



UDC 332

STUDY OF ECONOMIC SUSTAINABILITY IN THE FRESH AND PROCESSED PORK INDUSTRY: IMPACT ON INCOME IN KUPANG CITY

Nalle Agus A.*, Queen Maria R. Deno

Faculty of Animal Husbandry, Marine and Fisheries, University of Nusa Cendana,
Kupang, East Nusa Tenggara, Indonesia

Asa Halena Meldy

Faculty of Medicine and Veterinary Medicine, University of Nusa Cendana,
Kupang, East Nusa Tenggara, Indonesia

*E-mail: agusnalle@staf.undana.ac.id

ABSTRACT

The fresh pork and pork product business in Kupang City is rapidly growing due to increasing demand. This study aims to analyze the sustainability of this business from social, economic, and environmental dimensions. A survey was conducted among business operators across six districts, with a sample size of 70-80% of the population using purposive sampling. Data were analyzed using Multi Dimensional Scaling (MDS) with the Rapfish approach, and leverage analysis was used to identify sensitive attributes. Results indicate that the economic and social dimensions have moderate sustainability indices (57.86 and 55.80), while the environmental dimension is less sustainable (44.74). The three most sensitive attributes are raw material availability, worker protective equipment, and water sources supporting the business. Appropriate government policies are needed to guide and supervise this sector to enhance its sustainability.

KEY WORDS

Pork, sustainability, Kupang city, MDS, Rapfish.

The livestock industry has long been a major driver of local economies, especially in areas that rely on agriculture and livestock as their primary source of income. In many areas, this sector not only provides food, but also creates jobs and drives regional economic growth. Kupang City, as the economic center of East Nusa Tenggara, has great potential to develop the livestock sector, especially the pork industry, which is expected to be a driving force for the local economy. According to research, the secondary and tertiary sectors of the economy can create a multiplier effect that has the potential to improve community welfare in a sustainable manner through job creation and increasing local income (Greenford et al., 2020).

The pork industry in Kupang, both in the form of small businesses and household scale, has grown rapidly in recent years. The increasing demand for pork, both for local consumption and wider market needs, is one indicator that this industry has significant economic prospects. In many countries, the pork industry is considered an important component of the livestock sector and is often the main source of income for small and medium-sized business actors. In Italy, for example, the economic sustainability of the pig slaughtering industry plays a significant role in the economic stability of local communities and is considered an integral part of the food supply chain (Bonazzi et al., 2021).

However, the industry is not without its challenges, especially in terms of environmental and social sustainability. Global pork production is known to contribute to nitrogen pollution, which results in water and air pollution, as well as significant greenhouse gas emissions (Uwizeye et al., 2019). Other studies show that this industry has a greater environmental impact when compared to other sectors with lower emissions (McGlone, 2013). In addition, research in Canada shows that waste management methods have a significant impact on the carbon footprint of the pig industry. The analysis results show that good feed and waste



management can reduce emissions, but in reality these methods are often not adopted by small-scale farms due to resource constraints (Vergé et al., 2016).

In Kupang City, the home-based pork industry has become a source of livelihood for many families, but poor management practices pose a challenge. Some small businesses in the area still rely on informal sales systems that often do not meet hygiene and sanitation standards, potentially endangering public health. This condition is similar to that found in Ecuador, where the management of pig slaughter by-products in inadequate facilities causes environmental pollution and has negative impacts on public health (Pazmiño & Ramirez, 2021).

Economically, small and medium enterprises in the pork industry in Kupang face challenges in accessing markets and capital. Many of them rely on local markets and often face price fluctuations that threaten financial stability. These challenges are similar to those faced by small businesses in several other developing countries. In India, for example, micro, small and medium enterprises contribute almost 8% of GDP, but are also responsible for 70% of total industrial pollution, due to limited technology and resources to implement environmentally friendly practices (Bala, 2015).

In this context, a research gap arises related to the lack of in-depth studies on the economic, social, and environmental sustainability of small-scale pork industries in developing areas such as Kupang. Most studies on pork industry sustainability focus on large-scale production or in the context of developed countries, while the impacts of small-scale businesses in developing countries, especially on local communities, are still poorly studied (Dolman et al., 2012). In addition, there is little attention to the importance of integrating social and economic aspects in the sustainability of this business, even though this aspect is very crucial for the welfare of the communities involved.

