

Implementation of Tofu Waste Management: A Case Study of Mekar Group Tofu Factory in Sumberejo Kulon Village, Ngunut District, Tulungagung Regency Tulungagung

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Abstract:

The tofu industry produces liquid and solid waste that can potentially pollute the environment if not properly managed. This study aims to analyze the implementation of tofu waste management at the Mekar Group Tofu Factory in Tulungagung Regency based on Regional Regulation No. 7 of 2018. This research uses a qualitative approach with data collection through observation, in-depth interviews, and documentation. The results show that waste management implementation has been carried out through four aspects of policy implementation according to George C. Edwards III: communication, resources, disposition, and bureaucratic structure. Liquid waste is treated through filtration before disposal, while solid waste is utilized as animal feed. Supporting factors include adequate facilities, strong managerial commitment, and regulatory support. However, liquid waste treatment has not fully met technical standards due to the absence of advanced wastewater treatment systems. This study highlights the need to improve wastewater treatment technology to achieve optimal environmental sustainability.

Keywords:

Policy Implementation, Waste Management

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Introduction

Waste management from industrial activities is very important to maintain environmental cleanliness and protect public health. The food industry, including tofu production, contributes greatly to meeting the needs of the community, but the process also produces waste that can pollute the environment if not handled properly (Novindri et al., 2020). The increase in small- and medium-scale industrial activities in various regions demands more integrated and sustainable waste management to maintain environmental sustainability (Rahmawati et al., 2025)

A number of tofu industries in Indonesia still face various challenges in waste management, such as the high organic content in liquid waste, the emergence of unpleasant odors, and the limited availability of adequate waste treatment facilities. These conditions often trigger various environmental problems, ranging from declining water quality to causing discomfort for the surrounding residents. Previous research explained that the disposal of tofu waste without a treatment process can cause environmental pollution and increase the value of *chemical oxygen demand* (COD) indicating the need for oxygen to chemically oxidize organic compounds in the water and *biochemical oxygen demand* (BOD) indicating oxygen consumption by microorganisms during the biological decomposition process discussing organic in water bodies (Idrus & Dewa, 2017). Therefore, a strict waste management policy is needed and easy to implement by all industry players.

Local regulations and technical provisions are an important basis in industrial liquid waste management. Tulungagung Regency Regional Regulation Number 7 of 2018 regulates the types of waste treatment services, methods of measurement, determination of levy rates, and sanctions that must be complied with by business actors. The regulation emphasizes the obligation to provide IPAL (Wastewater Treatment Plant), the implementation of periodic monitoring, and the compliance of business actors with environmental standards. Through this regulation, local governments seek to encourage the formation of industrial activities that are more environmentally friendly and sustainability-oriented (Perda, 2001).

In the local context, the Mekar Group Tofu Factory in Sumberejo Kulon Village, Ngunut Tulungagung District is one example of an industry that has been able to implement waste management effectively. The plant has built adequate waste treatment

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facilities, carried out proper waste separation, and ensured that the liquid waste produced meets environmental quality standards. In addition, Mekar Group routinely checks waste quality, implements efficient production flows, and manages solid waste such as tofu pulp into derivative products that are beneficial to the community. This condition shows that the implementation of the Tulungagung Regent Regulation at the Mekar Group Tofu Factory is running well, so that it does not cause pollution problems or complaints from the surrounding community.

From this description, this study took the title Implementation of Tofu Waste Management: A Study on Tofu Mekar Group Factory Producers in Ngunut Tulungagung. The purpose of this study is to analyze and discuss the implementation of waste management at the Ngunut Tulungagung group bloom tofu factory. By examining this case study, the research is expected to provide examples of best *practices* in the management of tofu industrial waste in Tulungagung Regency.

Policy Implementation

According to Van Meter and Horn, policy implementation is the action of various parties, both government and private, to achieve the goals set in policy decisions (Komarudin et al., 2023) Policy implementation is the stage after a law is passed. According to Ripley and Franklin in (Handoyo, 2012), this stage includes all actions after the law takes effect, such as authorizing programs, implementing policies, distributing benefits, and generating tangible outputs.

Policy implementation is a complicated process and is often influenced by political dynamics because it involves many different interests (Okhtafianny & Ariani, 2023) The Grindle implementation model emphasizes the importance of alignment between policy design and implementation, focusing on implementation actions and their impact on society (Adnyana et al., 2023). Implementation is a series of actions from various actors with the support of certain facilities and based on existing rules to achieve the goals that have been set (Kencana, 2019).

