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Air Pollution Dynamics: Insights into Current Condition of Policy Framework and Future Strategy

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Abstract: *This comprehensive study examines the complex phenomenon of air pollution in Indonesia, providing insights into various aspects such as current conditions, the policy framework, and potential strategies ahead. By conducting a comprehensive review of relevant literature and employing novel methods to analyze Google Trends data, a meticulous examination of prevailing themes and public inquiries is revealed. Significantly, there is an increasing societal awareness of air pollution's condition, effects, and regulation, especially in urban cities, in August 2023. This study not only highlights the current difficulties but also delves into potential lessons learned by other countries and provides valuable suggestions. This paper makes a valuable contribution to the field of air pollution mitigation policies and environmental management. This study provides policymakers, industries, and communities with a comprehensive framework to address air pollution problems. This comprehensive study allows relevant stakeholders to adopt strategies that lead to a more environmentally sustainable Indonesia.*

Keywords: *Air Pollution; Pollution Control; Environmental Policy; Environmental Management; Government Regulation.*

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Introduction

Air pollution is one of the global environmental challenges that affect human health, ecosystems, and climate. In various parts of the world, including Indonesia, the negative impact of air pollution is becoming more and more significant. Air pollution can damage the respiratory system, exacerbate the problem of climate change, and threaten the sustainability of the environment as a whole (Agustian et al., 2020; Syuhada et al., 2023). Therefore, the development of air pollution mitigation policies is the main concern of many countries (Bermejo et al., 2023), including Indonesia. For several decades, Indonesian peatlands have been drained for agricultural growth. This advancement has significantly aided economic progress. At the same time, peatland draining is creating severe air pollution as a result of peatland fires (Hein et al., 2022). Peat fires are a major component of photochemical haze and air pollution in Palangkaraya (Hayasaka et al., 2014). This has also occurred in Kalimantan (Hayasaka & Sepriando, 2016).

Moreover, the increased urbanization, industry, and economic development in many places in Indonesia adds to the increase of particulate matter (PM) in the atmosphere. PM is strongly linked to severe air pollution, which can cause a variety of health issues and premature death (Istiqomah & Marleni, 2020). In the case of Jakarta, air pollution has become a major concern for the community, particularly as the level of air quality continues to deteriorate. According to a report from the DKI Jakarta Provincial Government and Vital Strategies, a global health organization, the transportation sector is the main contributor to PM2.5 air pollution in Jakarta (Rahman, 2022). PM2.5 particles are particles smaller than 2.5 micrometers in size that can enter the respiratory system and cause respiratory problems as well as a variety of other health issues such as irritation, impaired lung function, and heart disease (Muhamad, 2023). According to the data, the transportation sector accounted for approximately 67.04% of PM2.5 emissions in 2018 (Rahman, 2022). The transportation sector, however, is not the only source of air pollution in Jakarta. Other pollutants that contribute to air pollution include sulfur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), fine particulate matter less than 10 micrometers (PM10), black carbon (BC), and non-methane volatile organic compounds (NMVOCs). The industrial sector, power plants, housing, and the commercial sector all contribute to pollutant emissions.

The government has made numerous efforts to address the issue of air pollution. According to the Kurious-Katadata Insight Center (KIC) survey results, the majority of people believe that developing green open spaces (RTH) is an effective way to reduce air pollution (Annur, 2023c). Furthermore, encouraging the use of electric vehicles, implementing car-free days, enforcing industrial emission standards, and monitoring waste burning are all regarded as important steps in addressing air pollution. However, solutions such as electric vehicles are being debated. Although local governments, such as DKI Jakarta Governor Heru Budi, intend to mandate the use of electric vehicles for echelon IV and above officials (Annur, 2023c), some environmental experts argue that if the energy source for charging electric vehicles is still derived from fossil fuel power plants, this may not be an effective solution since it creates more pollutants in the air (Setyadharma, et al., 2021).

