

COMMUNITY ADAPTATION STRATEGIES TO THE IMPACT OF DUST FROM PT. SEMEN PADANG PRODUCTION IN INDARUNG SUBDISTRICT, PADANG CITY

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ARTICLE INFO	ABSTRACT
Diterima: 05 Januari 2026 Direvisi: 10 Januari 2026 Disetujui: 18 Januari 2026 Tersedia Daring: 22 Agustus 2026	<i>The cement industry makes a significant contribution to economic development; however, it also causes environmental impacts in the form of air pollution resulting from production dust. This study aims to analyze the adaptation strategies of communities affected by production dust from PT Semen Padang in Indarung Subdistrict, Padang City. This research applies John William Bennett's adaptation strategy theory from the perspective of environmental political sociology. The research method used is a descriptive qualitative approach with a purposive sampling technique. Data were collected through observation, in-depth interviews, and documentation. Data analysis employed the Miles and Huberman model. The results of the study show that there are three main adaptation strategies, namely adaptive behavior, adaptive tactics, and adaptation processes. In addition, it was found that community adaptation strategies are influenced by power relations between the community and the industry, reflecting inequality in the distribution of environmental risks. This study contributes to the development of environmental political sociology by emphasizing the importance of the community's role as adaptive actors in facing ecological pressures caused by industrialization.</i>
Keywords: Adaptation Strategies; Industrial Dust; Environmental Political Sociology, Environmental Inequality	

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1. INTRODUCTION

Industrialization is an important process in economic development, particularly in the cement industry sector, which plays a role in national infrastructure development. However, behind this contribution, industrial activities also generate negative externalities in the form of environmental pollution, especially air pollution caused by dust emissions (Al., 2022). Industrial cement dust particles, especially PM10 and PM2.5, have significant impacts on human health and environmental quality. Long-term exposure can cause respiratory system disorders, reduced agricultural productivity, and degradation of water quality (Rivaldi & Yulifar, 2025).

Indarung Subdistrict in Padang City is an area located near the PT Semen Padang industrial site. This proximity causes the local community to be directly exposed to the impacts of industrial activities, particularly production dust dispersed into residential environments (Susanto & Akmal, 2021).

From the perspective of environmental political sociology, this issue is not only related to ecological aspects but also concerns power relations and the distribution of environmental risks (Rahman et al., 2021). Local communities are often in a vulnerable position due to limited access to environmental decision-making processes (Susanto et al., 2021). Therefore, communities develop adaptation strategies as a form of response to environmental pressures. This adaptation is important to study as part of the social dynamics in dealing with the impacts of industrialization.

2. METHODS

This study uses a qualitative approach with a descriptive type of research^{8,9}. This approach aims to understand the subjective experiences of communities in dealing with the impacts of industrial dust (Ertien & Leily, 2021). The informants were selected using a purposive sampling technique, with a total of 12 informants consisting of directly affected community members, community leaders, and informal workers (Syafri et al., 2020a). Data collection techniques included: Field observation, In-depth interviews, Documentation study.

Data analysis employed the Miles and Huberman model¹⁰: Data reduction, Data display and Conclusion drawing.

3. RESULTS AND DISCUSSION

The Impact of Industrial Dust from a Socio-Ecological Perspective

The results of the study show that the impacts of production dust are multidimensional, covering health, environmental, and economic aspects (Kable et al., 2024). In terms of health, the community experiences respiratory disorders. Environmentally, dust causes a decline in air quality and damage to crops. Economically, there has been a decrease in agricultural productivity. "Our rice used to grow well, but now the harvest has declined because the leaves are often covered with dust." (Informant E, 52 years old) (Louwers & Laven, 2020).

These findings indicate that industrial impacts are not only ecological in nature but also socio - economic. To strengthen the research findings, the following visualization presents the impacts of industrial dust based on community perceptions:

