

**Bridging the Gap: Analyzing Factors Affecting Collaboration in South
Korean Air Pollution Policy Development**

By

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Abstract

Particulate matter (PM) pollution in South Korea has spurred public demand for governmental action, raising issues of transparency and public trust. In response, the progressive administration has emphasized public participation in PM policy development. This study qualitatively analyzes the drivers and barriers influencing stakeholder collaboration in this context. Semi-structured interviews with 11 stakeholders—including government officials, experts, environmental organizations, and citizen groups—were analyzed using ATLAS.ti. Key findings identified two drivers: legitimacy through inclusivity and trust, and effectiveness through collaborative diversity focused on shared goals. One influencer, shifting political priorities, and seven barriers—including divergent perceptions of PM, conflicting expectations, inadequate information access, communication gaps, challenges in public participation, structural barriers, and government reluctance to share power—were also revealed.

Policy recommendations include enhancing information transparency, fostering community-government collaboration, institutionalizing living labs and citizen science, developing interdisciplinary communication strategies, promoting public engagement, and establishing equitable partnerships. These insights aim to improve public participation and stakeholder collaboration in environmental governance, supporting the Korean Environment Institute's mission.

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Introduction

In South Korea, the particulate matter (PM) issue has become a matter of public concern, leading to a strong demand for governmental action on air quality, and ultimately diminishing public trust due to a lack of transparency and communication issues. In response to the previous administration's impeachment, the new progressive government sought to demonstrate a proactive approach to public participation, particularly on high-profile issues such as particulate matter. During the policy development process, the government aimed to foster public trust and enhance legitimacy by introducing mechanisms for public participation and multi-stakeholder collaboration. This proactive public involvement effort has become integral to developing PM policies in South Korea. Despite these efforts, the subsequent development and implementation of PM policies have met with unsatisfactory responses from both the public and experts. In this report, I will conduct a qualitative analysis of the drivers and barriers affecting stakeholder collaboration on PM policy in South Korea. Through the analysis of the collaborative process, this report will identify areas for improvement and propose strategies for improving public participation and collaboration in environmental policy.

Public participation and the principles of deliberative democracy have gained increasing attention among scholars and policymakers, representing a shift away from traditional, top-down approaches to policy development. The South Korean government's integration of these participatory practices into its air pollution policy framework represents a significant transition toward more inclusive governance. Conventional policy development in this realm has tended to rely on established methodologies and successes from countries like Japan, the United States, and European nations—the pioneers and exemplars in improving air quality. However, this traditional path, while informative, may overlook the unique cultural, socio-political, and geographical considerations of South Korean stakeholders. Recognizing the necessity for collaboration in addressing PM challenges, there remains a pressing need for thorough evaluations of collaborative practices, identifying the strengths and areas where adaptability to the local context can be bolstered. This report seeks to provide such an analysis, evaluating the effectiveness of strategies used and nuances in local stakeholder dynamics.

My primary research question centers on the factors that obstruct or facilitate collaboration between civil society actors and the government in the development of air pollution policies in South Korea. This main research question guides the study towards a comprehensive investigation into the complex interplay between governments and non-state actors in environmental governance. Given the intricate nature of air pollution issues, which demand coordinated action across various levels of society and governance, understanding these collaborative dynamics is crucial for effective policy development and implementation.

To dissect this overarching inquiry, this research will delve into four supporting questions that aim to illuminate the multifaceted dynamics:

- How do shifts in political leadership and their associated priorities influence the commitment to stakeholder engagement and the continuity of air pollution policies in South Korea?
- How do the interests, priorities, and communication practices of different stakeholders, including government policymakers, experts, civil society actors, and industry players, affect collaborative efforts in air pollution policy development?
- What structural and procedural barriers prevent genuine stakeholder engagement in the policy-making process for air pollution?
- What actionable strategies can be implemented to enhance stakeholder collaboration and public participation in air pollution policy development?

In examining these questions, I found two drivers one influencer, and seven barriers as factors that shape stakeholder collaboration. The following table presents a structured overview of these factors:

Table 1 Drivers, Influencer and Barriers of Stakeholder Collaboration

Drivers, Influencer and Barriers of Stakeholder Collaboration		
Drivers	Influencer	Barriers
Legitimacy Through Inclusivity and Trust	Shifting Priorities of Political Leadership	Conflicting Expectations on Government Responsiveness and Policy Consistency
Effectiveness Through Collaborative Diversity Focused on Shared Overarching Goal		Divergent Perceptions on PM: Exposure vs Emissions
		Inadequate Access to Information
		Communication Gap Among Stakeholders
		Challenges in Structuring Public Participation Across Policy Stages
		Structural and Procedural Barriers to Genuine Stakeholder Engagement
		Government Reluctance to Share Power and Embrace Change

Through answering these questions, this research contributes to providing actionable policy recommendations for policymakers, experts, and civic leaders. By acknowledging the critical role of public trust, and the divergent aims of policy influencers, this study stands to explain the complexities inherent in fostering effective collaboration for environmental challenges. These results will further research in the environmental policy field as well as support the work of my client, the Korean Environment Institute. This South Korean national research institute promotes citizen participation in government decision-making. This research is intended to both understand and facilitate better policy synergy, shedding light on the collaborative journey of South Korea—illuminating a path toward clearer skies and a more cooperative future in environmental governance.

Literature Review

The literature review aims to provide a comprehensive understanding of the development and current state of air pollution policy in South Korea. It highlights the historical perspectives, dynamics of stakeholder engagement, and research gaps surrounding particulate matter pollution. Through this review, existing research gaps are identified, and the necessity of the current study is justified, focusing on the collaborative dynamics between various stakeholders.

Historical Perspectives on South Korean Environmental Policy

Understanding the historical perspectives on South Korean environmental policy is crucial for contextualizing the current collaborative dynamics between civil society actors and the government. The review of existing literature reveals diverse methodologies applied to investigate the development of environmental policies in South Korea. Dowan Ku's sociological analysis traces the roots and expansion of the environmental movement from the 1960s to the 1990s, highlighting civil society's growing engagement in environmental advocacy.¹ This research reveals multiple instances where civil society emerged as a pivotal player in shaping environmental policies. Chuyoung Won's dissertation applies Science Technology Studies to understand how air pollution regulations—particularly regarding diesel vehicles—have been socially constructed from the 1960s to the present.² This work provides insights into the interaction and dynamics between government, civil society, and expert groups in changing environmental standards. The analysis of historical dynamics, as outlined in Dowan Ku's sociological study and Chuyoung Won's research, reveals the foundational role of civil society in shaping environmental policy. This historical engagement sets the stage for understanding the contemporary collaborative processes that this study aims to explore.

However, while these sources offer valuable insights into the historical backdrop of environmental policy in South Korea, they do not provide a cohesive account of how historical and stakeholder contexts have influenced the contemporary collaborative dynamic between civil society and government bodies in the realm of air pollution policy. There is a noted need for a synthesis that connects past policy transformations with current collaborative decision-making efforts.

Government publications and policy analysis reports introduce particulate matter policy history with a more pragmatic assessment of measures for integrated management.³ Additionally, nonprofit research by the Korea Safety Health Environment Foundation charts the historical trends in air pollution management, including civil society organizations' movement on air quality.⁴ While these sources document the steps taken and the outcomes achieved, they fall short in analyzing the interplay between historical factors and the current collaborative landscape.

In light of this gap, my research aims to investigate the factors that obstruct or facilitate collaboration between civil society actors and the government in air pollution policy development. Specifically, I seek to understand how historical contexts and past policy transformations shape today's governance strategies and stakeholder interactions. In doing so, this study will contribute to a more nuanced understanding of the dynamics at play in collaborative environmental governance.

Dynamics of Stakeholder Engagement

Collaborative governance has garnered substantial attention over the past two decades, particularly within frameworks of stakeholder engagement. While literature from American and European contexts offers valuable frameworks, South Korea's unique political and social environment warrants a focused study to understand the specific dynamics of stakeholder collaboration in air pollution policies.

In U.S. academia, numerous theoretical frameworks dissect the processes and factors of collaborative governance. Christopher Ansell and Alison Gash identified variables for successful collaboration, such as the history of conflict or cooperation, stakeholder incentives, power imbalances, leadership, and institutional design.⁵ Kirk Emerson, Tina Nabatchi, and Stephen B. Balogh expanded this by presenting an integrative framework emphasizing social learning, conflict resolution, and institutional arrangements in cross-boundary collaboration.⁶ Steven Yaffee's work on California's Marine Protected Areas illustrates how people can make collaborative decisions amidst political, social, and administrative challenges.⁷ Julia Wondolleck asserts that effective stakeholder engagement requires robust governance infrastructures and strong motivational factors to sustain

participation and commitment in collaborative ecosystem-based management.⁸ Similarly, European research focuses on frameworks for the collaborative decision-making process. Marie Claire Brisbois and Rob C. de Loë discuss a power-based analytical framework, while Suzanne von der Porten and colleagues provide concrete recommendations for integrating Indigenous values into decision-making processes.⁹

While these theoretical frameworks and empirical studies provide a comprehensive understanding of collaborative governance and public engagement in the U.S. and Europe, there is a notable gap in literature specific to South Korea. Existing research in South Korean academia on this topic is limited, leaving a need for investigations focused on South Korean cases and contexts. By drawing on lessons from American and European contexts, this study will focus on the specific dynamics between government, experts, civil society, and industry within the South Korean context. Understanding these dynamics is crucial for addressing my research question: How do the interests, priorities, and communication practices of different stakeholders, including government policymakers, experts, civil society actors, and industry players, affect collaborative efforts in air pollution policy development in South Korea?

By examining the shifts in political leadership, stakeholder interests, and the barriers to genuine engagement, this research will provide actionable strategies to enhance stakeholder collaboration and public participation in air pollution policy development. This approach will bridge the gap between historical perspectives and current challenges, creating a comprehensive framework to inform future governance strategies.

The Evolution of Air Pollution in South Korea

Understanding the development and current state of air pollution in South Korea is essential for contextualizing the collaborative dynamics between stakeholders, as outlined in the literature review. This section provides a comprehensive overview of the historical and contemporary issues surrounding particulate matter pollution in South Korea. By examining these issues, we can better comprehend the complexities and challenges that shape stakeholder collaboration in the development of air pollution policies. This historical and

contextual background is crucial for informing the subsequent research methodology and analysis of collaborative governance.

History of Air Pollution in South Korea (1960 - 2010)

From the 1960s to the 2000s, as South Korea's national values evolved from economic prosperity to global reputation and ultimately to democracy and engagement, public awareness and collaborative governance regarding air pollution have correspondingly transformed. This contextual background illustrates that the public's perception and participation in air pollution policy decision-making are heavily influenced by domestic political dynamics.

Particulate matter, often described as a "silent killer," consists of particles not visible to the naked eye when smaller than 10 micrometers. Unseen and unknown, these particles often evoke fear. In South Korea, significant public alarm towards particulate matter began in 2013—the country then ranked highest among OECD nations for the portion of its population exposed to excessive PM2.5 concentrations.¹⁰ To comprehend the evolution of public fears surrounding particulate matter involves immersion into a history replete with conflict within collaborative bodies and across both domestic and international political stages. In this section, I will delve into the history of particulate matter up to 2013, highlighting South Korea's unique socio-economic and political context—along with the national ethos concerning air pollution—as the foundation for understanding the multifaceted conflicts that have emerged since.