According to IQAir air quality data, Jakarta's air quality has been unhealthy for the past week, with PM2.5 concentrations far exceeding WHO standards. Moving sources of air pollution, such as motorized vehicles, and stationary sources of air pollution, such as coal-fired power plants, are thought to be the primary causes of this poor air quality. In order to address this issue, the Ministry of Environment and Forestry has halted the operations of several companies suspected of contributing to air pollution in the Jabodetabek area (Annur, 2023a). This action was taken as a result of a technical error and a violation of environmental regulations, particularly those pertaining to emission control. To improve air quality in Jakarta and other regions of Indonesia, government, industry, and society must collaborate together to reduce air pollution emissions and protect future generations. This study will examine Indonesia's air pollution policies and mitigation efforts. In addition, this article will examine lessons from other countries' air pollution problems. This study will provide insight into Indonesia's air pollution mitigation policy challenges and opportunities. This article also examines lessons from other countries that have addressed air pollution.

Method

The objective of this study is to analyze the dynamics of air pollution in Indonesia, including an assessment of the present state, an examination of the prevailing policy frameworks, and an exploration of prospective strategies for the future. In order to accomplish the objective, this research will employ a literature review methodology, drawing upon a diverse range of sources, including scholarly articles, national documents, and international publications. A literature review is an in-depth evaluation of prior research on a certain topic. The overview informs the reader of what is known as well as what is unknown about a topic, providing the cause or need for further research, which is what the actual study to which the literature review is related attempts to accomplish (Denney & Tewksbury, 2013). This step follows Rowe`s (2014) guidelines. Start by defining the review's purpose and research goals. Find a variety of relevant material by searching databases and sources. Next, review sources must be carefully evaluated for quality and relevance. Topics, concepts, and main results are used to organize the literature for a cohesive review. Criticizing key arguments, ideas, and methods to find common themes and patterns is part of combining the literature. The identification of gaps suggests future research topics. An introduction provides background and basic information, followed by major literature findings and arguments. Final observations and conclusions conclude the assessment. Review clarity, coherence, and accuracy are improved by thorough revision and editing.

Furthermore, the utilization of data analysis derived from Google Trends will be employed to examine the extent of public interest in matters pertaining to air pollution. Google Trends is a publicly available tool that examines online searches performed using the Google search engine and delivers the results in a standardized format (Boehm et al., 2019). The Google Trends website offers researchers the opportunity to access data from nearly all countries without incurring any expenses. Researchers can also download time series data that reflects the popularity of any given search term over a specific period, as long as there have been

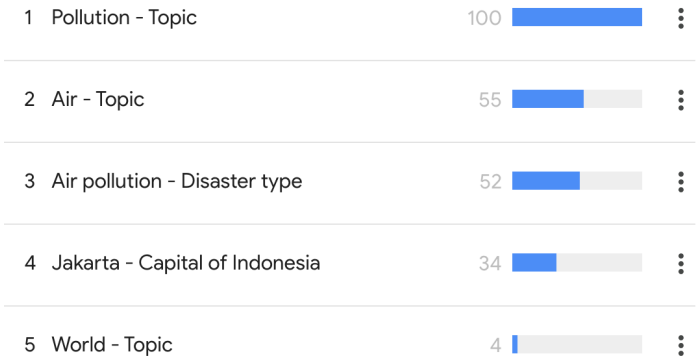
a sufficient number of searches conducted for that term. There are several compelling factors that make Google Trends a desirable data source for researchers in the field of social sciences (Mellon, 2013). The study will collect data from scientific journals, government reports, and Indonesian air pollution policy documents. The above sources will be used to evaluate Indonesia's air pollution policies, including their limitations and effects. International literature will also be examined to learn about other nations' air pollution strategies. This study will also use Google Trends data to measure public interest in air pollution in Indonesia. Google Trends shows the popularity of search queries over time. The data will be used to analyze public interest in air pollution over time. The analysis will show how air pollution has been integrated into public consciousness. Data from literature reviews and Google Trends analysis will be thoroughly processed and examined. The literature review will identify patterns and challenges in Indonesia's air pollution policies. International articles provide a broad perspective that can be applied domestically. Google Trends data can show how society views air pollution.