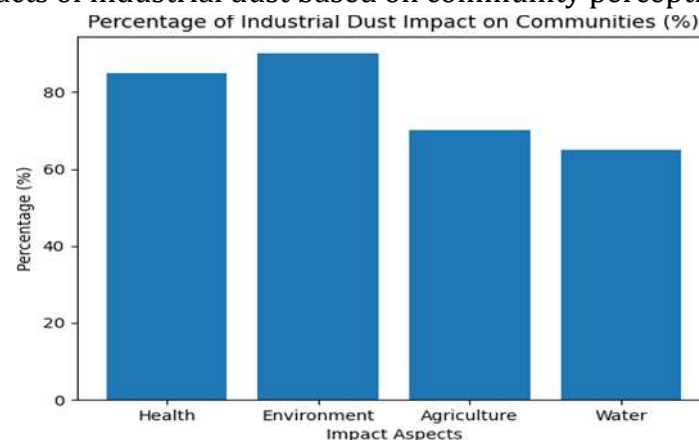


Figure 1. Percentage of Industrial Dust Impact on Communities

Based on Figure 1, it can be seen that the most dominant impacts of industrial dust experienced by the community are in the environmental (90%) and health (85%)

aspects. The high percentages in these two aspects indicate that exposure to industrial dust has direct consequences on the daily quality of life of the community. The dominance of impacts on the environmental aspect indicates that air pollution caused by dust is not only temporary but occurs continuously and accumulates within the community's living space. Dust that settles on the surfaces of houses, plants, and water sources shows that the domestic space of the community has been penetrated by industrial activities (Mngomezulu et al., 2024).

Meanwhile, the high impact on the health aspect indicates that the community is in a vulnerable condition to respiratory disorders due to exposure to fine dust particles. This is in line with field findings that show an increase in complaints such as coughing, throat irritation, and shortness of breath.

On the other hand, the impacts on the agricultural sector (70%) and water quality (65%) indicate that industrial dust also has indirect effects that influence the economic system and the sustainability of local resources. The decline in agricultural productivity due to dust settling on plant leaves indicates disruption to the process of photosynthesis, which ultimately affects community crop yields (Syafri et al., 2020b).

Furthermore, the distribution of these impacts shows that the community experiences not only ecological pressures but also socio-economic pressures simultaneously. This reinforces the argument in environmental political sociology that local communities are often the most affected groups in the process of industrialization, while having limited access to environmental protection mechanisms (Ngan et al., 2022).

Thus, this graph not only represents the level of impact but also illustrates the structure of ecological inequality experienced by communities living around industrial areas (Abubakar et al., 2022).

These findings indicate that the environmental impacts resulting from industrial activities are not singular but multidimensional and interconnected. Therefore, community adaptation strategies cannot be understood simply, but rather as complex responses to the ecological and structural pressures they face. The above visualization can also be presented in the form of a table to make it easier to understand, as follows (Lubis, 2019):

Table 1. Impact of Industrial Dust on Communities

No	Impact Aspect	Form of Impact	Intensity
1	Health	Coughing, shortness of breath	High
2	Environment	Dust in home, polluted air	Very High
3	Agriculture	Decreased crop yields	Moderate
4	Water	Turbid water	Moderate

Based on Table 1, it can be seen that the impacts of industrial dust on communities in Indarung Subdistrict are multidimensional, covering aspects of health, environment, agriculture, and water quality (Silalahi, 2006). The most dominant impact appears in the environmental aspect, categorized as very high, as indicated by houses that become dirty quickly and declining air quality. This shows that industrial dust has become part of the community's daily life and directly affects their domestic spaces (Eriksen et al., 2021).

In addition, the impact on the health aspect, which is categorized as high, indicates a strong relationship between air pollution and public health problems, particularly in the respiratory system. This condition demonstrates that the community is in a vulnerable situation due to continuous exposure to dust.

Meanwhile, the impacts on the agricultural sector and water quality, which are categorized as moderate, indicate that the effects of industrial dust are not only direct but also indirectly affect the sustainability of the community's economy. The decline in agricultural yields and changes in water quality serve as indicators that environmental pollution has spread across various aspects of community life (Rachmadi et al., 2024).

Thus, Table 1 not only illustrates the types of impacts experienced by the community but also shows that industrial activities have created both ecological and social pressures simultaneously. From the perspective of environmental political sociology, this condition reflects an imbalance in the distribution of environmental impacts, where local communities bear a greater ecological burden compared to the economic benefits generated by industrial activities.

Community Adaptation Strategies

Community adaptation strategies are social responses that emerge as a result of environmental pressures faced by individuals or groups within a particular social system. In this context, adaptation is not only understood as an effort to survive, but also as a form of active adjustment to environmental changes caused by industrialization.