The issue of air pollution in South Korea stems from the period of rapid economic growth known as the Miracle on the Han River. Following the Korean War in the 1950s, under Park Chung-hee's authoritarian governance, the country began large-scale national development projects in the 1960s and 1970s. The export-oriented heavy industry sector brought with it the onset of air pollution, yet both the government and the public initially greeted smog as a symbol of economic progress¹¹, as epitomized by the phrase engraved on an industrial tower in Ulsan: "When the black smoke of industrial production spreads into the air, it heralds the dawn of hope and progress for our nation." With economics prosperity being the utmost national priority, environmental issues scarcely entered social debates.

However, awareness of air pollution has gradually increased alongside rising incomes since the 1980s. A pivotal moment for air pollution policy was in the lead-up to the 1988 Seoul Olympics. The Chun Doo-hwan administration (1980 - 1988), eager to redirect the public focus to international image-building rather than internal affairs due to its authoritarian nature, prioritized enhancing South Korea's global reputation. In preparation for the Olympics, air quality became an increasing concern, especially when international marathon runners in a 1987 event in South Korea raised complaints about the pollution. Consequently, the government enacted key legislations such as the Environmental Basic Act and the Air Quality Conservation Act in 1990s, began regulating particulate matter in 1993, and initiated nationwide fine dust measurement in 1995. Though characterized by top-down government directives, these measures marked a shift in the perception of particulate matter in the country.

In the realm of civil society, after the democratization movement culminated in the June Democratic Uprising of 1987, the national discourse pivoted towards democracy and civic participation. Environmental advocacy groups, which had worked alongside mainstream politicians during the democratization movement, started collaborating with the government on air pollution issues in the 2000s. Collaborative committees involving civic groups, government, businesses, and experts were formed to facilitate joint decision-making—including the “Joint Committee of Citizens, Businesses, and Government for Resolving Diesel Vehicle Issues(경유차 문제해결을 위한 시민·기업·정부 공동위원회 발족)” and the “Civil-Private Joint Diesel Vehicle Environmental Committee(민관 공동 경유차환경위원회).” These forums allowed environmental groups to gain valuable experience and expertise in collaborative governance for air pollution management. However, their active involvement was curtailed when the Conservative Party consistently secured presidential victories.

Particulate matter issue in South Korea (2013 - 2024)

On top of domestic dynamics, the issue of air pollution in South Korea become increasingly complex since 2013, with external factors contributing additional layers. In that year, PM2.5

concentrations in some regions of China reached levels beyond the measurable range, with readings of 999. Concurrently, the World Health Organization (WHO) categorized PM2.5 as a Group 1 carcinogen. Statements by the Korean government and media coverages attributed the majority of South Korea's particulate matter problems to transboundary pollution from China. On October 28, 2013, South Korea's National Institute of Environmental Research under the Ministry of Environment warned that particulate matter originating from China could overwhelm the peninsula. The media adopted this language, employing terms like "threat," "emergency," and "fatal" to describe the impending particulate matter predictions. The Korean public's awareness of PM2.5 as a severe health hazard was heightened by such reporting, with perceptions of the crisis being heavily influenced by these statements and extensive media coverage. Moreover, clean air policy became a central issue in the 2017 presidential election, with public concern still prevalent according to a 2022 survey.

Although particulate matter level has improved since the 1990s, there is a strong public sentiment that air quality has substantially deteriorated over the past decade. A 2019 nationwide survey by the Ministry of Environment involving 1,111 respondents revealed that 92% believed PM pollution had worsened in comparison to ten years prior, and 94.7% felt that the issue was more severe in South Korea than in environmentally progressive nations like the United States and Europe.¹²

In 2018, a public petition demanding that the government pursue diplomatic actions against China over fine dust concerns rapidly accumulated 200,000 signatures within five days.¹³ Citizen-led rallies and petitions for fine dust resolution became commonplace, and placing responsibility on China for air quality improvements took root in societal discourse. Nonetheless, researchers point out that holding a nation accountable for transboundary harm under international law presents significant challenges. These include establishing causality, linking individual wrongful acts to a state, determining international obligation breaches, and outlining the criteria for substantial due diligence. Additionally, quantifying China's contribution to South Korea's particulate matter burden is fraught with difficulties, arising mainly from the uncertainties of modeling ratios and the challenge of acquiring accurate data from both China and South Korea. Despite these hurdles, defining a clear contribution ratio does not address the multifaceted diplomatic implications associated with such an endeavor.

As the public began to perceive particulate matter as a dire social issue, the Geunhye Park administrations (2012 - 2017) have largely focus on measuring.

As particulate matter recognition escalated into a serious social concern, action transcended mere measurement. During Jae-In Moon administration (2017-2022), a shift toward more substantive policy development and international cooperation occurred. With particulate matter classified as a societal disaster, a profound shift in public confidence became apparent—policymaking led by experts and government agencies was no longer deemed sufficient. The realization dawned that technical solutions could not fully satisfy the public's calls for action, given the growing dissatisfaction and mistrust among the populace. This situation highlighted the air pollution issue as novel compared to past environmental challenges, which had not stemmed as directly from public sentiment. In response to this pervasive social issue, it became clear that forging effective collaboration and engaging with the public were crucial steps needed to navigate the path to resolution. By reflecting on the impediments and enablers of cooperation, we are better positioned to understand how to tackle such complex societal problems.

Research Method

Given the intricate history and evolving dynamics of particulate matter issues in South Korea, it is important to understand how collaborative governance can effectively address these challenges. To this end, the research employs a qualitative approach through semi-structured interviews with key stakeholders involved in air pollution policy-making. This methodology aims to capture perspectives from four key stakeholder groups: government officials, expert groups, environmental advocacy organizations, and citizen groups. The study engaged 11 individuals across these stakeholder groups: one representative from government agency, four experts from national research institutes and universities, three representatives from major environmental advocacy organizations, and three members from citizen groups. This diverse sample was selected to provide a multifaceted view of the challenges and effectiveness of collaborative policy-making efforts. The length of interviews ranges from 30 minutes to two hours, with most lasting approximately one hour. These interviews were

transcribed and analyzed using the software package ATLAS.ti, allowing for systemic coding and thematic analysis.

The purpose of these interviews is to understand the dynamics that drive or hinder successful collaboration, identify stakeholders' views on policy efficacy and communication, and gather examples of successful collaborative efforts. This analysis is bolstered by a review of existing policy documents, providing crucial context for stakeholders' perspectives and illuminating the progression of South Korea's air pollution management strategies.

Interview Questions

The interview framework consists of seven key questions that primarily explore the interviewees' priorities, interests, and perceptions of other stakeholders' priorities and interests. Questions also include the drivers and challenges associated with collaboration, as well as instances of successful collaborative efforts. During the interviews, I modified or introduced additional questions as needed, tailoring them to the interviewees' responses and their ability to address specific topics.

1. What do you consider the most important environmental issue related to particulate matter?
2. Are you collaborating with government agencies to tackle the issue of particulate matter? What kind of work have you done?
3. Do you think that collaboration between government agencies, national research institutes, experts, civil society, and the industrial sector is necessary to address particulate matter issues? If so, what form of cooperation do you think is needed?
4. What do you think is the goal of the collaboration among the institutions mentioned earlier? Do you think the goals of the participating collaborations might be different?
5. In the process of developing or establishing policies to respond to particulate matter, what factors do you think hinder or facilitate cooperation between your institution (or civil society) and government agencies?
6. How do you evaluate the current status of citizen participation in the government's policy decision process for particulate matter?

7. Do you think there have been any successful cases of collaboration with the central government and local government? If so, what are the main factors that led to this success?

Stakeholder Table

As detailed in the research methodology section, my interviewees represent four key stakeholder groups: government agency, expert group, environmental advocacy organization, and citizen group. These groups were specifically separated based on their distinct roles, resources, interests, and strategies. One notable finding from the interviews is the internal distinction within the civil society group, separating environmental advocacy organizations from citizen groups.

Environmental advocacy organizations, with historical ties to political movements and established resources, have traditionally worked on broad environmental issues and serve as elite representative of citizens. They often employ more assertive strategies and have long-standing political alliances.

In contrast, citizen groups have emerged more recently, partly due to technological advancements that enable direct participation in the decision-making process. These groups often form through grassroots efforts, such as internet cafes, and focus on specific issues like particulate matter pollution without being tied to political positions. They generally adopt collaborative strategies and rely on volunteer-driven efforts. This phenomenon has grown significantly since the mid-2000s, reflecting a shift in how citizens engage with policymaking.

By analyzing the perceived problems, motivations, strategies, and resources, this stakeholder table offers a comprehensive understanding of the various insights and contributions each group brings to policy development. This structured approach aims to highlight the unique roles and challenges faced by each group in addressing particulate matter pollution and fostering effective public engagement in policy-making.

Table 2 Stakeholder Table

Stakeholder	Perceived Problem	Motivation	Strategy	Resource
Government Agency	Ineffective policy implementation regarding PM as a major threat to health and the environment	Effective air pollution policy and collaborative decision-making	Leverage government resources, engage in collaborative projects	Authority, expertise, and funding for environmental management
Expert Group	Poor collaboration and communication among stakeholders	Advancing research and technological development on particulate matter	Serve on government committees, engage in public education	Expertise in air pollution phenomena, leadership role in governmental committees
Environmental Advocacy Organizations	Misguided policy directions, temporary solutions, limited influence during Conservative presidencies, communication gaps	Advocating for environmental justice, energy transition, and policy advocacy	Collaborate with organizations, experts, and members of the National Assembly, advocacy campaigns	Long history of environmental advocacy, alliances with political parties, collaboration experience
Citizen Group	Lack of reliable information and robust policies, insufficient treatment for impending public health threats from PM	Improving community health and raising public awareness	Mobilize community efforts, engage in policy debates, collaborate with local government	Large membership base, active participation in policy discussions, grassroots activism

Drivers, Influencer, and Barriers

In examining the dynamics of stakeholder collaboration in South Korea's particulate matter (PM) policy development, it is essential to categorize the factors that drive, influence, or hinder effective collaboration. Drivers are understood as positive forces or conditions that facilitate and enhance stakeholder engagement and policy development. In this study, drivers include legitimacy through inclusivity and trust, as well as effectiveness through collaborative diversity focused on shared overarching goals. The influencer refers to factors

that exert a significant impact on collaborative processes, such as shifting political priorities, which can alter the focus and intensity of stakeholder interactions. On the other hand, barriers are obstacles that obstruct or impede effective stakeholder engagement. These include divergent perceptions of PM, conflicting expectations on government responsiveness and policy consistency, inadequate access to information, communication gaps among stakeholders, challenges in structuring public participation across policy stages, structural and procedural barriers to genuine stakeholder engagement, and government reluctance to share power and embrace change. Understanding these drivers, influencers, and barriers is crucial for developing actionable strategies to improve public participation and collaboration in environmental governance.