Results and Discussion

Revealing the Current Condition by *Google Trends*

Currently, the Jakarta pollution issue may have been noticed by the large number of public searches for this information on Google. This intriguing trend was discovered by our investigation in the last month (August 2023). The data above may be used to identify certain subjects that have gotten a lot of public attention in the past month. First, with a search score of 100, the topic "Pollution" is a big concern, demonstrating widespread public concern about pollution concerns. This subject illustrates widespread concern over pollution's detrimental consequences for the environment and human health. Furthermore, the related subjects "air" and "air pollution" received substantial search values (56 and 54, respectively), showing that people are interested in learning more about air quality and the impacts of air pollution. This might imply that people are becoming more conscious of the necessity of clean air and the negative consequences of air pollution. The topic "remote work" has also grown considerably in the RISING category, showing that individuals are curious about working remotely. This might be owing to shifts in labor patterns brought about by global events like the COVID-19 pandemic (Birimoglu Okuyan & Begen, 2022). The topics "steam-electric power station" and "coal" were also featured in the RISING category, indicating a concern for the energy sources and environmental impacts associated with coal-fired power generation and the use of coal. The topic "Air quality index" in the RISING category indicates that people want to learn more about the air quality index and how to measure the level of air pollution in their area. The names "Joko Widodo" and "Ministry of Environment and Forestry" also appear in the RISING category, indicating attention to environmental policies and government efforts related to environmental issues. From figure 1, the topical analysis reveals that the public is increasingly concerned about air pollution, air quality, changes in work patterns, energy sources, and environmental policies. This data shows that public awareness of environmental issues is increasing and that an increasing number of people are seeking information to understand the impacts and solutions to these issues.

Figure 1. Related Topics of "Polusi"



Source: Google Trends. 2023

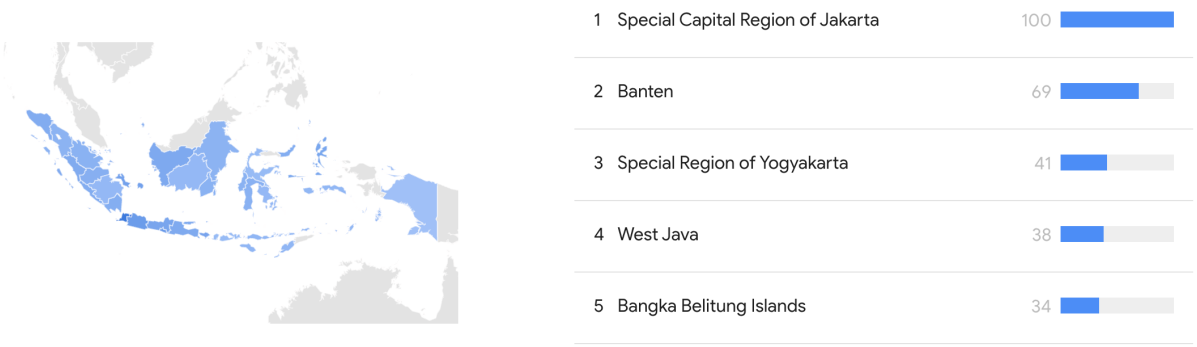
Figure 2. Related Queries of "Polusi"

Source: Google Trends. 2023

Also, according to the search keyword data (queries) displayed in the TOP category, people are very interested in the issue of "air pollution," with a value of 100. All the language in queries is Indonesian. There are also several search variations that focus on air pollution in Jakarta, such as "Jakarta Pollution," "Jakarta Air Pollution," and "Pollution in Jakarta." This indicates that Jakarta is the focus of attention when it comes to air pollution issues, as do the results of the Kurious-Katadata Insight Center (KIC) survey, which show that the majority of Indonesian people think that air pollution is a problem (Annur, 2023b). Pollution causes were also coined, such as "pollution causes" and "air pollution causes." The community appears to want to know what is causing this issue. There are also searches on pollution influences, such as "pollution effects" and "air pollution effects," showing a desire to understand the health and environmental consequences of air pollution, as air pollution is a key risk factor for disease

burden (Agustian et al., 2020). Searches for remote working patterns (WFH) and pollution, such as "wfh pollution" and "wfh," also yielded results. This demonstrates how distant working conditions might affect pollution patterns and air quality. In the RISING category, we can observe that searches for WFH and pollution are fast growing. Furthermore, there are trends related to Jakarta's air pollution status in 2023 and how to deal with air pollution. The public is also interested in actual information, such as "air pollution news in Jakarta." It can be seen that attention to Jakarta as a city with a significant air pollution problem is increasingly emphasized, with keywords such as "jakarta the worst pollution in the world" and "jakarta's worst air pollution in the world." This analysis shows that the public is deeply concerned about air pollution, particularly in Jakarta. They are looking for information on the causes, effects, countermeasures, and solutions to air pollution issues. Search trends for remote working patterns also reflect how changes in lifestyle and work can affect environmental issues such as air pollution.