According to John William Bennett¹³, adaptation strategies are a series of actions taken by humans to maintain their survival in the face of environmental changes. This adaptation is dynamic in nature and involves interactions between humans and their social as well as ecological environments (Wattimena & Makaruku, 2022).

Furthermore, from the perspective of environmental political sociology, adaptation strategies cannot be separated from power relations that influence community access to resources and their capacity to respond to environmental impacts (Organization, 2021). Communities living around industrial areas are often in vulnerable positions, so the adaptation strategies they undertake represent responses to these inequalities.

In the context of communities in Indarung Subdistrict, adaptation strategies develop as responses to the impacts of dust from cement industrial production, which affect various aspects of life, including health, environment, and economy. The adaptations carried out are not only individual but also collective, reflecting the community's efforts to sustain their livelihoods amid environmental pressures.

Referring to Bennett's concept, the community's adaptation strategies in this study are classified into three main forms: adaptive behavior, adaptive tactics, and adaptation processes. These three forms indicate that community adaptation is layered and interconnected in responding to environmental changes.

Thus, community adaptation strategies not only reflect survival capabilities but also demonstrate forms of social resistance to environmental pressures generated by industrial activities.

To systematically understand patterns of community adaptation, a conceptual framework is needed to illustrate the relationship between the impacts experienced and the forms of responses carried out by the community. Therefore, the adaptation strategies in this study are visualized in the following diagram:



Figure 2. Community Adaptation Strategy Model

The diagram shows that community adaptation strategies are a direct response to the impacts of industrial dust, which affect various aspects of life. These impacts become the main trigger for the emergence of different forms of adaptation carried out by the community. In this study, adaptation strategies are classified into three main forms: adaptive behavior, adaptive tactics, and adaptation processes. Adaptive behavior refers to direct, individual actions in responding to environmental impacts. Adaptive tactics indicate more planned efforts in managing environmental conditions, while adaptation processes reflect collective actions taken by the community to sustain their livelihoods. These three forms of strategies are interconnected and form a layered adaptation system. This indicates that the community does not only make spontaneous adjustments but also develops structured strategies in dealing with environmental pressures.

Furthermore, the outcome of these adaptation processes leads to the formation of community resilience (social resilience), which refers to the community's ability to survive, adapt, and continue their daily activities despite being in less-than-ideal environmental conditions (Béné et al., 2016).

Adaptive Behavior

Adaptive behavior is the most basic form of response carried out by individuals in dealing with environmental changes. This type of adaptation is direct, spontaneous, and generally does not require complex planning. Adaptive behavior represents an individual's immediate response to environmental pressures, aimed at minimizing risk and sustaining well-being. Contemporary studies suggest that such behavior emerges from interactions between environmental change and socio-psychological factors, including risk perception, social norms, and individual adaptive capacity^{15, 16}.

In an environmental context, adaptive behavior emerges as a response to pressures that are directly felt, such as health disturbances or discomfort caused by environmental conditions. According to Bennett, this form of adaptation reflects an individual's ability

to respond quickly to environmental stimuli in order to maintain physical condition and comfort in daily life.

However, adaptive behavior has limitations because it is short-term in nature and does not address the root causes of environmental problems. Therefore, it primarily functions as an initial protective mechanism against perceived impacts.

Forms of adaptation:

1. Use of masks
2. Closing house ventilation
3. Intensive house cleaning

“If it is not cleaned frequently, the dust accumulates very quickly.” (Informant F, 40 years old)

Analysis:

This strategy is short-term in nature and oriented toward individual protection.

Adaptive Strategy (Adaptive Tactics)

Adaptive strategy represents a more complex form of adaptation compared to adaptive behavior, as it involves elements of planning and environmental management. This type of adaptation is not only reactive but also proactive in addressing environmental changes (Dockery & Pope, 1994). According to Bennett, adaptive strategy reflects the ability of individuals or groups to design strategies to reduce environmental impacts through the management of available resources. In this context, communities do not merely respond to impacts but also attempt to control environmental conditions to better suit their needs (Partidário, 2012). Adaptive strategies are generally medium-term in nature and involve changes in both the physical and social environment. This indicates an increase in the community’s adaptive capacity in dealing with environmental pressures (Folke, 2016).

Forms: Environmental greening, Housing modification, Use of alternative water sources

“We built a plant fence so that the dust does not directly enter the house.” (Informant G, 46 years old)

Analysis:

This strategy reflects the community’s effort to create an ecological buffer.