Drivers:

1. Legitimacy Through Inclusivity and Trust

Effective environmental policy depends on more than scientific and economic considerations; it requires a foundation in legitimacy to genuinely resonate with the public demand and ensure successful outcomes. As we confront environmental challenges with far-reaching impacts and complex origins, the inclusion of diverse stakeholder voices becomes indispensable. This part explores how legitimacy serves as a critical driver in the collaborative process of shaping PM policy in South Korea.

Environmental issues, such as climate change and air pollution, often intersect with various sectors, including health, economics, and social equity. Including diverse stakeholders ensures that policies consider these interconnected dimensions. Furthermore, engaging a wide range of stakeholders, including marginalized and vulnerable communities, helps ensure that environmental policies are equitable and address the needs of all affected populations, thereby enhancing the fairness and acceptance of policy measures. This prerequisite for legitimacy in policymaking extends beyond mere compliances; it seeks to cultivate a shared sense of purpose and collective stewardship of the environment.

Understanding the role of legitimacy in environmental policy becomes all the more crucial when considering the mixed reactions to participatory processes from South Korean policymakers. Legitimacy not only underlines the essential nature of such collaborations but also anchors them in the public interest – a foundational principle in democratic governance.

Through the prism of the principal-agent problem, which accentuates the potential misalignment between government actions and voter interests due to informational asymmetries, the necessity for participatory mechanisms becomes apparent. Interviewees invariably stressed this point, aligning legitimacy with trust and transparency; government action must demonstrably work for the people. One interviewee pointed out this, “Policies must serve all citizens. Thus, understanding what the public wants is essential for successful policy development.”

Environmental challenges, being vast and cross-region by nature, compel us to transcend regional limitations and understanding the indispensable need for multi-stakeholder agencies. The intersection of citizens’ real-life challengers, as highlighted by interviewees, demands that meaningful participation is the most effective way to capture the nuanced and multi-faceted nature of environmental issues. Such collaboration ensures that policy responses are not only efficacious but also garner the confidence of those whom they are designed to serve. One advocate shared, “Citizens and environmental organizations play a key role in advocating for change. We constantly contemplate why and how to address issues like air pollution. Our perspectives should inform and shape policy.”

This collaboration goes beyond simple consultation; it includes recognizing the expert roles that NGOs and long-time environmental proponents play in policy development. Many interviewees emphasized that NGOs, as significant voices in their fields, represent citizen opinions and enhance the credibility of participatory processes. One participant noted, “NGOs should be included to lend credibility and ensure a wide range of citizen views are considered.” Excluding them could undermine the legitimacy of the process. Therefore, to ensure a legitimate and collaborative governance model, it is essential to involve those from NGOs with a track record of meaningful participation in representing citizens’ interests in environmental issues.

2. Effectiveness Through Collaborative Diversity Focused on Shared Overarching Goals

In the realm of environmental policy, effectiveness is not merely a product of streamlined processes but emerges from the robust interplay of diverse stakeholder perspectives. This

section will explore how diversity in stakeholder objectives can paradoxically enhance effectiveness in policy-making with South Korea's approach to PM policy.

Throughout the interviews, a universal agreement emerged on the necessity of stakeholder collaboration. The paradox conveyed by the interviewees—that stakeholders with differing objectives can better collaborate—reinforces the notion that diversity can foster efficiency in policy-making. Far from being an impediment, varied aims can catalyze stakeholders to find innovative, synergistic solutions that may not emerge in more homogeneous groups. As one interviewee observed, “Stakeholders may have different objectives, but it’s precisely the diversity of these goals that enables greater collaboration.” He also provided an analogy to illustrate the potential efficiency: “For instance, salt merchants competing over the same market might struggle to agree due to their direct competition. In contrast, a salt merchant and a woodcutter, each selling different products, can more easily reach consensus because of their different goals.” This perspective underlines the importance of not framing the situation as zero-sum but rather as an opportunity to forge win-win outcomes.

This dynamic was exemplified in the collaboration to tackle PM, where despite a varied interests, a common ground was found in the shared impact of PM on public health. A representative from an environmental advocacy group remarked, “Collaboration on tackling the particulate matter issue was highly effective due to a consensus on the importance of public health. This stands in contrast to other instances where economic interests often clash with the imperatives of environmental protection.” The urgent need to address the health implications of PM served as a rallying point that brought diverse stakeholders together in a collaborative effort.

Rather than leading to discord, the diverse goals of varying stakeholders catalyze a collaborative push for efficient problem-solving. Each stakeholder brings their unique perspective and expertise to the table, enabling a holistic approach that might not be achieved through homogenous groups. The desire for efficient solutions that effectively address public health concerns regarding PM is a powerful unifying force that facilitates partnerships among stakeholders with differing, but complementary, aims.

However, forging a consensus around PM was complex, fraught with discussions and controversies, mainly due to differing opinions on the root causes of PM. Is it attributable to

transboundary pollution from neighboring countries, or are domestic sources to blame? This debate affected the public's perception and satisfaction with the government's response, sparking indecision between diplomatic approaches and domestic emission reduction policies. As one interviewee pointed out, "I think everyone shares the common goal of reducing particulate matter. While we're aligned in our objective, it's likely that we each have different methodologies for how to achieve this."

The pursuit of efficiency in policy-making lends weight to the need for diverse stakeholder collaboration and robust public participation. It becomes clear that while consensus on the intricacies of complex environmental issues like PM may be elusive, the drive to achieve efficient solutions brings disparate groups to the table. Establishing a collaborative dialogue, informed by a breadth of expertise and public input, is not just an exercise in participatory democracy but a strategic imperative to develop policies that are pragmatic in resolving the urgent public health challenge posed by PM.

Influencer: Shifting Priorities of Political Leadership

While legitimacy and effectiveness are pivotal drivers for stakeholder collaboration, they operate within the political arena where leadership priorities can play a decisive role. The fluctuating political landscape can significantly impact the commitment to public engagement in decision-making processes. This section explores how shifts in political leadership influence environmental policymaking, particularly in relation to stakeholder collaboration and public participation.

Political priorities markedly influence the level of public participation in policy processes. As an expert interviewee noted, "Political leaning can create a divide in the emphasis placed on direct participation in decision-making versus simple public involvement." Under progressive governments, such as those of President Roh Moo-hyun (2003 - 2008) and Moon Jae-in (2017 - 2022), there were active discussions about participatory democracy, with attempts made at policy formulation through deliberation. In contrast, conservative administrations have typically been more reticent to engagement in extensive citizen participation.

Public trust, critical to the efficacy of environmental governance, was notably challenged during the Park Geun-hye administration (2013-2017). Amid a tenure fraught with scandals, one instance that particularly struck a chord was the ministry's statement that "grilling mackerel creates fine dust," which led to media misinterpretation. The portrayal of the government's messaging as trivializing the broader environmental crisis suggested an evasion of substantial responsibilities, further eroding public trust. The scandal known as 'Park Geun-hye Choi Soon-sil gate' ultimately triggered South Korea's first presidential impeachment, igniting a public demands for increased transparency and public engagement. This led to the rise of the following administration, that of President Moon Jae-in, which marked a stark contrast by placing participatory democracy at the forefront of its policy strategy, particularly in response to the pressing issues of air pollution and particulate matter.

Corresponding with the rise of public concern and a spike in media coverage since 2013, Moon Jae-in's administration made notable efforts to include broad stakeholder perspectives in its policy decisions. Moon's commitment to addressing PM issues topped his presidential campaign promises, with initiatives like the presidential Blue House petition system receiving overwhelming public responses. For example, a petition advocating for diplomatic action against China on PM concerns collected 200,000 signatures in just five days.¹⁴ An interviewee pointed out, "When the government's policy direction aligns with the will of the citizens, such initiatives progress swiftly."

Following through on these commitments, the Moon administration established the "Special Policy Committee on Fine Dust" and the "National Council on Climate and Air Quality (NCCA)," setting a precedent for inclusive and collaborative policymaking.¹⁵ One environmental advocacy group representative voiced approval of the new administration's approach, stating, "It's not easy to say that civic groups represent the national populace, but the fact that the government attempted to work with them means they intended to listen to the stakeholders' perspectives."

Despite these steps towards embedding public input into governance, the changing winds of political leadership pose continual challenges. Stakeholders reported variability in environmental engagement driven by the ruling party's priorities and noted the disruptive effect of election cycles and events like the COVID-19 pandemic on maintaining

environmental agendas. A pattern emerged, suggesting political leaders to often foreground electoral success, sometimes overshadowing environmental objectives.

Critiques of policy discontinuity due to frequent changes in leadership raised concerns about the long-term sustainability of environmental policies. As multiple respondents noted, the back-and-forth nature of political change often means that hard-earned progress can be swiftly unraveled, raising questions about how to protect the gains made in participatory environmental governance against the uncertainties of political shifts.

Barrier

1. Divergent Perception on PM: Exposure vs Emissions

The ongoing debate about PM_{2.5} pollution in South Korea underscores significant differences in perception among key stakeholders. While the shared goal is to safeguard public health, divergent views on the root cause and appropriate solutions have led to considerable controversy, public dissatisfaction, and erosion of trust in governmental policies.

This section examines the discrepancies in perceptions of PM by analyzing various dimensions: cause, problem characterization, solution, proposed policy approach, supporting sources, and group response. Divergent perceptions between the public and environmental experts lead to fundamentally different approaches to addressing PM pollution. The public's emphasis on immediate relief measures to protect against what they perceive as an external threat starkly contrasts with experts' focus on sustained, domestic emission control efforts. This section provides an overview of the discrepancies between the perceptions of the public and those of experts and environmental advocacy groups.

Table 3 The discrepancies in perceptions of PM

Aspect	Public Perspective	Expert/Environmental Advocacy Groups Perspective
Cause	Transboundary pollutants from China impacting South Korea	Predominantly domestic sources such as diesel vehicles and coal power plants
Problem Characterization	Newly recognized, immediate threat that appears overwhelming	Ongoing, long-term issue requiring consistent and proven domestic management
Solution	Diplomatic efforts and provisional personal protection measures, including subsidies for masks and air purifiers, to reduce individual exposure	Systematic emission reduction measures, including regulations on automotive and energy sectors, to reduce emissions at the source
Proposed Policy Approach	Emphasize international negotiations and provide immediate relief through personal protection measures	Maintain and enhance domestic emission control measures, informed by historical policy effectiveness
Supporting Sources	Government statements and media portraying China as the main culprit, supported by recent research recognizing transboundary pollution	Established research and historical successes in air quality management policies
Group Response	Protests and demands for immediate government action	Initial underreaction followed by increased advocacy for public education and domestic policy emphasis

Cause

Public Perception: The prevailing public view attributes PM_{2.5} pollution primarily to transboundary pollutants from China. Government statements and media coverage have significantly shaped this perception. For instance, on October 28, 2013, the National Institute of Environmental Research under the Ministry of Environment warned that particulate matter

originating from China could overwhelm the peninsula. Media outlets adopted this narrative, using terms like “threat,” “emergency,” and “fatal” to describe the situation. This heightened public concern and awareness of PM_{2.5} as a severe health hazard. An interviewee stated, “Statements by the Korean government and media coverage attributed the majority of South Korea’s particulate matter problems to transboundary pollution from China.” This narrative has led the public to demand immediate protective measures and diplomatic interventions to address what is perceived as an external threat.

