in the tofu and tempe production center area in Makassar City, South Sulawesi Province. The study was carried out for 4 (four) months. The research sample was determined randomly through *purposive sampling*, namely taking ten business units considering the business scale and having at least five years of experience. Furthermore, the affected people around the factory were 30 households with the criteria of living at most 30 meters away and being directly affected by the tofu-making business. Data collection through field observations and direct interviews. Distributing and filling out questionnaires online, offline, and *online*.

Quantitative descriptive analysis was used to determine the external impact of the existence of a tofu-making business on the social, economic, and environmental conditions of the community around the factory. The variable measurement uses a Likert scale with 3 (three) levels of attitude answers, namely agree (S=3), disagree (KS=2), and disagree (TS=1) in Table 1.

The qualitative data is converted into score values and then used to interpret public perceptions (Sugiyono, 2014). The criteria do not agree on the score interval (60-99) and disagree on the score interval (100-139) and criteria agree on the score interval (140-180).

Table 1. Variables and Indicators of the Socialand Economic Impact of the Existence of a Tofu-Making Business

Impact Variables	Indicator	Measurement Scale
Social Impact	1. Jobs	Likert scale
	2. Education	(1,2,3)
Economic	1. Income	Likert scale
Impact	2. Purchasing power	(1,2,3)
Environmental	1. Air pollution/odor	Likert scale
Impact	2. Waterways are polluted	(1,2,3)

Figure 1. Research Flow

The quantitative analysis calculates the estimated value of external losses felt by the community due to environmental quality changes using the *Contingent Valuation Method* (CVM). Contingent Valuation Method is a method of collecting information regarding people's preferences or willingness to pay (*Willingness to Pay*) to maintain the value of water and air ecosystems through in-depth interview techniques (*in-depth interview*), using the formula according to Haab & McConnell (2002); Fauzi (2006).

$$TWP = \Sigma WPi (ni/N) P \quad (1)$$

Where:

Wpi = willingness to pay in units of money (Rp)

ni = number of respondents who are willing to pay WPI (people)

N = number of respondents interviewed (people)

P = population (people)

Result and Discussion

Respondents' Characteristics

The socio-economic characteristics of respondents include factors that influence the tofu-making business, namely age, gender, formal education, and length of business. The following is presented in Table 2

Table 2. Characteristics of Tofu Maker Respondents in Makassar City

Characteristics of Respondents	Value (Unit)	Information
Average age	40 years old	Productive age
Gender		100%
Man	10 people	0 %
Woman	0 people	
el of education		50%
SD	5 people	30%
Junior High School	3 people	20%
SMA	2 people	Experienced
Long time trying	16 years	

Table 2 shows that the average age of respondents is 40 years, including the productive age category, male. Low education, there are five people (50%) with elementary school education. Having been in business for 16 years, it is considered entirely experienced.

Table 3. Characteristics of Respondents from the Community Surrounding Tofu Making Businesses in Makassar City.

Characteristics of Respondents	Frequency (people)	Percentage (%)
Age (years)		
a. 23 – 34	4	13.3
b. 35 – 46	20	66.7
c. 47 – 58	6	20.0
Gender		
a. Man	17	56.7
b. Woman	13	4.3
Education		
a. Junior High School	3	10.0
b. SMA	20	66.7
c. Masters	7	23.3
Work		
a. Civil servants	5	16.7
b. Private sector employee	5	16.7
c. Businessman	8	26.7
d. Service Workers and Not Working	2	6.70
(IRT)	10	33.2

Table 3 shows that the highest frequency in the 35-46 year age interval was 20 farmers (66.7%) with an average age of 38. This age is included in the productive age so they can respond well to every question. The frequency of male and female respondents is almost equal, indicating a high level of female participation. The highest distribution of formal education is high school, with as many as 20 people (66.7%). The occupation of respondents with the highest frequency was as a housewife, ten people (33.2%).