Therefore, this study offers novelty by analyzing the sustainability of the pork industry in Kupang from a holistic perspective, covering social, economic, and environmental aspects simultaneously. Not only focusing on environmental aspects, this study will also explore economic factors such as market access and income as well as social aspects such as local job creation and quality of life of the surrounding community. This approach is in line with the recommendations of studies that emphasize the need for a triple bottom line approach that integrates economic, social, and environmental sustainability to achieve sustainable results (Spies, 2003).

Thus, this study is expected to contribute to understanding the dynamics of the pork industry in areas such as Kupang, as well as providing insight into the formulation of policies that better support the sustainability of small and medium enterprises in this sector. Through the findings of this study, it is expected that the government and other stakeholders can develop effective strategies to improve production efficiency, reduce environmental impacts, and improve the economic welfare of the community in this sector.

METHODS OF RESEARCH

The research was conducted in Kupang City, with a research period from May to October 2024.

The data types are quantitative and qualitative, which are sourced from primary and secondary sources. Primary data comes from the results of interviews with respondents who run fresh pork and processed pork businesses, as well as other experts directly related to the existing research problem. Secondary data comes from various reports and/or other documents related to this research.

The respondents of this study were entrepreneurs who focus on fresh pork and its processed products spread across all sub-districts in Kupang City. Considering that the number of entrepreneurs in question is not large, the number of respondents taken was 70-80% of the existing population and was taken purposively.

In addition to business respondents, data collection was also carried out from decision makers, academics and the community to determine their responses and assessments regarding business sustainability from an economic, social and environmental perspective.



Data collection was conducted through surveys with interviews and observations. Interviews were conducted with respondents and were guided by a structured questionnaire. Observations were conducted directly at the business units implemented by the respondents.

Data analysis using Multi Dimensional Scaling (MDS) with Rapfish approach technique (Kavanagh, 2001; Pitcher and Preikshot, 2001; Kavanagh and Pitcher, 2004). Leverage analysis is used to determine various sensitive economic, social and environmental dimension attributes that affect the sustainability of the business being implemented. Monte Carlo analysis is used to evaluate the effect of attribute errors at a 95% confidence level (Isyanto and Dehen, 2015).

RESULTS AND DISCUSSION

The analysis of the sustainability of fresh pork and processed pork businesses in Kupang City was conducted using the MDS Rapfish approach for three dimensions, namely the economic dimension, the social dimension, and the environmental dimension. Each dimension is derived into ten attributes as presented in Table 1.

Table 1 – Dimensions and Attributes of Sustainability of Fresh Pork and Processed Pork Business in Kupang City

No	Dimensions	Attribute
1.	Economy	Initial business capital
		Operating revenues
		Business Interest
		Availability of Raw Materials
		Selling price
		Request
		Business Scale
		Availability of Labor
		Labor Wages
		Capital Assistance
2.	Social	Entrepreneur Education
		Community Acceptance
		Health and Work Accident Insurance
		Concern for the Surrounding Community
		Work Safety and Comfort
		Personal Protective Equipment (PPE) for Workers
		Minimum Wage Rate (UM) for Workers
		Worker Wage Differences
		Worker Capacity Building
		Social Assistance for the Surrounding Community
3.	Environment	Liquid Waste Handling System
		Ambient Water Quality Control
		Air Quality/Odor Control
		Solid Waste Handling System
		Handling of Solid Waste Accumulation
		Water Sources to Support Business
		Availability of Water to Support Business
		Fuel Source
		Waste Treatment before Disposal
		Waste Recycling

The attribute assessment uses an ordinal scale from 0 (bad) to 3 (good) which is a description of each of these dimensions. The results of the analysis show that the economic and social dimensions are in the fairly sustainable status category with values of 57.86 and 55.80 respectively. Meanwhile, the environmental dimension has a less sustainable status category with an index value of 44.74 (Figure 1).

The results of the analysis indicate that the economic and social dimensions are still relatively better than the environmental dimension. The index of each dimension, although having different values, interacts proportionally with each other. Thus, changes that occur in



one dimension will directly or indirectly affect changes in other dimensions. Syarifuddin (2009) stated that the concept of sustainable development does not indicate all index values that are the same but strives for each dimension to be in a category of sufficient or good sustainability status. Therefore, in order to ensure the sustainability of the fresh pork and processed pork business in Kupang City, it is necessary to improve various sensitive attributes of the existing economic, social and environmental dimensions.