Expert/Environmental Advocacy Group Perspective: Experts and environmental advocacy groups argue that the major sources of PM_{2.5} are domestic, primarily from diesel vehicles and coal power plants. They contend that quantifying China’s contribution to South Korea’s particulate matter burden is complex, citing uncertainties in modeling ratios and challenges in obtaining accurate data from both countries. One expert highlighted, “Quantifying China’s contribution to South Korea’s particulate matter burden is fraught with difficulties.” This perspective emphasizes the importance of focusing on domestic sources for effective policy-making. Historical data and established research indicate that consistent domestic policies have successfully mitigated pollution and should be prioritized.

Problem Characterization

Public Perspective: Public perception frames PM as a newly recognized, immediate threat, leading to heightened anxiety and demands for urgent, protective actions. This perception is fueled by alarming media reports and governmental warnings that cast PM as an unprecedented crisis. The resulting public anxiety compels the government to prioritize short-term relief measures, which are perceived as immediate solutions to a dire problem.

Expert/Environmental Advocacy Groups Perspective: Experts view PM pollution as an ongoing, long-term issue requiring sustained and constant domestic policies. An expert mentioned, “Existing policies have shown significant improvements in air quality when consistently applied.” They argue that the problem is not new and has been effectively addressed through well-established pollution control measures, such as regulations on diesel vehicles and coal power plants, which need to be continued and strengthened. Furthermore, a gap in public understanding of the correlation between domestic emissions reductions and

direct health benefits exacerbates anxiety and undermines confidence in government initiatives.

Solution

Public Perspective: The public, believing that PM pollution primarily originates from China, supports diplomatic efforts and immediate personal protective measures to mitigate exposure, including subsidies for masks and air purifiers. One interviewee noted, “The public supported personal protection measures due to the perception of an immediate threat from transboundary pollution.” Confronted with public pressure, the government has often leaned towards these provisional solutions. An environmental advocate pointed out, “The immediate fear for health due to PM has veered policy-making away from essential debates on enduring stewardship and towards ephemeral, sensationalized action. This misplaced emphasis steers us towards provisional fixes such as air quality tools and purifiers, while the real adversaries—our auto emissions and reliance on coal power—remain unchallenged.” This approach, while well-intended, aims to alleviate immediate public concerns but does not address the root causes of pollution. As a result, it fails to achieve long-term air quality improvements. The focus on personal protective measures has also led to the commodification of air quality solutions. As another interviewee observed: “Launching satellites to monitor transboundary dust from China, erecting air purification towers, and placing air purifiers in schools and homes have become new industries and sources of profit. Instead of spending money to reduce exhaust emissions, we invest in protective equipment, turning society into one that commodifies air.”

Expert/Environmental Advocacy Groups Perspective: Experts and environmental advocacy groups argue for systemic solutions aimed at reducing emissions at the source. This includes stronger regulations on diesel vehicles and coal power plants. One expert emphasized, “Addressing particulate matter needs to be more domestically focused, consistent and continuous.” These groups highlight the success of past policies in improving air quality when consistently applied. For instance, the Air Quality Conservation Act enacted in the 1990s and the Metropolitan Air Quality Management Plans of the 2000s led to significant improvements in air quality. However, the introduction of “clean” diesel vehicles and related policies in 2008 reversed these gains, resulting in deteriorating air quality.

Environmental advocacy groups opposed these diesel-related policies and collaborated on numerous initiatives, leading to some improvements by the early 2010s. One interviewee reflected, “Raising diesel prices and implementing special laws led to a reduction in emissions from major sources. As emissions dropped, air quality improved significantly, especially in metropolitan areas.”

Proposed Policy Approach

Public Perspective: The public, driven by immediate health concerns and alarming media portrayals, favors international diplomatic efforts and quick relief measures. This perspective is informed by the belief that the primary source of PM pollution is external, originating from China. The public supports actions like diplomatic negotiations and the provision of personal protective equipment, such as masks and air purifiers. However, while these measures seek to provide instant relief, they often neglect the underlying domestic sources of pollution. As a result, such policies may temporarily alleviate public anxiety but fail to achieve long-term improvements in air quality.

Expert/Environmental Advocacy Groups Perspective: Experts and environmental advocacy groups emphasize the importance of sustained and consistent domestic emission control policies. These groups point to the historical effectiveness of such policies in improving air quality. One expert noted, “Existing policies have shown significant improvements in air quality when consistently applied.” Examples include the emission reduction achieved through raising diesel prices and implementing special laws. These groups argue that maintaining and enhancing domestic emission control measures, informed by historical policy effectiveness, is crucial for long-term air quality improvement.

Group Response and Supporting Sources

Group Response: Responses from each group reflect their perceptions and proposed solutions. The public has been active in protesting and demanding immediate government action, driven by media influence and heightened health anxieties. Experts, initially less reactive, have increased advocacy from public education and more emphasis on domestic policies. As one expert pointedly observed, “Participants often overestimate their understanding of complex issues.”

Supporting Sources: The supporting evidence for each perspective on PM pollution varies significantly. The public's perspective is predominantly backed by government statements and media reports that emphasize transboundary pollution from China. An interviewee noted, “Statements by the Korean government and media coverage attributed the majority of South Korea’s particulate matter problems to transboundary pollution from China.” This narrative shapes public opinion by presenting external sources as the primary contributors to air pollution, leading to a demand for diplomatic solutions and immediate protective measures. Conversely, experts and environmental advocacy groups rely on established research and historical data demonstrating that domestic sources, such as diesel vehicles and coal power plants, are the primary contributors to PM pollution. An expert highlighted, “Existing research shows that consistent domestic policies have significantly reduced pollution levels in the past.” This reliance on historical and scientific underscores experts’ calls for sustained domestic efforts to effectively address PM pollution.

2. Conflicting Expectations on Government Responsiveness and Policy Consistency

As explored in the previous barrier 1 part, the divergent perceptions between the public and environmental experts on the causes and solutions for PM pollution fundamentally shape their expectations for government action. This section delves deeper into how these perceptions translate into conflicting demands for government responsiveness and policy consistency, further complicating collaborative decision-making processes.

In environmental policymaking concerning PM pollution in South Korea, there is a crucial tension between public sentiment and the need for consistent, science-driven decision-making. Environmental advocacy groups and expert groups emphasize the need for consistent government action over immediate responsiveness to public demands, reflecting the expert-citizen divide.

Government Responsiveness to Public Demand

One of the primary sources of public dissatisfaction with the PM policymaking process is the perceived lack of government responsiveness to public demand. Interviewees from citizen groups pointed out that the government appears slow and reluctant to enact significant policy changes in response to public concerns. As one interviewee remarked, “The government does

not respond quickly enough to address the public's concerns. Their reluctance to implement significant policy changes is frustrating."

For instance, the representative citizen organization "We Call for Actions to Combat Particulate Matter," which has 87,000 members nationwide, has mobilized efforts to demand precise information through increased measurement stations and the provision of more air purifiers in compulsory education institutions from elementary school to high school. Their activities includes street protests, active participation in public hearings, repetitive calls to government offices, and engagement with collaborative committees on PM pollution organized by the government. These efforts contributed to shaping key legislative measures, such as the Special Act on Fine Dust and the revision to the Disaster and Safety Management Basic Act.

However, the process was neither approachable nor accessible to citizens. Initially lacking connections and routes to convey their voices, citizen group members approached the Ministries of Environment and Education first. Government officers commonly requested that they generate strong public opinion on PM issues, placing the burden of agenda-setting on citizen groups. This lack of responsiveness pushed the citizen groups to collaborate with National Assembly members and city council members, ultimately leading to the enactment of municipal ordinances for PM issues.

As their activism gained media attention and pressure mounted from various government levels, the Ministry of Environment eventually approached the citizen group to inquire about their demands. The group secured opportunities to participate in collaborative committees such as the "Special Policy Committee on Fine Dust" and the "National Council on Climate and Air Quality (NCCA)." Despite this, barriers remained. The citizen group representative noted feeling pressured by other experts when raising her voice in committee meetings. Although occasionally supported by a few experts, she found it burdensome to oppose the majority opinion. The hierarchical dynamics between citizen and expert groups created multiple layers of obstacles for the citizen group to become committee members and voice their opinions in committee.

These barriers highlight the challenges public groups face in directly influencing government policy-making. As the public encounters repeated failures to secure government responses to their demands, their anxiety and distrust towards government responsiveness may grow.

Consistency in Environmental Policy

Environmental advocacy groups and experts criticize that citizens often demand immediate action in response to PM pollution, which may result in short-term policies that fail to address the root causes of the problem. An environmental advocacy group representative explained, “When we talk about PM policy, providing air purifiers or masks might seem beneficial but are merely temporary fixes. In reality, we should be aiming to shut down coal-fired power plants or limit the use of cars.”

Advocates and experts argue that policies must be persistent and scientifically grounded, rather than influenced by fluctuating public opinion. “Policies on PM, as well as environmental issues at large, should be persistently pursued with a clear and steady vision,” emphasized another advocate. They highlight key policies for energy transition and automobile emission reduction implemented by the government until 2013 as examples of effective strategies. Given their extensive experience working on air quality issues since the early 2000s, these advocates contend that a steady, science-based approach is crucial for addressing PM issues. This perspective suggests that effective air quality policies should target core pollution sources—such as coal power plants and diesel vehicles—and remain steadfast despite public fluctuations.

Moreover, the role of the government is not only to be responsive but also to educate the public and persuade them of the necessity of scientifically sound, long-term solutions. While public anxiety is understandable, the government needs to balance quick responsiveness with policy consistency. Flexibility and the creation of a systemic platform for communication and understanding are essential. Thus, ensuring broader public participation in the policy-making process becomes imperative. Ultimately, a comprehensive approach that combines prompt responsiveness with long-term consistency, alongside fostering participation and dialogue, is key to effective environmental governance.

The Expert-Citizen Divide

Many interviewees reported feelings of dismissal and marginalization, emphasizing the systemic challenge of integrating non-expert voices into the policy framework. The focus on quantifiable data often sidelines the valuable experiential knowledge that residents possess.

A significant barrier to participatory democracy is the expert-citizen divide in policy-making, where the emphasis on scientific and quantifiable data often overshadows the lived experiences and local knowledge of residents. Collaborative efforts with universities and independent data collection initiatives by citizens have shown potential in bridging this divide, although substantial challenges remain.

Initiatives such as independent particulate matter measurement have significantly amplified citizen voices in policy demands. “We started independently measuring and educating to create evidence-based data. This data has not only been utilized but has also strengthened our voices in policy demands,” shared a citizen involved in data collection. These initiatives clearly demonstrate the potential impact of citizen-driven data.

Attempts to bridge the divide through collaboration with universities have had partial success. Citizens have observed that, although universities receive national funding and resources, these collaborative efforts often fall short of addressing immediate community needs. “Research projects often stall due to policy or budget constraints, leaving citizens desiring more actionable solutions,” commented an interviewee. This reflects an imbalance where research objectives do not consistently align with public urgency.