Figure 3. Interest by subregion of "Polusi"

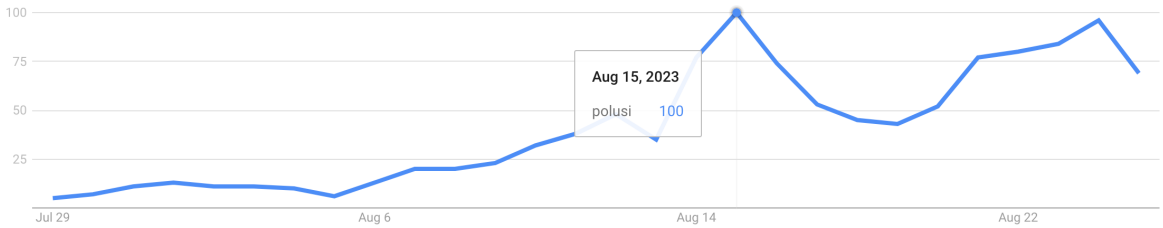


Source: Google Trends. 2023

Then, based on an examination of data obtained from Google Trends, which examines the temporal variations in search frequency for the term "pollution" across different areas in Indonesia over the course of the last month, it is evident that the Special Capital Region of Jakarta exhibits the most pronounced level of interest, with a value of 100. This observation suggests a heightened degree of apprehension or regard for the individuals residing within the vicinity. The city of Jakarta is associated with concerns over pollution, particularly in relation to the issue of air quality inside the urban environment, since it happens in this city (Santika, 2023). Banten is then ranked second with a total of 69, while the Special Region of Yogyakarta and West Java hold the third and fourth positions with 41 and 38, respectively. Furthermore, it is worth noting that these regions exhibit somewhat elevated levels of search activity pertaining to pollution. In contrast, several regions, namely Papua, Gorontalo, and West Papua, lack precise search data, resulting in comparatively lower search volumes. The decrease in search volumes might potentially be attributed to a range of variables, one of which is the extent of public consciousness regarding environmental and pollution concerns in these particular regions. In general, this research offers an early perspective on

public apprehension over pollution concerns and the extent of environmental knowledge in different regions of Indonesia.

Figure 4. Interest over time of "Polusi"



Source: Google Trends. 2023

In the analysis of search trends for the term "pollution" over the past month in Indonesia, notable fluctuations in search rates have been observed. The aforementioned data has the potential to provide insights into the fluctuations in public interest pertaining to the subject matter of "pollution" during the specified time frame. During the initial period (29/07/2023–05/08/2023), the search rates exhibited a tendency towards lower values, typically below 20. Nevertheless, during the initial week of August, there was a gradual and incremental rise in search rates. Subsequently, on the dates of July 8th and August 8th, 2023, a notable surge in search activity occurred, resulting in a peak of 20 searches. This observation potentially suggests the occurrence of an incident or the dissemination of information pertaining to pollution during the specified period. The data indicates that the maximum peak was observed on August 15, 2023, with a recorded search count of 100. On that particular date, the highest point was reached, signifying the utmost level of focus on the matter of pollution. This rate has gone up since the viral video on the internet showing the differences between Jakarta air and other cities by airplane (detikNews, 2023). Following the culmination, search rates exhibit a gradual decline while maintaining a relatively elevated level, accompanied by diminished daily variations from 8/16/2023 until the conclusion of the observed timeframe. It is imperative to acknowledge that the variability in this dataset can be influenced by a multitude of factors, encompassing events or news pertaining to pollution concerns during any specific period. The aforementioned data may also indicate an increasing level of public consciousness regarding environmental and health concerns associated with pollution.