Tofu Making Business Activities

In-depth interviews were conducted with respondents from tofu making businesses in Makassar District, Makassar City, South Sulawesi Province. The production of tofu goes through several stages, starting with the preparation of the soya bean raw material, followed by the soaking of the soya beans for 3 hours. After soaking, the soybeans are placed in a plastic bucket to be washed with running water. The soybeans are then crushed using a soybean crusher powered by an electric motor. The cooking process is carried out in a round cement vat using firewood. The thickened soybean paste is then filtered. This is followed by the precipitation process and the addition of vinegar. This is followed by the moulding and pressing process using wooden

moulds. Finally, the tofu is cut. The tofu making activities carried out by the respondents correspond to the stages of tofu making in the tofu industry of Muna Regency (Herdhiansyah et al., 2022) and in the tofu factory of Dadimulyo Village (Ramadhan Alfin, 2023).

The raw material preparation stage uses local soybeans. The best type of imported soybean for making tofu is Argentine soybean (Andarwulan et al., 2018). Soaking time for 3 hours, soaking soya beans for a range of 3 - 7 hours, results in the moisture content of the tofu product gradually high and the texture of the tofu becomes soft (Aryanti et al., 2016). The grinding and boiling process also affects the texture of the tofu (Iswadi, 2021).

Community Perception of the Social Impact of the Existence of Tofu Businesses

The social impact experienced by the community around the location of the tofu-making business has positive and negative effects. Below are presented the public's perceptions of social aspects, namely opening up employment opportunities and improving family education, presented in Figure 2.

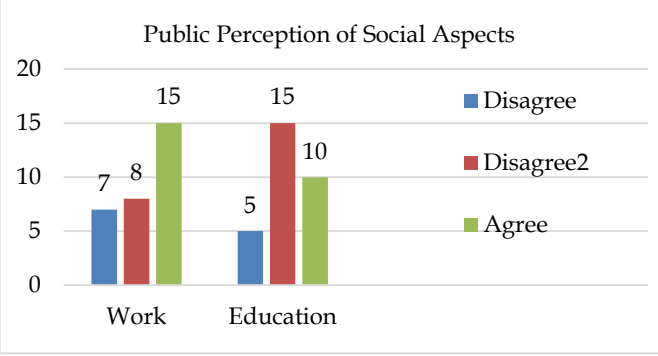

Figure 2. Community Perception of Social Aspects

The local community's perception of the social impact of a tofu-making business at a tofu and tempeh production center location opens up employment opportunities for residents around the factory. Fifteen respondents answered that they agreed that tofu businesses would open up employment opportunities, eight responded that they disagreed, and seven answered that they disagreed. Then, a tofu-making business allows their children to go to school. Ten respondents replied that they agreed that tofu businesses impacted children's education, eight answered that they disagreed, and five responded that they disagreed. This shows that most respondents said that the existence of tofu-making businesses did not have a social impact on the surrounding community.

Below is presented the level of public perception regarding the social aspects of the existence of the tofu-making business, namely employment and education, presented in Table 4.

Table 4. Level of Community Perception of Social Impact

Indicator	Community Response			Score	Category
	TS(1)	KS(2)	S(3)		
1. Jobs	7	16	45	68	-
2. Education	5	30	30	65	-
Total score	12	46	75	133	Dis
Number of respondents (people)	12	23	25	60	agr ee
Percentage (%)	20	38,3	41,7	100	

Based on Table 4 shows the level of public perception regarding the social aspects of the existence of the tofu-making business; there were 12 respondents (20%) who disagreed, while the remaining 38.3% disagreed, and 41.7% agreed. These results are in accordance with the situation of the Bakung Village community being helped in fulfilling their needs by the existence of jobs and changes in people's lifestyles (Fatmawati et al., 2023). Community income has increased so that they are able to pay for children's education (Virdausya et al., 2020).