The Implementation of PM Standards

The debate between the ambitious goals of citizen activists and the cautious pragmatism of experts is vividly illustrated in South Korea’s PM standards controversy. Citizen groups push for stricter environmental protections based on their daily lived experiences of air pollution, while experts argue that overly stringent PM standards, distant from current realities, are not beneficial for addressing the problem effectively.

Citizen groups argue for robust standards, asserting that their demands are both ambitious and achievable. An advocate stated, “Citizen group demands are often labeled as too

idealistic, yet without such advocacy, policies risk becoming ineffective and resources potentially misused.” Their drive stems from idealism, envisioning a future where some of their high aspirations could become reality. “Our demands may be idealistic, but I think it would be beneficial if at least half of these ideals could be realized in policy,” reflected another citizen activist. Behind their ambitious push lies a profound lack of public trust in the government's responsiveness. They often propose more stringent standards as a negotiating strategy, aiming to achieve at least partial concessions, believing the government may not fully heed their demands.

Conversely, professionals advocate for a measured approach, citing techno-practical concerns and the potential unintended consequences of stringent standards. “Advocating for reinforced standards is illogical. If PM levels are at 100-considered normal internationally-forcing a reclassification to ‘very bad’ only increases anxiety. It’s essential to manage the actual pollution sources, and not just focus on the occasional high readings,” noted an expert. Their approach is informed by past experiences working with the government to address air pollution issues. Recognizing the importance of collaborative efforts that consider the current situation and barriers faced by various stakeholders, experts emphasize the need for “realistic” and “achievable” goals. However, this emphasis on realistic goals sometimes exacerbates public anxiety, as citizens perceive it as a sign that their voices are not being heard.

Effective policy should draw on both lay expertise from citizen insights and expert technical knowledge, bridging the gap between public demands and scientific pragmatism. One interviewee noted, “A diversity of opinions should be heard in governance and cooperation processes. However, adjusting our overall direction every time the public voices a concern would not represent proper governance. The essence of governance lies in presenting a convincing argument for the chosen direction and its benefits to stakeholders.” said one policy expert. “The essence of governance lies in presenting a convincing argument for the chosen direction and its benefits to both citizens and businesses.”

3. Inadequate Access to Information

One interviewee from a citizen group noted, “Our activism initially began due to a lack of the relevant and reliable information.” Inadequate access to information poses a substantial barrier to effective collaboration between the government and civil society actors in addressing air quality issues. The divergence in information priorities underscores a fundamental gap between the lay public’s immediate needs and the experts’ strategic approach to long-term air quality improvement. Despite the abundance of PM research in South Korean academia, the public lacks actionable insights that can help them protect their health or make day-to-day decision. The influx of media coverage about the critical threat of PM to public health exacerbates this information deficit, furthering public distrust and negatively impacting joint efforts to improve air quality.

A survey conducted among the public and experts revealed that both groups—60.4% of the public and 75.8% of experts—view the lack of access to information as the most pressing concern.¹⁶ Why do both groups pinpoint the lack of access as the most pressing concern regarding PM issue? Why is access to information crucial for addressing PM issues, and what kind of information are they seeking? This section aim to answers these questions by examining multiple examples of inadequate access to information problem.

Accurate Measurement of PM Levels

Since 2013, as public awareness of the health impacts of PM has grown, people have sought accurate measurements of PM levels in their regions and neighborhoods. However, in 2013, there were not enough measurement stations, and coverage varied significantly from region to region. According to 2017 statistics, a pronounced scarcity of measurement stations existed outside Seoul and other metropolitan cities.¹⁷ Particularly in Jeonnam, Chungnam, Gyeongbuk, Gangwon, and Jeju, the five lowest-ranked regions, one measurement station’s coverage area was over seven times larger than that of Seoul. Most experts agree that Seoul’s coverage—one station per 15.5km²—is adequate, which means coverage in other regions is insufficient for accurate measurements. Specifically, there are many more oil refineries, steel plants, and thermoelectric power plants outside Seoul, in regions such as Jeonnam, Gyeongnam, and Chungbuk. Although Seoul has the highest traffic pollutants, these regions

are more vulnerable to industry air pollutants compared to Seoul. Thus, citizen living in other regions cannot trust the PM measurement results due to this scarcity.

Beyond the insufficiency of stations, there was considerable mistrust in the reliability of measurement data, spurred by skepticism over potential government manipulation and the placement of measurement stations. Additionally, the deficiency of PM_{2.5} stations compared to PM₁₀ stations exacerbated these concerns, contributing to the public's growing distrust of government data. Since 2017, the government has undertaken measures to improve transparency by allowing the public to visit and monitor the measurement process at stations and significantly increasing the number of stations. These efforts have begun to address some of the public's concerns regarding data reliability.

Actionable Information for PM exposure

Beyond numerical data, the public has also struggled with a dearth of actionable information on how to protect themselves from PM exposure effectively. As concerns over PM increased since 2013, people struggled to find reliable information on effective safety measures. Uncertainty abounded over which masks were effective and what methods could protect against PM exposure. The existing response manuals, lacking detailed, clear guidance, failed to alleviate public fears and uncertainty regarding PM dangers.

The lack of clear guidelines and validated protective measures has prompted citizens to seek alternative solutions, often based on hearsay and unverified claims, adding to confusion and concern. Misinformation also spread, such as the belief that consuming pork belly could help capture and digest PM particles in the throat. An interviewee emphasized, "Without setting up proper exposure management, communication breaks down. The general public raises issues about health exposure because it affects them directly, and they want better management of emissions. If this is not addressed, anxiety ensues."

Opinions from Experts

While the public struggles with the lack of information, some experts have different opinions on the accuracy of measurements and the health impact of PM. They argue that public concerns are often exaggerated due to anxiety and imprecise information. For example, according to statistics from 2016, there are 154 national measurement stations and 264 local

government measurement stations, totaling 510 stations in operation. This number is comparable to the US, European countries, and Japan.

Additionally, experts emphasize that increasing measurement stations is not always an ideal solution because the primary goal of measurement station is to obtain representative value and long-term trends. Installing additional measuring networks requires substantial costs. Therefore, the optimal strategy is to select representative areas and install the minimum number of stations necessary to avoid budget wastage.¹⁸

Regarding the health impact of PM, experts assert that the media has exaggerated the danger. Multiple interviewees from expert groups mentioned that South Korea's strict measurement standards do not reflect the current situation accurately. They argue that it is generally safe to engage in outdoor activities under the average PM levels in South Korea. While factors such as exposure ratio and proximity to pollution sources should be considered for more precise recommendations, many experts believe that the public's anxiety about PM in South Korea far exceeds the actual risk.

Importance of Access to Information in Addressing PM Issues

Despite having sufficient research and resources on PM, the public in South Korea struggles with a lack of accessible information. Public demands for accurate measurement results, increased measurement stations, and actionable information on PM pollution show the restricted access to information and limited channels for public inquiry. Without reliable and accessible information, the public experiences heightened anxiety about PM issues compared to experts who have comprehensive data.

Bridging this information gap through transparency, reliable data dissemination, and clear communication strategies is crucial. By enhancing public access to accurate information and engaging in continuous, two-way communication, stakeholders can foster greater cooperation and implement effective, long-term solutions to improve air quality. These measures would not only empower individuals to make informed decisions but also help rebuild trust between the public and the government.

4. Communication Gap Among Stakeholders

Alongside the problem of inadequate information, communication barriers also hinder effective collaboration and public participation. Addressing the PM issue goes beyond technology and science; it requires social consensus and mutual understanding, making communication a core component. This section explores the key communication challenges among the primary stakeholders: government, experts, citizens, and industry stakeholders.

A representative from the Ministry of Environment emphasized, “How diligently we explain policies as officials directly affects the smooth implementation of these policies. Providing ample explanation opportunities and building sufficient consensus is the key to promoting cooperation and citizen participation.” This highlights the need for transparency in the communication of environmental policies.

Government-Expert Communication

A key barrier to effective communication between government decision-makers and experts is the mismatch between the needs of policymakers and the focus of academic research. Even within national research institutes, researchers often find that their work is not utilized for policy-making. Policymakers, conversely, may view academic research as irrelevant to practical decision-making.

One interviewee explained this disconnect: “R&D often fails to influence policy because the results produced by experts are not in a form usable for policy. Researchers believe they have fulfilled their role and expect policymakers to incorporate their academic research into policy. However, policymakers find little practical value in academic studies.”

An example of this disconnect is the issue of PM secondary pollution. Research conducted in the early 2000s highlighted the severity of secondary pollution in South Korea and recommended targeted policies. However, these research findings were not adequately reflected in policies at the time. It wasn't until the mid-2010s that secondary pollution gained recognition as a significant source of PM, illustrating the need for enhanced communication between policymakers and experts. As one expert mentioned, “Experts continuously emphasized the need to study the secondary formation of PM and ozone for effective management. However, after those who devised the foundational plans left the Ministry of

Environment, the momentum for new initiatives was lost, and policies reverted to previous approaches.”

Incorporating expert insights into policy requires more than just access to research; it necessitates active dialogue, mutual understanding, and the cultivation of specialists adept at both scientific communication and policy implications. As another interviewee pointed out, “While experts are somewhat trained to communicate among themselves, communicating with non-experts and explaining the policy implications of environmental issues is challenging. Therefore, we need more experts who can bridge this gap.”

Citizen-Expert Communication

Communication barriers are also evident between citizens and experts. Experts often do not fully grasp the anxiety and concerns of citizens, while citizens struggle to understand the broader context of the PM issue. This mutual lack of understanding can lead to significant problems when there’s a failure in communication between the two groups.

One expert remarked on the role of government and media in amplifying the issue: “It was true that the concentration of PM was higher compared to so-called global north countries, but that was due to geographical factors and our industrial structure. At those levels, it was actually not particularly harmful to exercise outdoors. The government and the media are largely responsible for turning it into a social disaster, and the fact that experts did not properly counteract this narrative also bears significant responsibility.” Reflecting on missed opportunities for effective communication, another expert noted, “In hindsight, experts should have been more proactive in sharing their opinions through media outlets, social media, and academic gatherings, issuing statements collectively and engaging actively to convey accurate information.”

The lack of comprehensive experts who can communicate the entire picture of the PM issue exacerbates the problem. As one interviewee explained, “Only narrow specialists exist in specific research areas, and there are hardly any experts who can see and communicate the overall situation. This leaves the general public vulnerable to incorrect broadcasts or news articles, not realizing they may be inaccurate.”

Engaging Industry Stakeholders

Industry stakeholders face significant regulatory pressures from PM policies. A challenge in engaging industry stakeholders is navigating their resistance to the additional burdens imposed by PM regulations. One interviewee highlighted this point, stating, “From the industry’s perspective, they resist the added burden, naturally. The main issue is how well we can negotiate, adjust, and persuade conflict interests.”

