

Analysis Of Environmental Health Impacts And Socio-Economic Impacts On The Rice Milling Industry

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Abstract

This study aims to analyze the environmental health and socioeconomic impacts of the traditional rice milling industry in Tasikmalaya, focusing on potential hazards such as dust, noise, vibration, and hot working conditions that affect the health of workers and the surrounding community. The research method used was qualitative descriptive through field observations, interviews, and documentation of key informants and supporters, both from among workers and local residents. The results show that the highest dust concentrations are found around the milling and polishing machines, which have the potential to cause respiratory disorders. The continuous noise from the Fuso machines exceeds safe limits and threatens hearing function, while machine vibrations affect environmental comfort and building stability. Hot working conditions with poor ventilation cause discomfort and the risk of dehydration for workers. From a socioeconomic perspective, the rice milling industry makes an important contribution by creating jobs, increasing farmers' incomes, and strengthening the economic resilience of the community. However, there have also been changes in social structure and interaction patterns that tend to be more individualistic. This study concludes that risk control through dust management, noise reduction, and ventilation improvements is necessary to protect worker health and ensure the environmental and social sustainability of the rice milling industry.



Keywords: Dust, Vibration, Working Environment, Noise, Environmental Health, Socio-Economics

INTRODUCTION

It is very important to understand the social and environmental health effects of the conventional rice milling industry, especially at the local level, such as the rice mill in Tasikmalaya. Although this industry plays an important role in the agricultural ecosystem and provides income and employment for the surrounding community, its activities endanger the health of workers and disturb the comfort and health of nearby residents due to dust, noise, and vibrations from the milling machines. Therefore, it is important for this study to provide a comprehensive overview of local ways to control risks and improve the welfare of the community (Rahmantisa et al., 2022). This study is also relevant on a national scale because rice milling is an industry that involves many business units throughout Indonesia, especially small and medium-sized enterprises. Social and environmental problems that arise in one small location can reflect broader issues at the national level, where the balance between economic development and health and environmental protection is a major challenge (Widodo, 2020). With this understanding, research can contribute to better policies for the agro-industrial sector in Indonesia to ensure social and environmental sustainability.

The focus of this study is to analyze the environmental health impacts and socioeconomic impacts arising from rice milling activities in Tasikmalaya City. This study examines how physical conditions in the work environment, such as dust, noise, machine vibrations, and hot working conditions, affect the welfare of workers and the community surrounding the factory. The study also looks at social aspects, such as the industry's contribution to the local economy through job creation and its role as a family business that has been operating for 12 years. The study was conducted using field observation and data collection through questionnaires administered to workers and the surrounding community to obtain an empirical picture of the perceived impacts. This study focuses on rice mill workers and communities living near rice mills. The study was conducted in Kawalu District, Tasikmalaya City, at a rice mill that has been operating since 2013. The conditions observed were high dust concentrations, noise from Fuso trucks, which are the main means of transportation, and vibrations that could be felt in nearby buildings. Poor temperature and air circulation in the work environment also pose problems that affect the comfort and health of workers. This study also measured the levels of dust, noise, and vibration exposure and their direct impact on the health and socioeconomic conditions of workers and the



surrounding community, including the long-term risk of lung disease and hearing impairment due to exposure to this work environment. This empirical explanation is important for developing better risk management recommendations in the traditional rice milling industry.

Rice milling is part of the agricultural sector that plays a crucial role in the rice production chain in Indonesia. More than 182,000 rice milling businesses operate in Indonesia, with most of them classified as small and medium-sized industries. This industry processes rice grains into ready-to-consume rice through several stages, starting from the receipt and weighing of rice grains, drying, husking, polishing, to weighing and packaging. The existence of the rice milling industry not only accelerates the post-harvest process and improves rice quality, but also contributes to the community's economy by creating jobs for the local workforce. In Indonesia, most rice mills still operate traditionally without implementing optimal environmental health standards. This causes potential negative impacts, such as air pollution from husk dust and noise from milling machines, which can affect the health of workers and the surrounding community.