Community Perception of the Economic Impact of the Existence of Tofu Businesses

The economic impact experienced by the community around the location of the tofu-making business has positive and negative effects. Below are presented the public's perceptions of financial aspects, namely increasing income and increasing purchasing power for food, presented in Figure 2

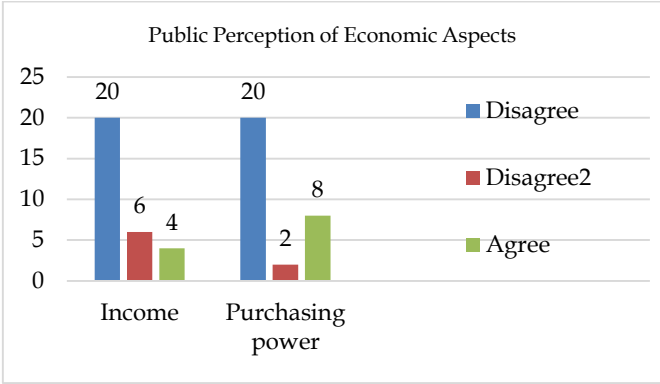

Figure 3. Public Perception of Economic Aspects

Perceptions of the surrounding community regarding the economic impact of a tofu-making business at a tofu and tempeh production center location, namely increasing community income and purchasing power for residents around the factory. Twenty respondents answered that they did not agree

that the existence of a tofu business increased income, six respondents answered that they disagreed, and four respondents responded that they agreed. Then, 20 respondents answered that they disagreed that the existence of the tofu business had an impact on increasing people's purchasing power, eight respondents disagreed, and five agreed. This shows that most respondents said that the tofu-making business did not economically impact the surrounding community. Most local people work as civil servants, private employees, and entrepreneurs; only a few family members work in the tofu-making business.

Below is presented the level of public perception regarding the economic aspects of the existence of the tofu-making business, namely increasing people's income and purchasing power, presented in Table 5.

Table 5. Level of Community Perception of Economic Impact

Indicator	Community Response			Score	Cate-gory
	TS(1)	KS(2)	S(3)		
1. Income	20	12	12	44	-
People's purchasing power	20	4	24	48	-
Total score	40	16	36	92	Don't
Number of respondents (people)	20	8	12	60	agree
Percentage (%)	33,3	13,3	20	100	

Based on Table 5 shows the level of public perception regarding the economic aspects of the existence of the tofu-making business. The level of public perception reached 33.3%, meaning that more than 33.3% of respondents did not agree that the tofu-making business impacted increasing people's income and purchasing power. In contrast to the research in Madiun, the existence of the tofu industry has a positive economic impact. Each worker earns a salary of Rp. 1,500,000 per month, which is still below the minimum wage in Blitar Regency, but is enough to meet basic needs (Fatmawati et al., 2023). Another positive impact is that the waste from the tofu factory, in the form of soya bean hulls, is used as animal feed and to blend organic fertiliser (Yunisyah et al., 2022). Community income has increased, enabling them to meet their basic needs and pay for their children's education (Virdausya et al., 2020).

Community Perception of the Environmental Impact of the Existence of Tofu Businesses

Environmental impacts in the form of air/odor pollution and polluted waterways are experienced by the community around the location of the tofu-making business. The following is a presentation of the public's perception of environmental aspects, namely air/odor pollution and waterways being polluted by liquid waste from the tofu factory, presented in Figure 3.

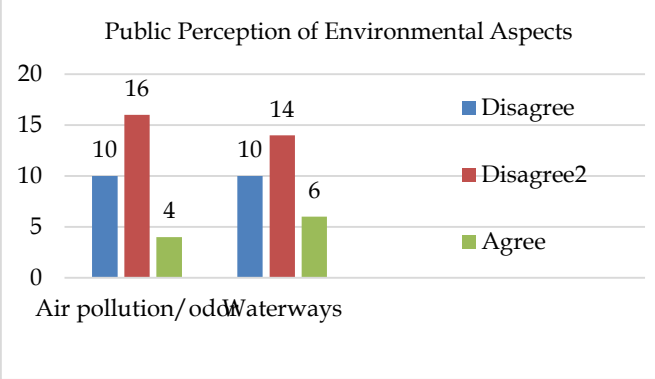

Figure 4. Community Perception of Environmental Aspects

Public perception of air/odor pollution caused by liquid waste from tofu-making businesses in tofu and tempeh production centers. Ten respondents answered that they did not agree that liquid waste discharged into waterways smelled, 16 respondents said they did not agree, and only four respondents said that the tofu-making business caused air pollution in the form of a disturbing smell. Based on Figure 3 shows that the majority of respondents said that the existence of a tofu-making business did not have a negative impact in the form of odors and water pollution on the surrounding environment.