As such, it is vital to persuade them of the long-term benefits of compliance, such as aligning with global standards to enhance their market power in the export market. One interviewee remarked, “We need to persuade industry that reducing PM can be beneficial, using various policy considerations or advantages. For example, during the diesel car environmental committee meetings, companies expressed concerns about losing competitiveness against Europe and the U.S. However, we persuaded them that matching international advanced country standards is crucial for their export-based survival. Such persuasion helped them align with international standards, which ultimately enhanced their competitiveness.” This shows the importance of communication from other stakeholders’ perspectives and proposing alternatives with mutual benefits, which is crucial for collaborative decision-making processes.

Successfully communicating with and persuading the industry requires a strategic approach that acknowledges their concerns and provides a clear path to compliance. This includes incremental implementation and aligning with international standards to ensure global competitiveness. As another interviewee noted, “It’s not about ignoring the current state of businesses and demanding immediate changes despite difficulties. Instead, it should be through well-coordinated persuasion that allows for gradual implementation. This approach fosters cooperative relationships.”

5. Challenges in Structuring Public Participation Across Policy Stages

Public participation is a critical component of collaborative governance and effective policy design for PM mitigation in South Korea. However, a lack of consensus on the appropriate stages for stakeholder involvement poses a significant barrier to effective collaboration and

public participation. This section explores the challenges and opportunities in integrating public input across different policy stages, highlighting the various perspectives and roles of stakeholders.

The Importance of Structured Public Participation

Effective communication is closely related to determining the appropriate stage for stakeholder engagement. There are four primary stages in policy development: agenda setting, policy formulation, implementation, and evaluation. Public participation and stakeholder collaboration should play a crucial role, particularly in the agenda-setting stage, as this phase involves identifying public demands, prioritizing issues, and setting the policy agenda. An interviewee from a civic group emphasized this point: “There was no consensus on which stage to involve public participation and collaboration.” This highlights the need for structured engagement early in the policy development process.

Agenda setting

In the agenda-setting stage, public participation can help identify key issues and establish priorities, ensuring that policies reflect the needs and concerns of citizens. For instance, an interviewee from an environmental organization stated, “Making overall direction through public engagement and collaboration between stakeholders is the first step to work toward setting targets for carbon reduction, and distributing these targets to various departments. Successively, each department then submits its plans to meet these goals.”

The freedom to set agendas is a critical issue. One interviewee noted, “When it comes to critical agendas requiring significant consensus rather than mere technical solutions, the Ministry of Environment has taken a leading role.” This often results in predetermined agendas that do not fully address essential issues. An interviewee remarked, “Stakeholders are forced to discuss in a way that minimizes conflict of interest, but the agenda is initially presented in a vague manner. This avoids the deep and potentially contentious issues that need to be addressed.” The restriction on setting authentic agendas limits the scope of discussions and prevents addressing core issues. Thus, it is essential to guarantee and encourage public participation from the beginning to ensure that the policy agenda is comprehensive and inclusive.

Policy Formulation and Implementation

During the policy formulation and implementation stages, expert input becomes crucial for refining policy details and operationalizing strategies. It is essential to translate the participatory direction set during the agenda-setting stage into actionable plans. An environmental advocate highlighted, “The most important thing is participating in the process of creating principles and directions, ensuring these principles can be realized in various stakeholders’ fields with operational plans.”

It is practically challenging to involve all stakeholders in each process. Acknowledging this, another interviewee mentioned, “Ideally, all stakeholders should be involved in each process, but practically, it’s not always possible.” There is often a disconnect between public input and expert recommendations during policy formulation and implementation. This discrepancy can lead to policies that do not fully address public concerns or leverage expert insights effectively.

Evaluation and Feedback

Implementing a robust feedback mechanism is essential for evaluating the effectiveness of policies and ensuring ongoing stakeholder engagement. Effective feedback loops can address concerns about the extent to which public input is integrated into final policies. An interviewee stressed, “Participants may feel frustrated if their suggestions are not reflected in policy formation and implementation. They might believe their input was ignored if the final outcome does not incorporate their contributions. This is a feedback issue that needs resolution.” Another interviewee echoed this sentiment, stating, “Collecting opinions, conducting the research and sharing only the results without reflecting all suggestions can cause dissatisfaction among participants.”

A structured feedback mechanism can ensure that policies are adaptive and responsive to changing conditions and new insights. Regular consultations, updates, and reviews are necessary to ensure that public and expert input is continually reflected in policy adjustments.

Effectively integrating public input at each stage of the policy development process is crucial for creating comprehensive and cohesive air quality policies. By ensuring structured engagement, clear communication, and robust feedback mechanisms, policymakers can

foster greater collaboration among stakeholders and enhance the overall effectiveness of PM mitigation efforts.

6. Structural and Procedural Barriers to Genuine Stakeholder Engagement

Many interviewees have remarked on the government's reluctance to genuinely listen to participants' input. Often, pre-drafted policies are presented as inflexible mandates, with stakeholder opinions seen merely as token meant to give an appearance of public engagement and collaboration. This section explores these perceived insincerities and their impact on effective stakeholder engagement and policy development.

The Crucial Role of Trust in Collaboration

A significant barrier to effective collaboration is the lack of trust among stakeholders. One interviewee expressed, "The most important issue is trust. People need to feel that their contributions are respected and genuinely considered, even if not always implemented. If this is undermined, collaboration falters." Another interviewee emphasized the sincerity required for collaborative governance, noting, "With higher public standards today, it's crucial to genuinely integrate public opinions into policy rather than treating the process as a mere formality." Trust and sincerity are foundational to any collaborative effort and their absence severely impacts policy effectiveness.

Environmental Groups' Skepticism from Negative Past Experiences

While participating in collaborative committees, several environmental groups, long-standing authorities on issues like fossil fuel plant operations and diesel car pollution, have voiced their skepticism. One respondent from an environmental advocacy group remarked, "It might seem that government is superficially accommodating the demands of environmental and citizen groups, but there are doubts about whether these actions really lead us towards the ultimate goals that we demanded." This skepticism among established groups illustrates a key barrier to building trust.

Specifically, established environmental advocacy groups such as Environmental Justice, Environmental Federation, and Green Transport Movement have, since the early 2000s,

pushed for the government to adopt more stringent regulatory measures. Despite their efforts and voiced demands during committee engagement, the anticipated policy shifts toward phasing out coal and diesel have not been achieved as pledged.

Limited Freedom to Voice Due to Pre-drafted Proposals

Experts involved in the collaborative decision-making process have also identified the issue of predetermined drafts as problematic. An expert respondent pointed out, “While there appears to be a well-established system for public participation, committees rarely develop and adopt their own proposals. Instead, they mostly pass the proposal brought by the government or Ministry of Environment after discussions.” This issue affects not just citizens but also experts; government officers often start with a foreign model, draft a preliminary proposal, and then turn to experts to affirm the rationale and viability. According to one expert, “It seems accurate to say that there was almost no participation from the public and experts in the policy development stage.”

The perceived intentions of the government in steering collaborative efforts further complicate trust and effectiveness. One participant mentioned, “While industries bring their proposals to the table for discussion, it is mostly the government that formulates the drafts.” Another interviewee noted, “There are committees and advisory meetings, but these often feel formalistic, with the government usually presenting almost complete drafts.” Centralized control and formalistic engagement mechanisms prevent genuine stakeholder involvement and contribute to dissatisfaction.

The Need for Fairness, Transparency, and Procedural Formalism

The lack of procedural formalism and the need for impartiality are recurring themes that contribute to stakeholder dissatisfaction. One interviewee commented on the need for fairness and transparency, “For each agenda, experts should present their positions to the citizens. Time equality for both proponents and opponents is critical.” However, these processes often fall short of providing equal time for both sides. Interviewees have noted issues such as, “During the National Council on Climate and Air Quality, time constraints and management led to insufficient adherence to strict procedural neutrality. The transition to online meetings during the COVID-19 pandemic further exacerbated these issues.”

In contrast, the Shin-Kori 5 and 6 Nuclear Reactor Public Deliberation Committee maintained rigorous fairness and procedural formalism. One interviewee noted, “Shin-Kori 5 and 6 Nuclear Reactor Public Deliberation Committee, things had to be very thorough. There was a Communication Committee that managed the public deliberation process, which was strictly separate from the pro-nuclear and anti-nuclear members, always maintaining a 3-to-3 balance. They alternately managed all decisions, including how materials were formatted and distributed, the order of debates, survey questions, agendas, and the selection of members. This structured approach allowed better management and inclusivity of public opinions.”

Additionally, concerns about maintaining “independence” often led to exclusion of key stakeholders who consistently voiced strong opinions. This was evident during the Moon Jae-in administration’s public discussions on nuclear waste management. An interviewee noted, “To assert independence, key stakeholders who have consistently been in favor or against have been excluded from the discussions. Officials worry that including these voices could lead to prolonged debates or boycotts, disrupting their time schedules. This intentional exclusion undermines the credibility of the process.”

Evolving Dynamics in Citizen Participation

An essential shift is needed towards genuine engagement, recognizing the evolving dynamics in citizen participation. Traditional methods of citizen participation often relied heavily on NGOs to represent public interests. However, this is changing as more citizens begin to independently organize and voice their opinions through various platforms. One interviewee from an environmental advocacy group noted, “Citizen participation methods are changing. More citizens are voicing their opinions through self-organized efforts rather than relying solely on NGOs. Whether through internet cafes, social media, or even direct actions like demonstrations, citizens are increasingly making their voices heard, particularly on issues like PM.” Furthermore, individuals who have been active in these self-organized groups or online forums are beginning to participate directly in government governance stages, a phenomenon encouraged by the advancement in technology and societal development. “Individuals who used to run online forums or meetings are not directly engaging in governance, showing a new trend where citizens exert direct influence on policy-making processes, especially noted in the case of PM issues,” another interviewee remarked.

The transformation of citizen participation from elite-dominated models to more inclusive and broad-based methods shows the importance of adapting participation frameworks. In the past, citizen participation was often limited to elite citizens and activists from NGOs. These individuals were considered to represent civic interests and were included in various committees. However, there has been a significant shift towards incorporating a wider array of citizens in deliberative democratic practices. “Previously, participation was dominated by elite citizens and NGO activists. Now, it involves a broader swath of the general public, incorporating deliberative democracy practices that engage hundreds of ordinary citizens,” noted an expert.

To achieve genuine collaboration for effective policy-making, it is crucial to address the structural and procedural barriers that currently hinder it. By enhancing transparency, establishing trust, and ensuring that stakeholder input genuinely informs policy decisions, the government can foster more authentic and effective collaboration. Recognizing and adapting to the evolving dynamics of citizen participation will be critical in this shift towards more genuine engagement.

7. Government Reluctance to Share Power and Embrace Change

One of the main challenges identified by interviewees is the government’s reluctance to genuinely share power and incorporate stakeholder input into decision-making processes. This hesitance to deviate from established practices and tightly control policy processes has been perceived as a significant barrier to effective collaboration and innovation in environmental policy-making.