Policy implementation is also defined as various activities carried out to carry out a policy (Noviyanti et al., 2023). Policy implementation connects policy objectives and their realization through the results of government actions (Akib, 2010). Policy

implementation is important in the policy process because it emphasizes how policies are implemented in real terms (Mokodompis et al., 2019).

According to George C. Edwards III in (Dewi Sinta Oktamia, 2018), policy implementation is the stage after a policy is made, which is an implementation process that follows legislative actions, executive orders, or judicial decisions. According to George C. Edwards III, there are 4 in policy implementation, including (Mansur, 2021)

Communication. Communication plays an important role in policy implementation because it determines the implementer's understanding of policy objectives and standards. If communication is clear and consistent, policies can be implemented as intended, while poor communication can lead to misinterpretations and hinder implementation.

Resources. Resources are an important factor that includes budget, manpower, information, facilities, and technical capabilities. Without adequate resources, policies are difficult to implement optimally. Adequate resources ensure that implementers can work effectively according to policy demands.

Disposition or attitude. The disposition of the implementer includes their commitment, motivation, and willingness to implement the policy. A positive and supportive attitude will make implementation easier, while a negative attitude can slow down or even thwart its implementation.

Bureaucratic Structure. The bureaucratic structure includes work mechanisms, procedures, and division of tasks in the implementing organization. A clear structure and supported by detailed standard operating procedures (SOPs) will facilitate policy implementation, while complex or overlapping bureaucracy can hinder, slow down, and reduce the effectiveness of implementation.

Waste Management

According to the Great Dictionary of the Indonesian Language (KBBI), waste management is defined as a process, way, or action in processing waste (Prayitno, 2020) Good waste management includes comprehensive waste management so that its existence does not cause disturbances to health, aesthetics, and the environment (Sunarsih, 2014) Waste produced by industrial activities is one of the environmental issues that is quite crucial in the industrialization phase (Nasir et al., 2019)

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Waste is defined as unwanted residual material that has no economic value and is one of the main contributors to environmental pollution, which negatively impacts public health (Lismiatun et al., 2021). According to Merriam-Webster, waste is defined as *refuse from places of human or animal habitation*. Meanwhile, the World Book Dictionary describes waste as a useless or valuable material that must be disposed of (Nasir, 2012).

Regional Regulation No. 7 of 2018 and Regent Regulation No. 70 of 2020 concerning levies and obligations for liquid waste management. Tofu liquid waste treatment includes several stages (Rasmito et al., 2019)

1. Initial Shelter

Making a reservoir at a waste treatment plant (mini IPAL) so that waste is not directly dumped into the river. According to the → Regional Regulation, there must be a shelter stage.

2. Initial screening

Separating the remaining small solids for more effective fermentation.

3. Fermentation to make liquid organic fertilizer (POC)

Put the liquid waste into a closed drum. Add:

- EM-4 (microbial inoculan)
- Brown sugar/molasses
- Water (to optimize fermentation volume).
- Fermentation $\pm$ 14 days under anaerobic conditions.

4. Maturation & filtration

After fermentation is complete, → is filtered and put in jerry cans.

5. Utilization or distribution

Used as liquid organic fertilizer or sold.

Utilization of solid waste treatment (Kaswinarni, 2007)

1. Tofu Pulp as Animal Feed

1. The pulp is squeezed, dried, and then stored in a sack.
2. It can be mixed with bran, ground corn, or fermented probiotics

Based on the above understanding, it can be concluded that waste management is a planned effort to process and handle waste that has no economic value so as not to cause pollution or disturbances to health, aesthetics, and the environment, especially because

waste, as an unwanted byproduct, has become a major issue amid increasing industrial activity.

Methodology

This research uses a qualitative approach to explore and understand in depth the implementation of waste management implemented by the Mekar Group Tofu Factory (Nurhajati, 2011) The qualitative method was chosen because it is able to explore social phenomena, operational practices, and behaviors of industry players in the local context as a whole. The data source was obtained through direct observation in the factory environment and in-depth interviews with the management and several communities around the Tahu Mekar Group Factory.