One of the long-established rice milling industries is the Rice Milling Business. This business is a family-run enterprise that has been managed from generation to generation. Located on Jalan Letjen Mashudi, Karsamenak, Kawalu District, Tasikmalaya City, this industry has been operating for 12 years and has become an important part of the local community's agricultural ecosystem. With an area of approximately 1,890 m² and a 280 m² ditch, the location of this industry is strategic, easily accessible, and has adequate parking facilities, making it easy for farmers to use the milling services.

RESEARCH METHOD

This study uses a qualitative descriptive analysis method kualitatif (Creswell & Creswell, 2018; Upe, 2022) namely describing the potential hazards arising from rice milling activities at rice mills (based on field observations and information gathered from selected respondents). Data collection techniques included observation, interviews, and documentation (Grace et al., 2023). The location of this study was the working environment of a rice milling industry in Tasikmalaya City. The technique used to determine informants was key informants and supporting informants. Data were collected from informants using interviews that had been determined based on items related to potential physical and chemical environmental hazards to rice milling workers and socio-economic impacts.



RESEARCH RESULTS AND DISCUSSION

A. Rice Milling Production Process

Rice milling is a family business that has been passed down from generation to generation. Located on Jalan Letjen Mashudi, Karsamenak, Kawalu District, Tasikmalaya City. This industry has been operating for 12 years and has become an important part of the local community's agricultural ecosystem. With an area of approximately 1,890 m² and a 280 m² ditch, the location of this industry is strategic, easily accessible, and has adequate parking facilities, making it easy for farmers to use the milling services.

1. Rice Grain Receipt and Weighing

At this stage, rice grains obtained from farmers are weighed using a hybrid scale to determine their quantity and initial quality. This process aims to ensure the accuracy of the quantity of rice grains to be processed and to assess their characteristics before entering the next stage of processing. At this stage, rice grains are obtained from farmers. They are then weighed using modern and accurate hybrid scales to ensure that the amount of rice grains received matches what the farmers have reported. In addition to quantity, this weighing process also helps assess the initial characteristics of the rice grains, such as moisture content and raw material quality, which will affect the final rice production yield. Care and accuracy in weighing are very important to maintain farmers' trust in the milling process while optimizing production efficiency (Hastang et al., 2017; Mukaromah et al., 2022).



Figure 1. Weighing Rice Grains

2. Drying Rice Grains

After weighing, wet rice grains must be dried until the moisture content reaches 14% to



prevent damage during milling. Drying is done naturally by drying the grain directly under the sun on a drying floor or tarpaulin so that the grain does not mix with dirt and remains clean, with periodic turning so that it dries evenly. The natural drying method is very efficient and environmentally friendly because it does not require fuel or electricity operating costs, and is easy for farmers and small-scale industry players to implement. However, its weakness is that it is highly dependent on weather conditions. During the rainy season, the drying process can be disrupted, making it difficult to achieve optimal moisture content in the grain, increasing the risk of mold damage and reducing the quality of the rice produced. Therefore, proper monitoring and management of the drying process is necessary to avoid post-harvest losses (Aristia, 2021; Maryana & Meithasari, 2017). By maintaining optimal moisture content through proper drying, milling can produce rice with good quality and long shelf life during storage, while minimizing yield losses that impact farmers' income and the rice milling industry.



Figure 2. Drying Rice Seeds

3. Rice Husk Removal

Once the rice grains have reached the optimal moisture content, the next step is to remove the husk using a husking machine. This stage aims to separate the husk from the brown rice. The result of this process is brown rice, which still has the aleurone layer and husk, which are the main waste products of rice milling.