One interviewee remarked, “Government officials work diligently, but they are very reluctant to deviate significantly from established practices, making citizen participation and engagement with civil society somewhat foreign concepts.” This observation shows how government officials often seek to maintain control over policy processes, reinforcing traditional practices rather than embracing new, collaborative approaches. The risk-averse nature of bureaucrats, who prefer to stick with tried and tested methods, further solidifies this control. The bureaucratic nature of government agencies often limits the flexibility and

responsiveness required for effective collaboration. One interviewee noted, “Many Environment Ministry officials who did not align with policy directions were frequently replaced.” This practice indicates a preference for maintaining alignment with existing policy directions rather than pursuing innovative approaches.

Frequent rotations and career concerns also hinder long-term engagement and the development of in-depth knowledge needed to address complex issues like PM effectively. One interviewee pointed out, “Frequent relocations among government officials mean they often just aim to avoid issues during their tenure, lacking the in-depth knowledge or continuity to address complex issues like PM effectively.”

Additionally, the reluctance to invest in new research and policy innovations further hinders effective air quality management. An interviewee pointed out, “Honestly, the Ministry of Environment was aware of the issues but lacked the capacity to invest in new measures. From the late 2000s, as PM levels fell in the capital region, the Ministry of Strategy and Finance questioned the need for ongoing investments, exerting pressure on the Ministry of Environment. This led the Ministry to find it easier to stick with existing policies rather than introducing new initiatives.” This pressure reveals a systemic issue where financial constraints and bureaucratic inertia lead to a reliance on established policies instead of exploring new solutions.

Policy Recommendation

1. Enhance Information Transparency

Encouraging the public disclosure of meeting minutes and policy development processes involving all stakeholders—corporations, civil society, and the Ministry of Environment—could significantly enhance transparency. This approach is essential for addressing public distrust, fostering a collaborative environment and ensuring that all voices are equally and fairly considered in the decision-making process. Transparent communication serves as the cornerstone of a democratic policy development process, where accountability and inclusivity are paramount.

The necessity for enhancing information transparency stems from two significant barriers that hinder effective policy development: inadequate access to information and perceived insincerity in collaboration. The lack of accessible and reliable information prevents stakeholders from participating meaningfully in policy discussions, exacerbating public distrust and impairing joint efforts to improve air quality. According to an interviewee's remark, there has been a significant barrier to making the meeting minutes of PM collaborative committee publicly available. As this interviewee noted, "experts objected to disclosure because if it were made public, Special Policy Committee on Fine Dust would essentially be criticizing the Committee itself."

Resistance from experts led to policies becoming confidential, restricting essential information to internal reports for related officials. This limitation increased public dissatisfaction related to access to information and, consequently, led stakeholders to become unmotivated to engage actively to genuine stakeholder engagement. This restricted access to information made the public suspicious about whether the government fairly incorporates citizens' and civil society's voices equivalently to corporations and experts. Furthermore, the perception that the government presents pre-drafted policies without genuinely considering stakeholder input leads to skepticism and disengagement, weakening collaborative efforts.

To address these barriers, enhancing information transparency by mandating the public disclosure of meeting minutes and policy development processes is recommended. Meeting minutes from all policy committees and discussions related to PM should be publicly available. This allows stakeholders to review discussions, understand the decision-making process, and hold the government accountable.

Making meeting records and decisions publicly accessible has multiple benefits. For instance, insights from the Chemical Safety Policy Forum¹⁹ highlight that making meeting records and decisions publicly accessible helped align debates toward balanced regulatory measures. Through such transparency, the representation of various stakeholders, such as corporations, civil society, and expert groups, was ensured by having an equal number of committee members from each group.

When stakeholders know that their discussions and stances are made public, it fosters a more balanced and fair discourse. This approach can prevent a wholesale rush towards regulatory

relaxation under corporate pressure, as was observed in the Chemical Safety Policy Forum. Even though some regulatory relaxations occurred to reduce corporate burden, corporations are more likely to yield and integrate measures that mitigate the negative impact of regulation relaxations and be more acceptable to additional regulations, considering public scrutiny and possible social pressure.

Furthermore, making proceedings transparent signals to corporations that they must acknowledge their social responsibility regarding PM issues. Even when corporations strongly opposed safety management measures, the recorded transparency and public accessibility of such debates made it difficult for them to solely focus on private benefits without acknowledging their social responsibilities.

The process of aligning regulatory measures through public forums ensures that even with changing government and policies, the foundational agreements between stakeholders and the principle of civic participation remain protected. This public and documented deliberation process ensures that even contentious issues are tackled transparently and responsibly, maintaining stakeholder trust over time.

By mandating public disclosure of meeting minutes, the government can significantly enhance transparency and trust. It would facilitate fair representation of all stakeholder groups and encourage corporations to consider social responsibility alongside economic interests. This approach not only builds a collaborative environment but also ensures that regulatory measures are balanced and resilient to changes in political leadership.

2. Foster Community and Government Collaboration

To effectively combat environmental challenges like PM pollution, fostering collaborations through Memorandums of Understanding (MOUs) can lead to meaningful initiatives without the high costs and resistance typically associated with government-mandated measures. This policy recommendation outlines how MOUs between local governments and companies can serve as strategic partnerships that drive significant environmental advancements.

Local governments and business should be encouraged to enter into MOUs based on mutual interests and strategic goals. Leveraging political will and strategic industry partnerships is essential for the government, as both elected officials and corporations are accountable to the public, who are voters and customers. This necessitates demonstrating political will and social responsibility in addressing environmental issues, such as PM pollution. Identifying and supporting entities that take initiative in environmental stewardship is crucial. As one interviewee noted, “Some companies take proactive steps and actively participate,” highlighting the importance of promoting leading examples. These shared objectives present opportunities for future collaborative work with industries without imposing financial burdens.

For instance, Mayor Jeong Jang-seon of Pyeongtaek has made hydrogen economy as a major part of his platform since the 2018 election, appealing to his constituents.²⁰ Upon becoming mayor, he initiated efforts to establish MOUs for energy transition with multiple corporations eager to take environmental initiatives. On March 28, 2023, Pyeongtaek City, Kyungdong Naiven, and MiCo Power signed a MOU for hydrogen city development cooperation.²¹ In this project targeting public facilities in Pyeongtaek City, MiCo Power, a provider of advanced power generation solutions, will install hydrogen fuel cells to generate electricity. Kyungdong Navien, a leading HVAC company, will use their condensing air conditioners to recycle heat produced during electricity generation for cooling. Based on the success of this pilot project, Pyeongtaek City plans to expand the initiative to other public facilities. This shows how political and industrial alignment can drive successful environmental policies.

By adopting MOUs and incentivizing pollution reduction behaviors, the government can create a cooperative framework that encourages sustained environmental progress. This approach not only addresses current environmental challenges but also sets a precedent for future collaborative efforts, ensuring long-term sustainability and stakeholder engagement.

3. Institutionalize Living Labs and Citizen Science

Innovative and collaborative approaches are crucial to effectively addressing environmental challenges such as PM issues. Community-led initiatives such as Living Labs and citizen science projects offer valuable insights and solutions by capturing the perspectives and

experiences of those most affected by pollution. This policy recommendation outlines steps to institutionalize these collaborative methods, ensuring they are integrated into public policy development and implementation.

Despite a considerable divide between experts and citizens in policy development, community-led initiatives have demonstrated significant influence on environmental policy. Methods like Living Labs and citizen science projects harness the lived experiences and ideas of those directly impacted by pollution. Governments and universities should advocate for policies that enable such collaborative approaches, emphasizing the value of citizen expertise. Partnering with organizations like the Social Innovation Center²² and local governments can ensure sustained efforts and integrate academic institutions to enhance the impact and sustainability of citizen science projects.

While most universities have been less involved, programs through educational innovation centers and sustainable innovation centers can facilitate greater community engagement. There are multiple living lab examples addressing various topics through these centers, but not many focus specifically on PM issues. Academic institutions should invest more effort in inclusive research that incorporates data and insights from citizen scientists, ensuring that findings effectively inform public policy.

While living lab examples for PM issues are relatively rare, there are promising initiatives worth noting. The Chuncheon City Particulate Matter Reduction Living Lab illustrates how community-led initiatives can drive meaningful change. This project, led by the Chuncheon City We Call for Actions to Combat Particulate Matter Group, the Korea Climate Change Research Institute, and the Social Innovation Center, engaged around 70 residents in activities to reduce PM through sustainable behaviors. Regular meetings and updates fostered continuous engagement and adaptation, with participants sharing their progress, challenges, and suggestions for improvement. As one participant remarked, “We met regularly, shared our progress, and addressed challenges collaboratively.” This project demonstrated the dual benefits of raising awareness and reducing PM through incentivized behaviors such as cycling, carpooling, and using public transportation.

This broad-based participation was essential for community buy-in and impact, highlighting how such initiatives can lead to substantial environmental and behavioral improvements.

Though only about 20% of the recommendations were integrated into Chuncheon City's policies, this modest success underscores the need for continued advocacy and stronger integration of community-driven insights into formal policy frameworks.

Governments should provide institutional support for Living Labs, enabling them to become a permanent part of the policy-making process. Documented findings from the Living Lab informed local government policies, demonstrating the value of integrating community insights into policy development. By institutionalizing Living Labs and citizen science projects, the government can create a framework that encourages sustained environmental progress.

4. Develop Interdisciplinary Communication Strategies

Effective communication and collaboration between experts and government are crucial for translating scientific research into actionable policy. Despite significant research on PM, including studies on exposure and secondary pollutants, a gap remains in translation of these findings into practical policy measures due to communication barriers. This policy recommendation outlines strategies to enhance interdisciplinary communication, ensuring that scientific insights drive well-rounded and effective environmental policies.

To make policy-making effective, scientific research needs to be distilled into clear policy recommendations. Policymakers often find scientific data challenging to digest, and researchers fail to present findings with explicit policy implications. An interviewee pointed out, "Despite extensive research on particulate matter, there has been a lack of translation into practical policy measures." This gap results from fragmented communication approaches that prioritize emission-focused research over comprehensive studies on exposure and other relevant areas.

The necessity of interdisciplinary communication is evident in the policy development process. Due to difficulties in translating research findings into policy-relevant insights and persuading decision-makers to prioritize new approaches over proven foreign policies, experts have limited opportunities to contribute to early policy-making stages even with advanced and relevant research results.

To bridge this gap, more structured and frequent interdisciplinary meetings between scientists, policymakers, and other stakeholders should be implemented. These meetings should be more intensive and focused than the bi-weekly 2-hour session previously held in PM-related committees. This approach will ensure thorough discussion and a better understanding of research implications. Regular and more substantial interactions can bridge communication gaps and promote collaborative strategies.

Researchers should distill their scientific findings into practical toolkits that policymakers can easily understand and apply. Since many policymakers struggle to grasp the comprehensive details of PM issues, this lack of basic understanding can lead to misguided solutions and policies. Decision-makers cannot be expected to understand all complex data; therefore, researchers' efforts to translate findings into actionable insights are crucial. Additionally, the role of social scientists in translating scientific findings into policy implementation is necessary to bridge this gap effectively.

Furthermore, researchers should take an active role in communicating their findings through media, social media, and academic platforms. They should regularly publish opinion pieces and participate in public discussions to increase visibility and understanding of their work's policy implications. "Experts should more actively voice their opinions through media and scholarly platforms, providing clear policy recommendations rather than solely focusing on academic publications," suggested an interviewee. This proactive stance will ensure research findings have broader societal and policy impacts.