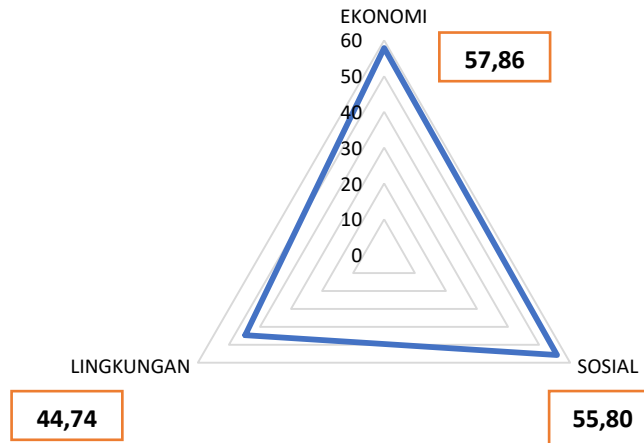


Figure 1 – Sustainability Index Flyover Diagram, Fresh Pork and Processed Meat Business in Kupang City

Information: *Ekonomi: Economic, Lingkungan: Environmental, Sosial: Social*

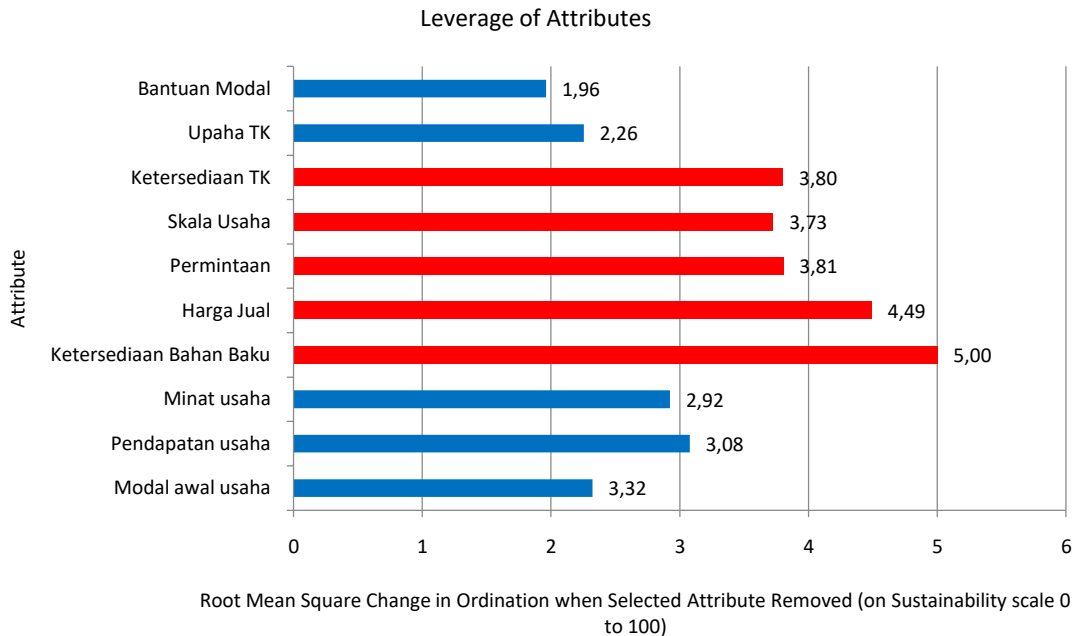


Figure 2 – Results of Economic Dimension Leverage Analysis

Information: *Bantuan Modal: Capital Assistance, Upaha TK: Labor Wages, Ketersediaan TK: Labor Availability, Skala Usaha: Business Scale, Permintaan: Demand, Harga Jual: Selling Price, Ketersediaan Bahan Baku: Raw Material Availability, Minat usaha: Business Interest, Pendapatan usaha: Business Income, and Modal awal usaha: Initial Business Capital.*

The results of the leverage analysis found five attributes from the sensitive economic dimension that affect sustainability, namely the availability of raw materials, selling prices, demand levels, business scale and availability of labor (Figure 2). Based on the results of the



analysis, it is believed that from the economic dimension, the sustainability of fresh pork and processed meat businesses in Kupang City can still be improved if a number of sensitive attributes are improved. This condition cannot be separated from the characteristics and conditions of the businesses run by traders/sellers who are still very dependent on the availability of raw materials in the form of live pigs obtained from community farms in Kupang City or from outside Kupang City (such as Kupang Regency and other Timor mainlands) even in limited quantities also come from districts outside Timor mainland.