2. Adaptation Process

The adaptation process is the most complex form of adaptation because it involves social interaction and collective action within the community. This type of adaptation occurs not only at the individual level but also at the group or community level (Bryant & Bailey, 1997).

From Bennett’s perspective, the adaptation process reflects the community’s ability to build social systems that support survival amid environmental changes. This form of adaptation often involves cooperation, division of roles, and the strengthening of social networks (Zorzenão et al., 2024).

In addition, the adaptation process may include changes in the economic and social structures of the community, such as livelihood diversification or shifts in patterns of social interaction. Therefore, the adaptation process is long-term in nature and contributes to the formation of social resilience.

Forms:

1. Mutual cooperation
2. Negotiation with industrial parties
3. Economic diversification

“Now many people are looking for other jobs, not only relying on farming.” (Informant H, 44 years old)

Analysis:

This form of adaptation indicates social transformation resulting from environmental pressures. These three forms of adaptation strategies show that community adaptation is not linear but layered and interconnected. Adaptive behavior serves as the initial response, adaptive strategies strengthen adjustment efforts, and the adaptation process reflects broader social transformation. Thus, community adaptation strategies can be understood as a dynamic process that not only aims for survival but also represents a response to structural pressures generated by industrial activities.

Discussion: Environmental Political Sociology Perspective

From the perspective of environmental political sociology, community adaptation strategies reflect inequality in the distribution of environmental risks (environmental inequality). Industries gain economic benefits, while communities bear the ecological burden. This phenomenon is in line with the concept of *environmental marginalization*⁷, where certain social groups become more vulnerable as a result of development policies (Raco, 2018).

However, the adaptation strategies carried out by communities can also be understood as a form of agency, in which communities still possess the capacity to respond to and negotiate the conditions they face.

Thus, adaptation is not merely a form of adjustment, but also a form of subtle social resistance. To understand these relationships more systematically, a visualization is needed to illustrate the interaction between industrial actors, environmental impacts, and communities as the affected parties. Therefore, this relationship can be seen in the following diagram (Robbins, 2012):

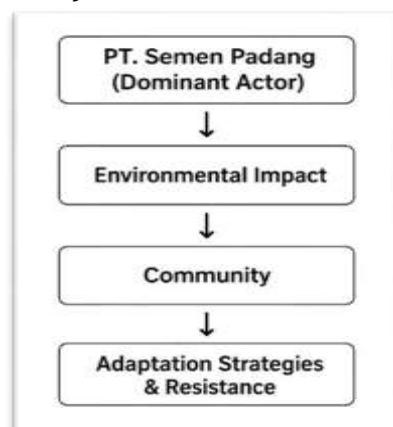


Figure 3. Power Relations Diagram of Industrial Impacts on Communities

Based on Figure 3, it can be seen that PT Semen Padang, as the dominant actor, has control over production activities that generate environmental impacts in the form of industrial dust. These impacts are then directly experienced by communities living

around the industrial area (Aoki et al., 2024). The diagram illustrates a one-way flow, where environmental impacts move from industrial activities toward the community. This confirms that the community is positioned as the affected group, while having limited capacity to control the source of these impacts (Daud et al., 2025). However, the community is not entirely passive. Through various adaptation strategies, they demonstrate the ability to respond to and adjust to environmental pressures. In this context, adaptation strategies can be understood as both a response and a form of subtle resistance to existing inequalities (Purnama et al., 2025).

Thus, the diagram shows that the relationship between industry and community is not neutral, but is shaped by power relations that determine the distribution of environmental benefits and risks.

4. CONCLUSION

Based on the research findings, it can be concluded that communities in Indarung Subdistrict experience various impacts resulting from dust produced by the cement industry, covering health, environmental, and economic aspects. These impacts are not only direct, such as respiratory problems and houses that become dirty quickly, but also indirect, such as decreased agricultural productivity and declining water quality.

In responding to these conditions, the community develops various adaptation strategies as a response to environmental pressures. These strategies include adaptive behavior, adaptive tactics, and adaptation processes. Adaptive behavior is reflected in individual actions such as the use of masks and adjustments to daily activities. Meanwhile, adaptive tactics are seen in community efforts to manage the environment, such as planting trees and modifying houses. The adaptation process is reflected in collective actions, such as mutual cooperation and livelihood diversification. These three forms of strategies indicate that the community is not passive in facing environmental impacts, but rather has the capacity to adapt and sustain their livelihoods under less-than-ideal environmental conditions. The adaptations carried out by the community also reflect efforts to maintain a balance between livelihood needs and environmental conditions that continue to be under pressure due to industrial activities. Thus, this study emphasizes that community adaptation strategies are dynamic and layered processes, functioning not only as survival mechanisms but also as expressions of the community's social capacity to respond to environmental change.