Understanding the Existing Air Pollution Policy Framework

The implementation of air pollution legislation in Indonesia has demonstrated notable advancements in mitigating the impacts of climate change and managing air pollution. Indonesia has undertaken significant measures to address this problem, encompassing both emission mitigation and adaptation strategies in response to the consequences of climate change and air pollution. In 1999, the Indonesian Ministry of Environment initiated a strategic plan aimed at mitigating forest fires in

susceptible regions, taking into consideration the significant role of the forestry sector in contributing to greenhouse gas emissions (Haryanto, 2018). In 2011, the implementation of a moratorium on the issuance of permits for land clearance in primary forests and peatlands was established as a tangible measure to advance the objectives of reducing greenhouse gas emissions and promoting land use reform. Nevertheless, a thorough investigation reveals that the moratorium's influence on carbon reduction is constrained (Haryanto, 2018).

Indonesia has incorporated the energy and deforestation sectors into its mitigation endeavors (Alisjahbana & Busch, 2017). The formulation of energy policy has been found to contribute to a rise in the utilization of fossil fuels, such as coal, resulting in significant ramifications for the production of greenhouse gases. While there are already rules in place for renewable energy, it is necessary to enhance the financial incentives associated with these laws. The association between palm oil and deforestation raises concerns regarding the manufacturing of biofuels derived from this source (Mekhilef et al., 2011). The Clean Development Mechanism (CDM) is a promising avenue for emissions reduction, but with a relatively restricted number of registered projects in comparison to surrounding nations (Haryanto, 2018). The inclusion of mechanisms to secure recompense for the prevention of deforestation under global climate accords is indicative of Indonesia's commitment to this endeavor.

Looking at the Ministry of Environment and Forestry database, there have been many rules pertaining to the management and mitigation of air pollution in Indonesia. Our findings reveal that the Indonesian government has implemented a range of legislation and policies in order to tackle the issue of air pollution, employing diverse strategies. Various rules, such as Minister of Environment and Forestry (LHK) Regulation Number P.14 of 2020 pertaining to the Air Pollution Standard Index, exemplify endeavors to establish air quality standards that must be adhered to by diverse entities in order to mitigate air pollution. In addition, Minister of Environment and Forestry Regulation Number P.6/MENLHK/SETJEN/KUM.1/2/2018 addresses the issue of competency standards and certification pertaining to people who are entrusted with the responsibility of managing air pollution control facilities. This exemplifies the significance of possessing appropriate credentials and expertise in effectively overseeing air pollution control facilities. Furthermore, a number of rules have been implemented to establish emission quality requirements across several industries, including but not limited to the mining industry, rayon industry, and fuel business, including oil and natural gas. The presence of such legislation is indicative of the government's endeavors to manage emissions originating from diverse industries, which have the potential to contribute to atmospheric pollution. Moreover, the presence of regulations pertaining to the protocols for granting technical approvals and operational feasibility letters in the domain of environmental pollution management (Minister of Environment and Forestry Regulation No. 5 of 2021) indicates the implementation of rigorous procedures in overseeing activities associated with the control of air pollution. When examining the legislation pertaining to air pollution, it is evident that the government has demonstrated a steadfast dedication to

this particular environmental policy. However, it is important to note that there may be variations throughout the implementation phase, which will be examined in the subsequent review.

Proposing the Future of Air Pollution Policies

Obstacles & Difficulties

The implementation of air pollution mitigation policies in Indonesia has a number of problems and hurdles that must be solved in order for air pollution control measures to be effective. These difficulties range from a lack of community awareness to a lack of infrastructure and collaboration amongst authorities. In light of the issue of air pollution, a multitude of obstacles necessitate exact and synchronized resolutions. Initially, the opposition encountered by the industrial sector and relevant players towards alterations in policies might impede the advancement of initiatives. It is because emissions are strongly linked to their source, which is industrial waste (Surya et al., 2020). Achieving mutually beneficial agreements necessitates the adoption of a meticulous and comprehensive communication strategy. Additionally, the presence of restricted resources, such as financial money and staff, poses a significant challenge in the enhancement of monitoring systems and infrastructure (Gunawan et al., 2017). This difficulty may be effectively addressed by employing innovative funding options and implementing prudent resource allocation practices.

Furthermore, there is a need to enhance public knowledge of the adverse consequences associated with air pollution (Sulaeman et al., 2020). The implementation of targeted teaching programs and effective communication strategies via mass media platforms might serve as a viable approach to tackle this particular difficulty (Susanto & Thamrin, 2021). Furthermore, it is imperative to establish efficient collaboration across governmental entities and economic sectors in order to effectively tackle this multifaceted matter. The difficulty of achieving consensus and reconciling divergent agendas necessitates collective endeavors.