On the other hand, the fresh pork sales business unit is still facing the need for capital to increase the scale of the business. Efforts to fulfill capital through loans are still faced with legal constraints that are generally not owned as formal requirements from formal financial institutions. Likewise, the location of the business is not fixed and is at risk of certainty of sustainability is often a consideration in efforts to increase the scale of the business.

The selling price attribute is also quite sensitive in influencing sustainability, including when compared with the demand level attribute. The level of competition between fresh pork entrepreneurs/traders, consumer purchasing power, seasonal factors and the influence of substitution with similar products (such as the price of chicken, fish and others) are estimated as variables that determine the certainty of price and demand level. Even the situation above is increasingly determined by the availability of labor which is generally not a permanent workforce and more of a family workforce.

Given the various conditions that exist, targeted policies and government intervention are very necessary, through coaching and supervision of existing businesses, considering that in the medium and long term, it is a prospective business not only for the welfare of entrepreneurs but also in driving the economy and micro, small and medium enterprises in Kupang City in a sustainable manner.

The results of the social dimension leverage analysis obtained five attributes that are sensitive to the sustainability of fresh pork and processed pork businesses in Kupang City, as presented in Figure 3. These five attributes can be classified into groups of attributes of security, comfort and worker safety, worker welfare and concern for the surrounding community.

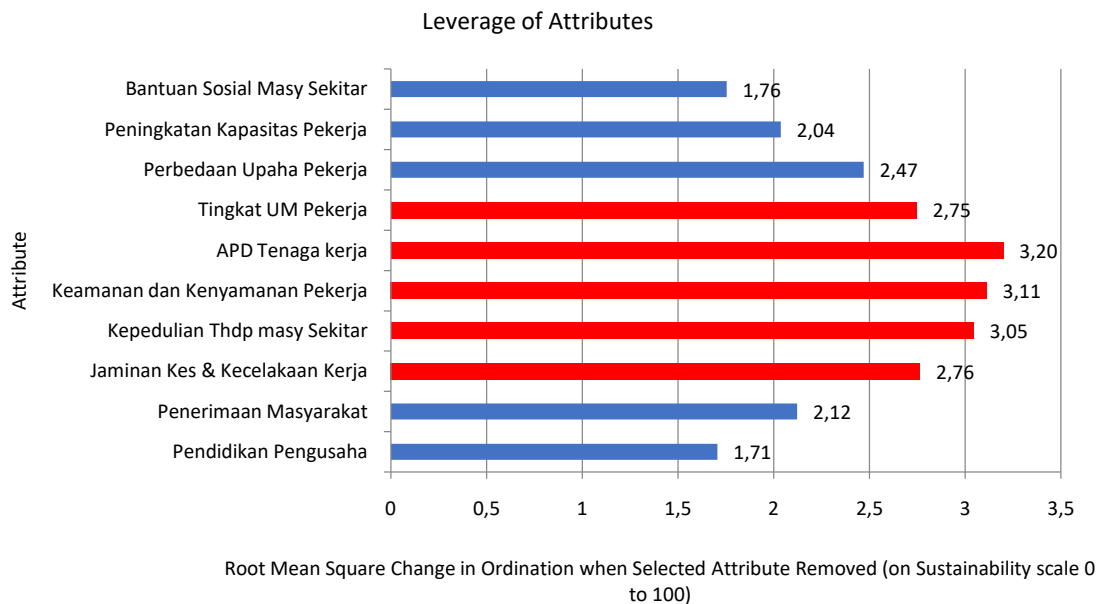


Figure 3 – Results of Social Dimension Leverage Analysis

Information: Bantuan Sosial Masy Sekitar: Social Assistance for Surrounding Communities, Peningkatan Kapasitas Pekerja: Capacity Building for Workers, Perbedaan Upaha Pekerja: Wage Differences Among Workers, Tingkat UM Pekerja: Minimum Wage Level for Workers, APD Tenaga Kerja: Personal Protective Equipment for Workers, Keamanan & Kenyamanan Pekerja: Safety and Comfort of Workers, Kepedulian Thdp Masy Sekitar: Concern for Surrounding Communities, Jaminan Kes & Kecelakaan Kerja: Health and Work Accident Insurance, Penerimaan Masyarakat: Community Acceptance, Pendidikan Pengusaha: Entrepreneur Education.