The implications of this study highlight the importance of the roles of government and industry in managing environmental impacts more sustainably. Efforts to control air pollution and to enhance corporate social responsibility are necessary steps to reduce the environmental burden borne by the community.

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5. REFERENCES

- Abubakar, I. R., Maniruzzaman, K. M., Dano, U. L., Alshihri, F. S., Alshammari, M. S., Ahmed, S. M. S., Al-Gehlani, W. A. G., & Alrawaf, T. I. (2022). Environmental Sustainability Impacts Of Solid Waste Management Practices In The Global South. *International Journal Of Environmental Research And Public Health*, 19(19), 1–26. <https://doi.org/10.3390/ijerph191912717>
- Al., N. Et. (2022). Community-Based Adaptation To Climate Change In Coastal Indonesia. *Climate And Development*. <https://doi.org/10.1080/17565529.2022.1234567>
- Aoki, E., Shirai, N., Baba, K., Masuhara, N., & Taniguchi, M. (2024). Developing Behavioral Models Of Citizens For Adapting To And Mitigating Climate Change. *Frontiers In Climate*, 6.
- Béné, C., Headey, D., Haddad, L., & Von Grebmer, K. (2016). Is Resilience A Useful Concept In The Context Of Food Security And Nutrition Programmes? *Food Security*, 8(1), 123–138.
- Bryant, R. L., & Bailey, S. (1997). *Third World Political Ecology*. Routledge.
- Daud, A., Rahman, A., & Putri, R. (2025). Environmental Health Risk Assessment Of Particulate Matter Exposure In Industrial Areas. *Journal Of Environmental Health Research*, 29(1), 45–56.
- Dockery, D. W., & Pope, C. A. (1994). Acute Respiratory Effects Of Particulate Air Pollution. *Annual Review Of Public Health*.
- Eriksen, S. H., Nightingale, A. J., & Eakin, H. (2021). Reframing Adaptation: The Political Nature Of Climate Change Adaptation. *Global Environmental Change*, 35, 523–533.
- Ertien, R. N., & Leily, S. R. (2021). Tantangan Dan Peluang Pariwisata Berbasis Masyarakat Di Desa Tamansari Dalam Era Normal Baru Opportunities And Challenges For Community-Based Tourism In Tamansari Village In The New Normal Era. *Jurnal Masyarakat Indonesia*, 47(1), 91–104.
- Folke, C. (2016). Resilience (Republished). *Ecology And Society*, 21(4).
- Kable, J. A., Potter, A. S., Akshoomoff, N., Blasco, P. M., Bodson, S., Ciciolla, L., Degray, S., Hulce, Z., Kushner, E. S., Learnard, B., Luciana, M., Perez, A., Novack, M. A., Riggins, T., Shin, S. Y., Smith, S., Vannest, J., & Zimak, E. H. (2024). Measurement Of Emerging Neurocognitive And Language Skills In The Healthy Brain And Child Development (Hbcd) Study. *Developmental Cognitive Neuroscience*, 70(September). <https://doi.org/10.1016/j.dcn.2024.101461>
- Louwers, Y. V, & Laven, J. S. E. (2020). Characteristics Of Polycystic Ovary Syndrome Throughout Life. *Therapeutic Advances In Reproductive Health*, 14, 263349412091103. <https://doi.org/10.1177/2633494120911038>
- Lubis, M. S. (2019). Pengaruh Iklim Organisasi Dan Komitmen Organisasi Terhadap Pembentukan Organizational Citizenship Behavior (Ocb) Karyawan Dalam Rangka Peningkatan Kinerja. *Jurnal Apresiasi Ekonomi*, 3(2), 75–84. <https://doi.org/10.31846/jae.V3i2.176>