The result of this husking process is broken rice that still has the aleurone layer (bran) and husks, which are the main waste products of rice milling. This husking stage is usually carried out twice, accompanied by sifting to separate the broken rice from the unhusked grain. Proper husking greatly determines the quality of broken rice that will be further processed in the polishing stage

to produce white rice ready for consumption. Husk waste can be used as fuel or animal feed, so this process also supports resource efficiency (Lianto, 2025; Oppong Siaw et al., 2023). Using a husker machine makes the husking process more efficient, faster, and more consistent compared to traditional methods, which is important for meeting large-scale rice production needs while maintaining the quality of the final product. Optimal machine settings minimize rice damage and increase production yield.



Figure 3. Peeling the Skin

4. Polishing

After the husking process, the broken rice is further processed through a polisher to remove the aleurone layer that still clings to the rice grains. This process produces white rice with a smoother texture and brighter color. The polishing process is a further stage after husking, which aims to remove the aleurone layer on the surface of broken rice to produce white rice with a smoother texture and brighter appearance. In this process, broken rice is fed into a polishing machine that works by rubbing the rice against polishing components such as grinding stones or polishing cylinders. This friction removes the fine bran layer attached to the rice, making it cleaner and shinier.

However, this polishing process also generates heat due to friction, which can cause the rice grains to break more easily. To overcome this, the polishing machine is equipped with an air cooling system that circulates air into the polishing chamber to lower the temperature of the rice (Shinji Maruyama & Iyanaga, Ken Kobayashi, Hisashi Hukuda, Kunio Shigaki, 1988). The polishing duration and machine pressure need to be adjusted appropriately to optimize the white rice yield without causing too much damage. In addition, the bran dust released during this process is filtered and drained out of the machine so that it does not mix with the rice. The polishing process

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increases the selling value of rice by producing a more attractive, cleaner, and longer-lasting end product, making it very important in the high-quality rice production chain.



Figure 4. Polishing

5. Weighing and Packaging

After going through the polishing process, the rice is weighed again using digital scales or frog scales, as needed. This weighing is intended to ensure that the amount of rice produced is in accordance with the desired measurement. After that, the rice is packaged in various sizes to maintain its quality and facilitate the distribution and marketing processes.

Interviews with workers revealed that high temperatures affect work comfort, as evidenced by workers' habit of wearing light clothing such as short-sleeved shirts. The rear of the production area tends to be more humid than other areas because it is not exposed to direct sunlight and has limited ventilation. In the rice milling industry, it was found that the main source of noise comes from the Fuso engines used in the milling process. Several workers reported experiencing a decline in their hearing ability. It was also found that the main source of vibration comes from the Fuso engines used as the main drive for the rice milling machines (Turcot et al., 2015). The production process uses diesel fuel because it improves engine performance. In addition, the use of diesel fuel has become a tradition and habit among rice mills. At this location, steam produced from the combustion of diesel fuel in rice milling machines was also found to escape outside the factory area.



Figure 5. Weighing and Packaging

During the rice drying stage, dust begins to form due to the movement of dried rice grains and wind. During the husking process using a rice husking machine, the husks that are removed produce large amounts of dust that spreads around the production area (Pranav & Biswas, 2016). The polishing stage, which aims to remove the aleurone layer to produce white rice, is also a major source of dust from bran residues dispersed in the air. The highest dust concentrations are found in the areas around the milling and polishing machines, where workers are most frequently exposed.

B. Environmental Health Impacts

1. Health Effects of Dust

In the rice milling industry, rice dust is produced through the processes of weighing, drying, husking, and polishing. Large amounts of rice dust can cause environmental pollution, and prolonged exposure to it can be harmful to workers' health. Rice dust generated during these processes can settle on roofs, where it can be blown into the environment and inhaled by workers, consumers, and the surrounding community. The rice milling work area is open, lacks adequate barriers, and is located in the middle of a residential area.