Furthermore, the process of transitioning from fossil energy sources to renewable energy sources necessitates the implementation of a well-developed and comprehensive strategy, taking into account the existing reliance on fossil fuels (Setyadharma et al., 2021). It is because sossil fuel and transportation are the main sources of pollutive particles (e.g., sulfur oxide and nitrous) released into the atmosphere (Kusumaningtyas et al., 2018). The resolution of the difficulty associated with uncertainties pertaining to the economic ramifications and energy provision throughout the transition necessitates meticulous strategic deliberation. One of the key challenges in the advancement of sustainable technology is the uncertainty surrounding its long-term costs and efficacy. Potential solutions can be derived through the ongoing pursuit of research and the strategic use of resources. Especially in transportation. Air pollution from transportation is a dominant sector that exhausts seventy percent of air pollutants into urban ambient air (Ambarwati, 2020). Meanwhile, here, a significant portion of the population continues to rely on private automobiles as their primary mode of transportation instead of opting for public transit alternatives (Pujiati et al., 2022). Ultimately, the implementation of robust law enforcement measures is needed in order to effectively enforce air pollution restrictions (Hasyim et al., 2020).

Nevertheless, it is imperative to address the existing obstacles pertaining to the competency of law enforcement personnel and the potential for corruption (Gunawan et al., 2017; Tacconi et al., 2008; Zahroh & Najicha, 2022). This may be achieved by bolstering the law enforcement framework and promoting openness. By adopting a coordinated and comprehensive strategy, these difficulties may be effectively addressed, leading to the creation of a cleaner and more sustainable environment for future generations. In tackling all of these issues, Indonesia may learn from other countries that have surmounted comparable barriers. Indonesia can overcome these challenges and make genuine success in its air pollution reduction efforts with strong commitment, good cooperation, and the adoption of results-oriented policies.

Global Experiences and Lessons Learned

Various nations have used a range of solutions to address the issue of air pollution, providing useful lessons that Indonesia may learn from. To reduce air pollution, Singapore uses an integrated approach to city and industrial planning and strict growth control. Other air pollution mitigation measures taken by the Singaporean government include legislation, strict law enforcement, and air quality monitoring systems (Hasyim et al., 2020). Even in densely populated, industrialized metropolitan areas, Singapore's main goal is to maintain good air quality. The Singaporean government promotes clean fuel in industry and transportation and regulates emissions. These regulations cover motor vehicles, smoky vehicles, idle engines, off-road diesel engines, haze pollution management, and smoking bans.

Meanwhile, China has achieved significant emission reductions mostly through strong administrative authority, especially when emission reductions were linked to government employee performance and advancement. China, like most industrialized nations doing more research on the effects of increasing ozone on plants and the adoption of new technologies and implementation are needed to reduce air pollution to levels that protect human health and the environment (Zeng et al., 2019). Policy innovations include stricter emission limits, clean technology promotion, and pollution control are held. Additionally, China recognizes the importance of economic development in reducing air pollution. Studies show that rising income, a sign of economic growth, reduces air pollution. This has led to a focus on economic growth and environmental conservation. To reduce provincial air pollution differences, China has passed regional-level legislation. Local governments, especially in high-polluting areas, should prioritize SO2 and NOx reduction (Azimi et al., 2020).

Moreover, evidence-based decision-making based on environmental monitoring and research has helped the US manage air pollution. The Clean Air and Clean Water Acts have greatly improved air and water quality nationwide. Tetraethyl lead removal from gasoline reduced environmental lead pollution. Reductions in tropospheric ozone, airborne particulate matter, sulfur, nitrogen, and mercury and bioaccumulation of deadly methyl mercury have also improved vision. These pollution reductions benefit the environment, society, and economy. These programs demonstrate the importance of long-term study and monitoring data in environmental policymaking (Sullivan et al., 2018).These global experiences are

crucial to Indonesia's air pollution fight. The importance of openness and monitoring is clear. In cases of declining air quality, a transparent air pollution monitoring system helps people take appropriate action. Indonesia could implement a similar framework to provide reliable, accessible information to the public. Indonesia must prioritize well-informed communities by increasing air pollution education and awareness campaigns. This would allow citizens to take proactive air pollution reduction measures. Indonesia can reduce air pollution and create a more sustainable environment by adopting these lessons.