- Mngomezulu, S., Mbanga, S., & Adeniran, A. (2024). The Factors Influencing Waste Management For Economic Development—The Perspective Of Nelson Mandela Bay Municipality Residents. *Frontiers In Sustainability*, 5, 1469207. <https://doi.org/10.3389/frsus.2024.1469207>
- Ngan, S. L., Er, A. C., Yatim, P., How, B. S., Lim, C. H., Ng, W. P. Q., Chan, Y. H., & Lam, H. L. (2022). Social Sustainability Of Palm Oil Industry: A Review. *Frontiers In Sustainability*, 3, 855551. <https://doi.org/10.3389/frsus.2022.855551>
- Organization, W. H. (2021). *Air Quality Guidelines*.
- Partidário, M. (2012). *Strategic Environmental Assessment: Better Practice Guide*.
- Purnama, C. Y., Srisayekti, W., Fitriana, E., & Djunaidi, A. (2025). Pro-Environmental Behavior To Improve Quality Of Life. *International Journal Of Environmental Health Research*, 35(3), 819–838.
- Rachmadi, D., Yanto, H., Sukestiyarno, & Sutopo, Y. (2024). Navigating The Dynamics Of Teacher Job Satisfaction: Leadership, Supervision And Performance. *Journal Of Ecohumanism*, 3(7), 1271–1298. <https://doi.org/10.62754/joe.v3i7.4290>
- Raco, J. R. (2018). *Qualitative Research Methods*. Grasindo.
- Rahman, M. K., Crawford, T. W., Paul, B. K., Sariful Islam, M., Curtis, S., Giashuddin Miah, M., & Rafiqul Islam, M. (2021). Riverbank Erosions, Coping Strategies, And Resilience Thinking Of The Lower-Meghna River Basin Community, Bangladesh. In *Climate Vulnerability And Resilience In The Global South: Human Adaptations For Sustainable Futures* (Pp. 259–278). Springer. https://doi.org/10.1007/978-3-030-77259-8_13
- Rivaldi, M. D., & Yulifar, L. (2025). Tradition And Modernity: An Ethnographic Study Of The Adaptation Of The Ciptagelar Traditional Village Community In The Era Of Globalization. *Santhet (Jurnal Sejarah Pendidikan Dan Humaniora)*, 9(3), 863–871. <https://doi.org/10.36526/santhet.v9i3.5400>
- Robbins, P. (2012). *Political Ecology: A Critical Introduction*. Wiley-Blackwell.
- Silalahi, U. (2006). *Social Research Methods*. Unpar Press.
- Susanto, H., & Akmal, H. (2021). Migration And Adaptation Of The Loksado Dayak Tribe (Historical Study Of Dayak Loksado Community In Pelantingan Village). *2nd International Conference On Social Sciences Education (Icsse 2020)*, 5–10. <https://doi.org/10.2991/assehr.k.210222.002>
- Susanto, H., Akmal, H., & Fathurrahman. (2021). Migration And Adaptation Of The Loksado Dayak Tribe (Historical Study Of Dayak Loksado Community In Pelantingan Village). *Forests, Trees And Livelihoods*, 27(3), 141–157. <https://doi.org/10.2991/assehr.k.210222.002>
- Syafri, S., Surya, B., Ridwan, R., Bahri, S., Rasyidi, E. S., & Sudarman, S. (2020a). Water Quality Pollution Control And Watershed Management Based On Community Participation In Maros City, South Sulawesi, Indonesia. *Sustainability*, 12(24), 10260. <https://doi.org/10.3390/su122410260>
- Syafri, S., Surya, B., Ridwan, R., Bahri, S., Rasyidi, E. S., & Sudarman, S. (2020b). Water Quality Pollution Control And Watershed Management Based On Community Participation In Maros City, South Sulawesi, Indonesia. *Sustainability*, 12(24), 10260. <https://doi.org/10.3390/su122410260>

- Wattimena, A. Y., & Makaruku, M. H. (2022). Karakteristik Budidaya Tanaman Pala (*Myristica Fragran* Houtt) Pola Dukung Di Kecamatan Leihitu Dan Leihitu Barat Kabupaten Maluku Tengah. *Agrinimal Jurnal Ilmu Ternak Dan Tanaman*, 10(1), 38–44. <https://doi.org/10.30598/Ajitt.2022.10.1.38-44>
- Zorzenão, R., Gouveia, N., & Junger, W. L. (2024). Air Pollution And Health Impacts: A Systematic Review Of Particulate Matter Exposure. *Science Of The Total Environment*, 906, 167456.