Below is presented the level of public perception regarding environmental aspects regarding the existence of the tofu-making business, namely air pollution in the form of odors and water channel pollution, presented in Table 6.

Table 6. Level of Community Perception of Environmental Impacts

Indicator	Community Response			Score	Cate-gory
	TS(1)	KS(2)	S(3)		
1.Air pollution/odor	10	32	12	54	-
Waterway pollution	10	28	18	56	-
Total score	20	60	30	110	Dis-agree
Number of respondents (people)	20	30	10	60	
Percentage (%)	33.3	50	16.7	100	

Table 6 shows the level of public perception of environmental conditions, namely the occurrence of air pollution in the form of odors. 50% of respondents disagree that waste causes a smell. The survey results show that liquid waste is not directly discharged into waterways but through a processing process in Waste Water Treatment Plant (IPAL) tanks so that liquid waste discharged into rivers is free from chemicals.

The results of this study differ from research (Fatmawati et al., 2023)where the waste from the tofu factory is discharged into the river next to the residents' homes, causing the river water to change colour and become white foam, and causing an unpleasant smell that disturbs people living near the factory (Yunisyah et al., 2022). The quality of the surrounding community's well water is also affected, for example, it smells bad and has a slightly cloudy colour (Arifa & Ratnawati, 2023). Lack of capital as well as lack of land for the production of tofu water management equipment (IPAL) are factors that cause environmental pollution, especially in water quality.

The Value of Community Losses from the Existence of the Tofu-Making Business

This method is based on willingness to pay (WTP). Respondents' willingness to pay to maintain the value of the community ecosystem around the Tofu Making Business. The total WTP value is presented in Table 7.

Table 7. Willingness to Pay (WTP) Value

WTP value	In	N	P	Total WTP (Rp)
50.000	15	30	6.244	156.100.000
100.000	10	30	6.244	208.133.333
150.000	5	30	6.244	156.100.000
200.000	0	30	6.244	0
250.000	0	30	6.244	0
Amount of WTP (Rp)	30	-	-	502.333.333
Average WTP (Rp/KK)				80.450

Table 7 shows that the respondents' willingness to pay (WTP) is IDR 50,000, IDR 100,000, and IDR 150,000 per year. The total willingness to pay (WTP) of respondents was IDR 502,333,333. So, the average respondent's willingness to pay is IDR 80,450 per head of family. This result is in line with the research results of Noor (2018), that the Willingnes to Pay Sungai Tamban Muara, Barito Kuala District is IDR 80,000/KK. Furthermore, research results (Matondang & Suseno, 2020) show that the average WTP of the community for efforts to conserve water resources in Sukadam Village is IDR 11,667. This means that people are willing to pay a fee of Rp. 11,667/KK/Month as a form of contribution to preserving water resources in Sukadam Village.

Conclusion

The response of the community around the tofu-making business to the social environment is in the category of not providing employment and education opportunities for children in the surrounding community. The community's response to economic aspects is in the disagree category, meaning that the tofu-making business has no impact on increasing people's income and purchasing power. Respondents disagreed that tofu liquid waste disturbed the surrounding environment. Before being discharged into waterways, liquid waste goes through a processing process in a wastewater treatment plant (IPAL) so that liquid waste discharged into rivers is free from chemicals and odor. Meanwhile, solid waste is sold for animal feed. Value of willingness to pay (*willingness to pay*) community to maintain the value of the surrounding ecosystem amounting to IDR 80,450/year/KK as the community's contribution to preserving water and air resources.

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Author Contributions

NL, IR: Developing ideas, overseeing data collection, analyzing data, writing, reviewing, responding to reviewers' comments; SNS, MK: analyzing data, reviewing scripts, and writing.

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Conflicts of Interest

The authors declare no conflict of interest.

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