Based on Regulation of the Minister of Health of the Republic of Indonesia No. 70 of 2016 concerning Occupational Health Standards and Requirements for Industrial Work Environments, the permissible level of total dust in the air of a work environment is 10 mg/m^3 , while the level of respirable dust must not exceed 3 mg/m^3 . If the level of rice grain dust in the work environment exceeds this limit, it can increase the risk of health problems for workers. In addition, according to Regulation of the Minister of Manpower No. 5 of 2018 concerning Occupational Safety and

Health in the Workplace, exposure to particulates exceeding the threshold can cause chronic obstructive pulmonary disease (COPD) and long-term pulmonary dysfunction.

2. Health Effects of Noise

Almost every stage in the rice grain industry that uses machines produces loud noises from inside the fuso machine during the husking and polishing process. The noise produced is a continuous noise, where the fuso machine runs continuously, causing noise pollution. Based on Minister of Manpower Regulation No. 5 of 2018 concerning Occupational Safety and Health in the Work Environment, the noise threshold limit in the workplace is 85 dB(A) for exposure of 8 hours per day. If the noise level exceeds this threshold, workers must be provided with personal protective equipment (PPE) to reduce the risk of hearing impairment. Additionally, according to Minister of Environment Decree No. 48 of 1996, the noise limit for industrial areas is 70 dB(A) during the day and 65 dB(A) at night.

3. Health Effects of Vibration

The vibrations generated by production machinery in the rice milling industry not only affect workers, but also impact the quality of the working environment and the physical condition of the buildings and equipment used. Vibrations that occur continuously during the production process, especially those originating from Fuso trucks, husking machines, and polishing machines, can cause changes to the structure of the working environment, both in the short and long term. High vibrations resulting from rice milling industry activities also have the potential to disturb the surrounding environment, especially for residents living near industrial areas. Vibrations from large machines that operate for long periods of time can be felt in the homes of residents living near the factory, especially if the buildings are not structurally sound enough to withstand them.

Based on Regulation of the Minister of Health of the Republic of Indonesia No. 70 of 2016, vibration is included in the physical factors of the work environment that need to be controlled to prevent negative impacts on the health and safety of the work environment. In addition, according to the ISO 2631-2:2003 standard, the permissible vibration level for buildings and work environments is less than 0.15 m/s^2 to avoid negative impacts on building structures and environmental comfort. If the vibration value exceeds this threshold, it can cause disturbances to the stability of the building and increase the risk of damage to industrial equipment.



4. The Impact of Work Culture

In the rice milling industry, heat comes from the production process, worker density, the sun, the roof, and rice husk dust. Open work areas with minimal ventilation cause heat generated by milling machines to be distributed unevenly and affect the overall room temperature. This heat is mainly generated by friction between the rice and the milling machine and from the husk separation process. The zinc or asbestos roof absorbs heat, and with around 25 workers in a room measuring $\pm 50 \text{ m}^2$, this exacerbates the hot working environment and poses a risk to workers' health. Mitigating the impact. This can cause discomfort to the surrounding community and increase the risk of minor damage to residential buildings, such as cracks in walls or damage to household furniture that is sensitive to vibrations.

Based on Minister of Manpower Regulation No. 5 of 2018, the threshold value for working climate is determined based on the Wet Bulb Globe Temperature (WBGT) index. For moderate work, the permissible WBGT value is 26.7°C , while for heavy work it is 25.0°C . If the ambient temperature exceeds these limits, measures must be taken to reduce the heat load on workers. In addition, according to Indonesian National Standard (SNI) 16-7063-2004, the ideal workplace temperature is between $18\text{--}30^\circ\text{C}$ with humidity between 40–60% to ensure worker comfort. In excessively hot work environments, workers may experience discomfort and even health problems. Naturally, even without physical activity, the body loses about 5–10% of its fluids per day. Overexposure to heat accelerates fluid loss through urine, sweat, and respiratory water vapor. If body fluids continue to decrease without adequate replacement, dehydration and fatigue can occur. This process is related to heat transfer within the body, which primarily involves body tissues and body fluids transported by blood flow.