The non-use of personal protective equipment (PPE) when workers carry out their activities at all stages of the business, and the non-inclusion of workers in health insurance and work accident programs (such as BPJS TK), is estimated to have an impact on the safety, comfort of workers and has the potential to lead to uncertainty about business sustainability. Another important attribute is the level of minimum wages for workers. The dominant business is a non-formal business, where most do not have legal permits for the business, resulting in no obligation for business actors to provide wages for workers in accordance with the regional minimum wage applicable in Kupang City. The wage level imposed is solely based on bargaining between the two parties.

On the other hand, concern for the surrounding community is also a sensitive attribute in ensuring business sustainability. This is closely related to the location of the business around the settlement, so that both directly and indirectly it will interact with the surrounding community. In such conditions, it is very necessary for business actors to care about the surrounding community which can be realized such as worker recruitment, assistance/donations for the local government (RT/RW) during national holidays or various other forms of social assistance.

The results of the leverage analysis on the environmental dimension obtained 5 attributes that are sensitive to business sustainability, namely water sources supporting the business, availability of water supporting the business, handling of solid waste accumulation, solid waste handling systems and fuel sources. If the handling and improvement of a number of attributes in question, it is estimated that it can guarantee the environmental sustainability of the business being run.

Most business units have not implemented a good solid waste management system, resulting in the accumulation of solid waste both around production locations and marketing locations. If this condition is not addressed, it can have a negative impact on the surrounding environment such as an unpleasant odor, especially during the rainy season.

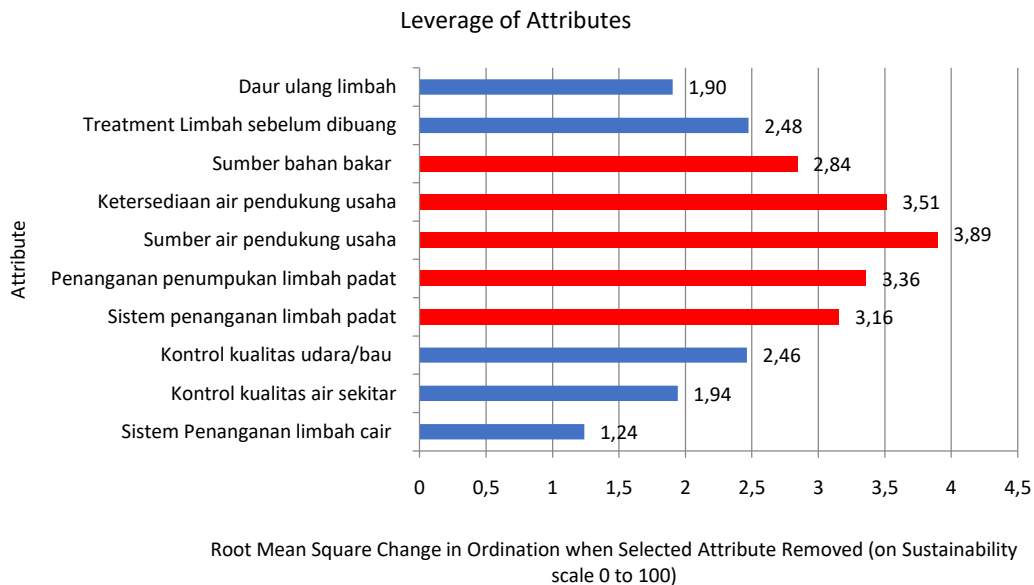


Figure 4 – Environmental Dimension Leverage Analysis Results

Information: Daur Ulang Limbah: Waste Recycling, Treatment Limbah Sebelum Dibuang: Waste Treatment Before Disposal, Sumber Bahan Bakar: Fuel Source, Ketersediaan Air Pendukung Usaha: Availability of Water for Business Operations, Sumber Air Pendukung Usaha: Water Source for Business Operations, Penanganan Penumpukan Limbah Padat: Management of Solid Waste Accumulation, Sistem Penanganan Limbah Padat: Solid Waste Management System, Kontrol Kualitas Udara/Bau: Air Quality and Odor Control, Kontrol Kualitas Air Sekitar: Surrounding Water Quality Control, Sistem Penanganan Limbah Cair: Liquid Waste Management System.