The research location was carried out at the Mekar Group Tofu Factory in Sumberejo Kulon Village, Ngunut Tulungagung District. A literature study was conducted by examining various theories of policy implementation, regulations regarding industrial waste management, and previous research relevant to waste management at the Mekar Group Tofu Factory (Herlina et al., 2024)

Data validity in this study was ensured through source triangulation by comparing information obtained from interviews, observations, and documentation. The data analysis technique used includes data reduction, data display, and conclusion drawing.

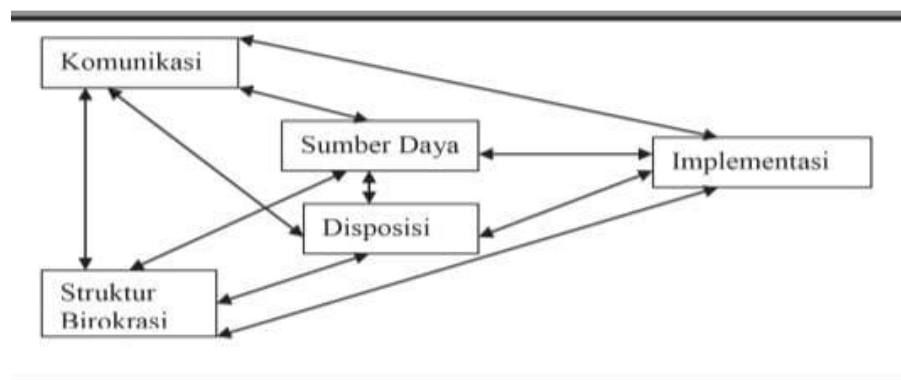


Figure 1
Policy Implementation Model (George C. Edwards III, 1980)
Source: <https://share.google/images/YXhIAY3Bm3CJ2DOnO>

Result and discussion

From the results of the interview, it can be concluded that the manager of the Mekar Group tofu factory is the right and efficient figure in applying the principles of implementing tofu waste management in accordance with field conditions. This can be seen from his ability to provide real examples related to the importance of waste treatment and become a role model for workers and the surrounding community. The manager understands his duties and roles in ensuring that the production process runs without causing adverse environmental impacts, compliance with regulations, and common interests. This approach encourages increased awareness and involvement of workers and the community in protecting the environment through more responsible waste management practices.

According to George Edward III in (Ramadhan et al., 2016) there are 4 stages to the implementation of policies in tofu waste management, namely:

1. Communication

The Tahu Mekar Group Factory has a good coordinating relationship with local governments, especially with the agencies responsible for environmental supervision. The agency periodically makes visits to provide direction, guidance, and ensure that the waste management process is in accordance with applicable regulations. This situation helps plant managers clearly understand the steps that must be implemented, from waste separation, liquid waste filtration, to solid waste management. With a smooth flow of information, the implementation of waste management policies can run more optimally and effectively.

2. Resources

The Mekar Group Tofu Factory has adequate facilities to carry out waste management. Solid waste from the production process is reused as animal feed so that it does not accumulate or cause environmental problems. Meanwhile, liquid waste is flowed into the river after going through the filtration process, so that odors can be minimized and the quality of wastewater is maintained so as not to pollute the surrounding environment. In addition, the existence of routine coaching from the agency provides support for non-physical resources in the form of knowledge,

technical assistance, and supervision of regulations, which further strengthens the implementation of waste management policies at the factory.

3. Disposition

The attitude of factory managers is one of the key factors in the successful implementation of the policy. From the results of our research, the managers of Tahu Mekar Group show a strong level of awareness and willingness to follow the provisions related to waste management. The surrounding community also did not submit complaints, because waste management has been carried out properly so that it does not cause a strong odor or environmental pollution. This positive attitude reflects that the commitment of the implementing party to the rules is strong enough and contributes to supporting the effectiveness of policy implementation.

4. Bureaucratic Structure

The bureaucratic structure that regulates waste management in Tulungagung Regency through the Regent's Regulation provides clear guidelines for small and medium industry players, including tofu mills. The Mekar Group Tahu Factory has carried out these procedures, such as filtering liquid waste, maintaining the cleanliness of the disposal line, and utilizing solid waste more productively. Because the technical provisions set are simple but still directed, the factory can run the production process without major obstacles and remain within the corridor of government regulations. This uncomplicated policy structure also facilitates implementation at the field level.