C. Socioeconomic Impact

1. Creating Jobs and Reducing Unemployment

The rice milling industry plays an important role in creating jobs for the local community in Kawalu District, Tasikmalaya. As a family business that has been operating for more than 12 years, this industry absorbs labor from around the industry, both in the production process and other supporting services. This job creation helps reduce unemployment rates in the surrounding area, especially among farmers and informal workers who previously had limited access to permanent employment (Anga & Abimiku, 2021; Sahu et al., 2024). With stable employment opportunities, workers' household incomes have also increased, directly improving their families' living standards.



In addition, the existence of rice mills triggers other economic activities, such as rice transportation services, machine repairs, and logistics and marketing needs for rice products. These activities involve many parties and expand the socioeconomic impact to the informal sector. However, increased employment also puts pressure on the working environment, such as potential exposure to dust and noise that affects workers' health. Therefore, occupational health and safety management is very important to maintain the sustainability of these social benefits without sacrificing health. Overall, the contribution of the rice milling industry in creating employment is one of the main pillars of local economic development that provides opportunities for improving community welfare.

2. Increased Farmer Income and Local Economic Resilience

Rice milling has a significant economic impact on local farmers' incomes. With nearby and easily accessible milling facilities, farmers can more quickly process their harvested grain into marketable rice, thereby accelerating capital turnover and reducing the risk of crop damage due to prolonged storage (Ruhinduka et al., 2020). The stable selling price of rice due to continuous demand from mills also provides income certainty for farmers, making farming more profitable and sustainable.

Furthermore, the existence of mills helps strengthen local economic resilience. With improved farmer incomes, community purchasing power increases, triggering the growth of micro and small businesses around industrial areas. This has an impact on the stronger socio-economic resilience of rural communities. However, economic dependence on mills also carries risks, especially in the event of fluctuations in grain prices or operational disruptions at the factory, which can destabilize farmers' incomes and community welfare (Iqbal et al., 2020; Mudatsir & Asriyanti Syarif, 2023). Therefore, diversifying income sources and strengthening the capacity of local economic institutions are important aspects in managing these socioeconomic impacts.

3. Social Structure Transformation and Changes in Community Interaction Patterns

The existence of the rice milling industry not only affects economic aspects but also causes significant changes in the social structure of the surrounding community. With the increasing dependence on milling as the main livelihood, there has been a shift in employment patterns from traditional agricultural activities to industrial and milling service-based jobs (Nengsih & Syafrini, 2022). This shift affects the social dynamics of the community, including changes in social status and patterns of interaction among residents.



Social interactions that were previously based on collective relationships and mutual cooperation began to shift towards more individualistic and formal relationships, especially in the workplace. The reduction in traditional social activities such as communal work and cultural activities also had an impact on social cohesion and community solidarity (Sari & Handoyo, 2024). However, some people feel that their increased social status as rice mill workers or business owners brings a new sense of confidence that can strengthen their social identity. This transformation of social structures and interaction patterns reflects how economic change involves cultural and social aspects, requiring greater attention in development policies oriented towards social sustainability.

CONCLUSION

The rice milling industry in Tasikmalaya operates traditionally, producing significant environmental and socioeconomic impacts. Rice dust generated during the weighing, drying, husking, and polishing processes is a major source of air pollution that can potentially harm the respiratory health of workers and the surrounding community. Continuous noise from machinery, particularly Fuso trucks, as well as machine vibrations also cause health problems such as hearing loss and risk of physical damage to buildings around the factory. The hot working climate and poor ventilation exacerbate discomfort and the potential for dehydration among workers. On the socioeconomic side, rice milling makes an important contribution to job creation, increased income for local farmers, and strengthening the economic resilience of the community. However, social structures have changed, with a shift in community interaction patterns from collective to more individualistic and formal. The main recommendation is the need for risk control through dust management, noise reduction, machine maintenance, and improved ventilation to better protect worker health and the environment, while maintaining the economic and social benefits of this industry. This conclusion provides an important overview for the development of sustainable rice milling policies at the local and national levels.

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