Steps Towards a More Advanced Air Pollution Mitigation Policy

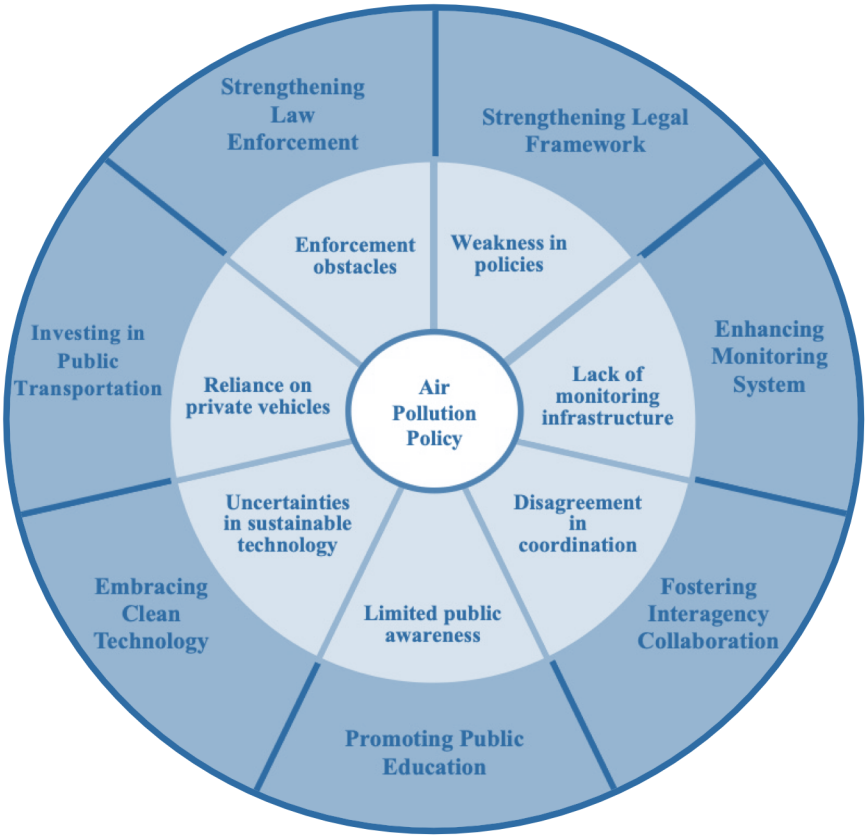


Figure 5. Challenges and Strategies in Air Pollution Policy

Efforts to develop air pollution mitigation strategies in Indonesia need tangible and coordinated initiatives spanning a wide range of issues, from regulatory strengthening to increased monitoring and active community engagement. In the face of difficult issues, the methods outlined below can assist in driving progress toward a cleaner and healthier environment. Several strategic initiatives are required to enhance air pollution reduction in order to achieve cleaner air and a healthier ecosystem. First and foremost, significant policy and regulatory change is required (Gunawan et al., 2017). Improving laws and regulations regaring environmental economic intruments is critical for lowering

pollution levels Improving Law No. 32 of 2009 on Environmental Protection and Management, as well as its related regulations, can build a strong legal foundation for reducing pollutant emissions (Ninik & Maryono, 2018). Technical legislation specifying emission levels for various industrial and transportation sectors must be in sync with technology progress and environmental consciousness. Creating effective rules guarantees that economic activities are in sync with environmental preservation aims. Second, an

improved monitoring and supervisory mechanism is required. Increased expenditures in air pollution monitoring and control are critical. Expanding and integrating the air monitoring network, as well as incorporating novel technology such as internet-connected air sensors, will result in more accurate real-time air quality data (Snyder et al., 2013). Collaboration between government agencies, universities, research institutes, and civil society is required for effective monitoring. Transparent broadcast of gathered data is critical for public awareness, allowing individuals to take preventative actions during periods of bad air quality. Third, it is vital to promote collaboration across diverse government departments and sectors. It is critical to improve cooperation among institutions involved in environmental management, include air pollution control (Hsu et al., 2021). Task groups comprised of members from many ministries and agencies can enhance collaboration in tackling air pollution concerns. Collaboration with the corporate sector and industry is also essential. Adoption of cleaner technology and sustainable industrial practices may significantly cut pollution emissions. Incentives such as tax cuts can promote change by encouraging firms to invest in novel pollution control systems.