Other environmental attributes that are also sensitive to business sustainability are the source and availability of water to support the business. Likewise, the source of fuel in this case is firewood which is predominantly used by business actors. In supporting the fresh



pork and processed pork business, generally business actors use water from PDAM, buy from water tanker services and/or privately owned groundwater (wells). With such conditions, most business actors admit that they often face scarcity of water and firewood which are very much needed to support the business. This condition will certainly have an impact on the continuity and sustainability of the business being run.

Based on the phenomena faced, especially regarding the sensitive attributes of each economic, social and environmental dimension, and then the handling efforts are very necessary to ensure the sustainability of the business in a sustainable manner. The expected sustainability is not only determined by one dimension alone, but the interaction of the three dimensions and including sensitive attributes. Thus, strategies and anticipatory steps taken by business actors are very necessary, not only to ensure business sustainability but also to have an impact on economic, social and environmental development in Kupang City and its surroundings. Likewise, policies and intervention from the Kupang City government are needed in carrying out guidance, supervision and control of the current fresh pork and processed pork businesses.

In essence, Monte Carlo analysis is used to determine the magnitude of the error factor (error) caused by differences in respondent assessments of attributes, errors in data entry, or incomplete data (Kavanagh, 2001). The results of the Monte Carlo analysis of fresh pork and processed meat businesses in Kupang City are presented in Table 2.

Table 2 – Monte Carlo Analysis Results Based on Sustainability Dimensions

Dimensions	Sustainability Index		Difference	Str.	R2
	MDS	Monte Carlo			
Economy	57.86	57.58	0.28	0.2373	0.8682
Social	55.80	55.26	0.54	0.2470	0.9007
Environment	44.74	43.47	1.27	0.2411	0.9011

Table 2 shows that the difference between the MDS and Monte Carlo sustainability indices shows a difference that is relatively still greater than the standard difference value set, which is less than 0.25. This is likely a relatively high level of diversity when respondents provide perceptions of questions that correspond to each existing attribute. However, if observed from the low stress value indicator and high determinant coefficient. And this condition can be a good indication of the analysis being carried out.

The stress values of the three dimensions analyzed are all less than 0.25 and the coefficient of determination is relatively large, namely between 0.86 - 0.90. These results indicate that the assessment of the level of accuracy in applying the RapiFish analysis approach to evaluate the sustainability of fresh pork and processed meat businesses in Kupang City is quite good and relevant. Kavanagh (2001), Kavanagh and Pitcher (2004), and Hasdi, et al. (2015) stated that a stress value less than 0.25 (25%) indicates that the analysis results are quite good, while a coefficient of determination value approaching 1 (100%) indicates that the selected attributes are able to explain because they are close to 100 percent of the analyzed model.

Based on the existing findings, it can be concluded that the MDS and Monte Carlo approaches involving economic, social and environmental dimensions to assess and ensure the sustainability of fresh pork and its processed products in Kupang City are quite relevant. Therefore, efforts to increase the potential for sustainability need to pay attention to and address various attributes of each dimension that are identified as sensitive attributes are very necessary.

CONCLUSION

Based on the results of the analysis, discussion, and findings of this study, it can be concluded that the economic and social dimensions show a moderate level of sustainability, with indices of 57.86 and 55.80, respectively. On the other hand, the environmental dimension has a sustainability index of 44.74, which is categorized as less sustainable. This



indicates that the environmental aspect requires greater attention in efforts to enhance sustainability in this sector. Out of the 15 attributes analyzed across the three dimensions of economy, social, and environment, there are three attributes with the highest Root Mean Square (RMS) values: the availability of raw materials, the availability of protective equipment (PPE) for workers, and water sources supporting the business activities. These attributes highlight the key factors that must be addressed to ensure the sustainability and welfare of fresh pork and pork product businesses. Given that pork products are marketed openly, often in roadside locations, there is a potential risk concerning hygiene standards. Therefore, appropriate policies and strategies from the government are required, including guidance and supervision for business operators. Additionally, group empowerment and the strengthening of legal aspects are essential to provide stronger support for business groups, allowing them to increase their capacities sustainably.

For future research, it is recommended to conduct more in-depth studies with several approaches. Firstly, developing more comprehensive sustainability indicators, especially concerning environmental aspects, is highly recommended to obtain a broader perspective on the sustainability of fresh pork and pork product businesses. Second, a longitudinal study can be conducted to observe changes in sustainability indices over time, which will provide insights into the progress and effectiveness of policies implemented in this sector. Thirdly, future studies could focus on analyzing risks to public health and environmental impacts, considering the high exposure of products in open locations, which may pose health risks.

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