Figure 2

The Tofu Making Process

Source : Tahu Mekar Group Factory Sumberejo Kulon Ngunut Village,
Tulungagung 2025

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The management of liquid waste at the Tahu Mekar Group Factory is carried out through a filtration process before being discharged into the river. Although the waste management has been implemented properly, there is still a gap between the current practice and the ideal technical standards of wastewater treatment, particularly due to the absence of advanced treatment systems such as anaerobic reactors or complete wastewater treatment plant (WWTP) units. Based on the results of observations and interviews, this filtration process functions to separate suspended solids and reduce odors before the waste is released into the waterstream. This method shows that the factory has carried out the initial form of treatment and does not dispose of the raw waste directly.

Thus, Mekar Group's liquid waste treatment has fulfilled the basic principles of waste management, namely separating and initial treatment, but has not fully met the standards for liquid waste treatment as required by the Regional Regulation, because there are no advanced treatment units such as precipitation, coagulation-flocculation, anaerobic fermentation, or a simple wastewater treatment plant (IPAL) reactor.



Figure 3

Tofu Solid Waste

Source : Tahu Mekar Group Factory Sumberejo Kulon Ngunut Village,
Tulungagung 2025

The management of solid waste at the Mekar Group Tofu Factory shows strong conformity with the provisions of the Regional Regulations of Tulungagung Regency, especially related to the principles of waste reduction and utilization. Solid waste in the

form of tofu pulp is not thrown away, but is reused as animal feed by the surrounding community. The use of tofu pulp as animal feed not only reduces the potential for odor pollution and waste accumulation, but also provides additional economic value for the community, thereby creating a positive reciprocal relationship between industry and the environment. Thus, it can be concluded that the solid waste management at Mekar Group has met the standards of good practice required by the Tulungagung Regional Regulation because it is able to overcome potential pollution while providing social and economic benefits in a sustainable manner.



Figure 4

Tofu Liquid Waste

Source : Tahu Mekar Group Factory Sumberejo Kulon Ngunut Village,
Tulungagung 2025

Although the findings have explained the implementation of waste management based on qualitative analysis, this study does not include quantitative measurements such as Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). As a result, the level of wastewater pollution cannot be measured objectively. Therefore, the inclusion of quantitative data is necessary to strengthen the validity and comprehensiveness of the research findings.

This study has several limitations. First, this research only focuses on a single case study, so the findings cannot be generalized to all tofu industries. Second, the number of

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informants is limited, which may affect the comprehensiveness of the data obtained. Third, this study does not include quantitative measurements such as Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). Lastly, the study relies on qualitative analysis, which may lead to subjective interpretation.

Conclusion

Based on the results of the analysis, it can be concluded that the implementation of waste management at the Tahu Mekar Group Factory has been running in accordance with the applicable provisions in the Tulungagung Regency Regional Regulation Number 7 of 2018 which regulates the types of waste treatment services, methods of measurement, determination of levy rates, and sanctions that must be complied with by business actors. Of the four stages, according to George Edward III, it has succeeded in implementing tofu waste management at the Mekar Group Tofu Factory in Sumberejo Kulon Village, Ngunut Tulungagung District. This success is reflected in good communication between the plant manager and the related agencies, so that information regarding technical procedures for waste treatment can be understood and applied appropriately. In addition, adequate resource support, both in the form of liquid waste filtration facilities and the use of solid waste as animal feed, also strengthens policy implementation. The attitude of managers who show a high commitment to comply with environmental regulations is also an important factor that makes there no complaints from the community and minimal pollution impacts. The bureaucratic structure and regional regulations through the Regent's Regulation that are clear and easy to apply make it easier for factories to carry out waste management. Overall, the Mekar Group Tofu Factory has been able to implement responsible waste management, thereby supporting production sustainability while maintaining the quality of the surrounding environment. To increase this effectiveness, it is recommended that factories continue to improve the quality of liquid waste treatment, including considering the use of simple waste treatment plants (IPAL) and developing innovations in the use of solid waste to have higher economic value. Local governments are also expected to strengthen technical assistance and supervision, while the community can be involved through environmental education. In addition, technical

guidelines for waste management for small industries need to be continuously updated so that policy implementation is more consistent and sustainable.

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Disclosure statement

The authors declare that there is no conflict of interest regarding the publication of this research. This study was conducted independently and objectively without any financial, personal, or institutional interests that could influence the research results or their interpretation.

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