Fourth, education and awareness initiatives are crucial. Improved educational activities and environmental awareness campaigns are required to emphasize the negative repercussions of air pollution and encourage appropriate action (Sulaeman et al., 2020). Incorporating environmental education into curriculum can enhance awareness among younger generations about the need of maintaining air quality (Hacking et al., 2013; Sukma et al., 2020). Mass media initiatives are also essential. Disseminating clearly understandable information on the impacts of air pollution and preventative measures that individuals may take can encourage community involvement in pollution control initiatives. Fifth, it is critical to embrace environmentally friendly and clean technology. Developing and implementing sustainable technology is critical for reducing pollution emissions (Prasad et al., 2019). Innovations in automobiles, renewable energy, and industrial operations may drastically cut carbon footprints and air pollution. One of this step is the use of solar energy. It has great promise for reducing the greenhouse impact and air pollution caused by the vast consumption of fossil fuels. In light of the foregoing, the use of solar-powered recreational boats is regarded as a unique tourism attraction in Indonesia (Sunaryo & Yusro, 2018). Governments may encourage corporations to adopt cleaner technology by granting incentives and funding research and development activities that promote environmentally friendly solutions.

Sixth, the development of sustainable infrastructure and transportation networks is critical. The development of more ecologically friendly

transportation solutions can considerably help to pollution reduction (Gunawan et al., 2017). Investing in environmentally friendly public transportation, such as trains and Bus Rapid Transit (BRT) systems, can reduce reliance on private automobiles, which are important contributors to emissions (Angelina et al., 2017). Creating safe and convenient bike lanes can aid in the shift to more environmentally friendly modes of transportation. Government assistance in the development and promotion of sustainable transportation infrastructure is critical. Finally, tough law enforcement is essential. To create a cleaner environment, strict enforcement of emission limits and air pollution rules is required (Hasyim et al., 2020). Improving law enforcement authorities' capacity to monitor and respond to infractions will serve as a disincentive to individuals who violate rules. By applying these measures extensively, we can pave the road for a healthier, cleaner, and more sustainable future.

Conclusion

This study gives an exhaustive description of Indonesia's air pollution circumstances, policy framework, and prospective potential solutions. The examination of Google Trends data demonstrated a strong public interest in and understanding of air pollution and its consequences, particularly in metropolitan regions such as Jakarta. Pollution, air quality, remote work, energy sources, and environmental legislation have all received substantial attention, indicating a rising concern for the environment. The report emphasises the significance of effective strategies to combat air pollution. Current policies in Indonesia have resulted in good advancements, such as rules establishing air quality standards and emission limitations for various businesses. However, problems remain, such as industrial opposition to regulatory reforms, limited resources for monitoring infrastructure, and the need to raise public awareness. To address these issues, the study suggests a multifaceted strategy. It is critical to strengthen legislative and regulatory frameworks in order to ensure alignment with technology improvements and environmental goals. Improved monitoring systems, together with the incorporation of developing technology such as real-time air quality monitors, can give reliable data for informed decision-making. Collaboration among governmental authorities and sectors is critical for effective air pollution control. Involving industry, adopting clean technology, and providing incentives can all help to promote pollution reduction initiatives. Public education campaigns and media activities should be expanded to promote knowledge about the dangers of air pollution and the measures individuals may take to prevent it. Furthermore, learning from global experiences is critical. Singapore, China, and the United States all provide useful insights in policy execution, monitoring, and technological adoption. Indonesia may use these lessons to develop a more advanced and comprehensive strategy to air pollution reduction. The research also emphasises the importance of developing sustainable infrastructure and transportation alternatives. Promoting environmentally friendly public transit, investing in renewable energy sources, and encouraging the use of clean technologies all help to reduce pollution emissions. Looking ahead, there are numerous intriguing paths for additional research and action. Longitudinal research might give a better insight by tracing the change

of public interest in air pollution through time. This would not only capture current patterns but also provide insights into how awareness evolves over time. Furthermore, investigating geographical inequalities in public interest and knowledge might throw light on localised problems and aid in tailoring actions to specific places.

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