5. Promote Public Engagement in Policy Development

Promoting public engagement in policy development is fundamental to ensuring that policies are representative, inclusive, and effective. Effective public engagement enhances the democratic process, leading to better-informed and more balanced policy outcomes. This section outlines strategies to enhance public participation in the policy-making process, emphasizing the importance of genuine engagement and transparency.

Public engagement is crucial for democratic policy-making. Engaging various stakeholders—such as environmental groups, citizens, and industry representatives—helps create more

balanced and accepted policies. Two notable examples demonstrate the importance and challenges of public engagement: the public discourse around the Shin-Kori 5 and 6 nuclear powerplants and the debate over the Donggang Dam.

Governments should establish structured processes for public deliberation on key policy issues, ensuring the inclusion of diverse stakeholder groups. The Shin-Kori 5 and 6 case demonstrated that rigorous debate and open discussion can lead to a more respected process. Involving stakeholders from the beginning and ensuring procedural legitimacy fosters acceptance of the outcomes. Despite the final decision to build two additional nuclear power plants being disappointing for anti-nuclear groups, the process itself was celebrated for its democratic principles. The decision-making process was neither predetermined nor pushed through without public input. Participating groups representing both pro-nuclear and anti-nuclear stances engaged in rigorous debate and negotiation, resulting in a process viewed as exemplary for South Korea's deliberative democracy. As one participant remarked, "The process, despite its outcome, was exemplary and significant in the history of South Korean democracy, showcasing the value of genuine deliberation and open discussion."

Procedural legitimacy in the Shin-Kori 5 and 6 case was reinforced by strict rules on the number of representatives for each side and equal speaking time for all participants. These rules were determined by the organizational committee, ensuring a transparent and fair deliberation process. An interviewee noted, "The process was not predetermined and was open to discussion. People are not fools; they can tell when a decision is being forced. This transparency led to acceptance, even from those disappointed by the outcome."

Similarly, joint fact-finding missions involving all relevant stakeholders can gather comprehensive data on policy issues. This approach, as shown by the Donggang Dam case, can lead to informed and balanced decisions. The balanced representation and thorough investigation of the site's cultural significance were crucial in deciding to cancel the project, marking it as a successful example of public engagement in governance. Although the debate over the Donggang Dam initially did not involve general citizens, it highlights successful governance through balanced stakeholder representation and thorough investigation. One participant noted that the inclusion of neutral parties and the thorough investigation led to a well-informed decision to cancel the project.

Public engagement is most effective when citizens are treated as equal partners in research and policy development. However, challenges persist, as citizens often feel their contributions are sidelined or underappreciated. For example, one interviewee expressed, "Citizens often felt that researchers used the data collected for their own achievements rather than contributing to the community." Recognizing citizens as co-researchers and ensuring their input shapes policy can lead to more effective and accepted outcomes.

Additionally, establishing citizen science funds to support community-led research projects can significantly enhance public engagement. This financial support can enable citizens to initiate and conduct research, ensuring their insights contribute to policy-making.

By implementing these strategies, governments can foster genuine public engagement in policy development, leading to more effective and accepted policy outcomes.

6. Establish Equitable Partnerships and Conduct Codes

To ensure policies are representative and inclusive, it is essential to address the root causes of unequal treatment and integrate the voices derived from lived experiences into the policy-making process. This approach acknowledges the importance of both expert and layperson expertise in shaping effective and equitable public policies.

The root of unequal treatment in policy collaborations often lies in the prevailing undervaluation of layperson expertise. Examining the interfaces between the public, government, and experts, it becomes evident that existing large-scale participatory mechanisms like the National Council on Climate and Air Quality (NCCA) and the Fine Dust Special Countermeasures Committee have been criticized for rubber-stamping pre-drafted policies.

Experts and policymakers frequently fail to recognize that the insights derived from individuals' lived experiences are invaluable, especially in the public health domain. These experiential insights can reveal issues tied to specific regional characteristics and dynamic factors that may be missed in controlled laboratory settings. Moreover, the differing priorities between experts and citizen groups further exacerbate this divide. While experts must meet

specific targets to secure funding and advance their projects, citizen groups primarily focus on advocating for policy changes that address their concerns.

To achieve this, the government should allocate dedicated funding to universities and research institutions for community engagement research. Additionally, creating and enforcing conduct codes that emphasize mutual respect, transparency, and the recognition of layperson expertise will set expectations for equitable collaboration between experts and citizen groups. Encouraging grassroots and small-scale participatory models—such as town hall meetings and local government consultations—provides additional channels for public input and ensures that local issues are genuinely considered in policy-making. Establishing authoritative bodies to validate and legitimize public participation in policy development will ensure that public engagement is genuine and influential.

Conclusion

This practicum report has sought to provide a comprehensive analysis of the factors influencing stakeholder collaboration in the development of particulate matter policies in South Korea. Based on the study's findings, it is evident that while there have been significant efforts toward public participation, numerous challenges remain unaddressed. The interplay between political shifts, diverse stakeholder interests, and structural barriers presents complex obstacles that hinder effective policy implementation.

The research has identified two primary drivers that facilitate stakeholder collaboration in PM policy-making: legitimacy through inclusivity and trust, and effectiveness through collaborative diversity focused on shared overarching goals. Additionally, the study highlights the significant influence of shifting political priorities on the focus and continuity of stakeholder engagement. Seven barriers were identified as obstructing effective collaboration: divergent perceptions of PM exposure versus emissions, conflicting expectations on government responsiveness and policy consistency, inadequate access to information, communication gaps among stakeholders, challenges in structuring public participation across policy stages, structural and procedural barriers to genuine stakeholder engagement, and government reluctance to share power and embrace change.

Despite the dissolution and restructuring of the previous governmental bodies and a change in administration, the fear and criticism surrounding PM pollution persist among the public. Although the new progressive government aimed to foster public trust through inclusivity and collaboration, the efficacy of these initiatives has been questioned. Notable, the committee reports intended to guide these efforts have not been publicly disclosed, limiting transparency and accountability.

Building on these findings, several policy recommendations have been proposed:

First, enhancing information transparency is crucial. This can be achieved by encouraging the public disclosure of meeting minutes and policy development processes involving all stakeholders. This approach is essential for addressing public distrust and fostering a collaborative environment, ensuring that all voices are equally and fairly considered in the decision-making process.

Second, fostering community and government collaboration through Memorandums of Understanding (MOUs) between local governments and corporations can lead to meaningful environmental initiatives without the high costs and resistance typically associated with government government-mandated measures. MOUs based on mutual interests and strategic goals can drive successful environmental policies through political and industrial alignment.

Third, institutionalizing Living Labs and citizen science projects is a vital step toward community-led initiatives into public policy development and implementation. These methods harness the perspectives and experiences of those most affected by pollution, offering valuable insights and solutions.

Fourth, developing interdisciplinary communication strategies to enhance collaboration between experts, government officials, and public is critical. Effective communication ensures that scientific insights are distilled into actionable policy recommendations, bridging the gap between research and practical policy measures.

Fifth, promoting public engagement in policy development is fundamental to ensuring that policies are representative, inclusive, and effective. Establishing structured processes for public deliberation on key policy issues will help guarantee the inclusion of diverse stakeholder groups, leading to more balanced and accepted policies.

Lastly, establishing equitable partnerships and conduct codes is essential for addressing the root causes of unequal treatment and integrating the voices of those with lived experiences into the policy-making process. This approach emphasizes the importance of mutual respect, transparency, and the recognition of both expert and layperson expertise in shaping effective public policies.

There are still broader areas for improvement that would benefit from further research. The evolving forms of public engagement, the roles of civil society, governmental institutions, and experts must be re-evaluated comprehensively to foster a truly participatory policy development process. Moreover, the issues of marginalized communities have been inadequately addressed in the current PM policy framework. Concerns specific to non-metropolitan regions, outdoor workers, and residents living near industrial zones have not been sufficiently represented, partly due to weaker organizational structures and lack of advocacy. Developing tailored approaches to enhance their representation and address their unique challenges is essential.

Appendix: Summary of Findings and Recommendations

Bridging the Gap: Analyzing Factors Affecting Collaboration in South Korean Air Pollution Policy Development

Background:

Particulate Matter (PM) pollution in South Korea has become a significant public concern, leading to strong demands for governmental action and diminishing public trust due to perceived transparency and communication issues. In response, the new progressive government has prioritized public participation in PM policy development to foster trust and legitimacy. Despite these efforts, recent PM policies have elicited unsatisfactory responses from both the public and experts.

Objective:

This study qualitatively analyzes the drivers, influencer, and barrier affecting stakeholder collaboration in South Korea's PM policy development. Through this analysis, we aim to identify areas for improvement and propose strategies to enhance public participation and collaboration in environmental policy.

Key Findings:

Drivers:

- **Legitimacy Through Inclusivity and Trust:** Engaging a broad spectrum of stakeholders to build trust and legitimacy
- **Effectiveness Through Collaborative Diversity Focused on Shared Overarching Goals:** Ensuring diverse stakeholder involvement to enhance policy effectiveness through collective goals.

Influencer:

- **Shifting Priorities of Political Leadership:** Political shifts significantly influence the focus and continuity of stakeholder engagement.

Barriers:

- **Divergent Perceptions on PM: Exposure vs Emissions:** Differing stakeholder views on PM sources complicate consensus-building.
- **Conflicting Expectations on Government Responsiveness and Policy Consistency:** Misaligned expectations hinder effective collaboration.
- **Inadequate Access to Information:** Limited information flow reduces stakeholder capacity to participate meaningfully.
- **Communication Gaps Among Stakeholders:** Poor communication among stakeholders leads to misunderstandings and inefficiencies.
- **Challenges in Structuring Public Participation Across Policy Stages:** Difficulty integrating public input throughout all policy stages.

- **Structural and Procedural Barriers to Genuine Stakeholder Engagement:** Existing structures and processes limit full stakeholder participation.
- **Government Reluctance to Share Power and Embrace Change:** Hesitance to decentralize power impedes collaborative efforts.

Policy Recommendations:

- **Enhance Information Transparency:** Improve access to data and information for all stakeholders.
- **Foster Community and Government Collaboration:** Build robust platforms for ongoing community-government interaction.
- **Institutionalize Living Labs and Citizen Science:** Utilize participatory research models to engage citizens in data collection and problem-solving.
- **Develop Interdisciplinary Communication Strategies:** Promote effective communication across diverse stakeholder groups.
- **Promote Public Engagement in Policy Development:** Encourage active and continuous public involvement in policy formulation.
- **Establish Equitable Partnership and Conduct Codes:** Ensure fair and inclusive participation practices and establish clear guidelines for engagement.

Conclusion:

By addressing these drivers, influencer, and barriers, and implementing the proposed recommendations, South Korea can enhance public participation and stakeholder collaboration in its environmental governance. These efforts will support the mission of the Korean Environment Institute to promote citizen involvement in governmental decision-making, ultimately leading to more effective and inclusive air quality management strategies.

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