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# Policy Implementation of Vehicle Emission Testing under Fragmented Multilevel Governance in Bandung City

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**Abstract**

This study aims to examine how motor vehicle emission testing is implemented in Bandung City and why it has not yet functioned as an integrated environmental policy instrument. The study uses a qualitative case study design based on interviews, field observations, and document analysis conducted from October 2025 to February 2026. The analysis draws on Kearns and Lawson's policy implementation framework, particularly the dimensions of policy content, implementation agency, inter-organisational relations, and social-political factors. A multilevel governance perspective and Gephi-based network mapping are also used to examine the distribution of authority and actor relations. The findings show that emission testing in Bandung City is distributed across the transportation sector, environmental sector, taxation-related administration, private workshops, and intermediary associations. However, these actors operate through different mandates, service mechanisms, reporting systems, and policy interests. Regulatory inconsistency, unclear outcome indicators, uneven logistical readiness, limited certified personnel, weak data integration, and uncertain enforcement reduce the ability of emission testing to operate as a coherent policy process. ASBEKINDO and private workshops occupy important operational positions in the implementation network, but their role cannot replace government responsibility for rule-setting, monitoring, reporting integration, and enforcement. This study contributes to policy implementation research by showing that weak enforcement, low public compliance, limited facilities, and compliance costs are not isolated barriers, but symptoms of a broader governance problem. Strengthening emission testing requires an implementation chain that links testing, reporting, repair follow-up, compliance tracking, and cross-regional coordination.

Keywords: Vehicle emission testing; Policy implementation; Multilevel governance; Environmental governance; Inter-organisational coordination; Bandung City

## INTRODUCTION

Motor vehicle emissions are closely connected to urban air pollution because road-based mobility produces pollutants that affect air quality and public health. The transportation sector contributes to greenhouse gas emissions through carbon dioxide



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and other pollutants produced by fuel combustion, including carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter (Popa et al., 2014; Umah & Gusmira, 2024). In Indonesia, the transportation sector has also been identified as one of the main contributors to greenhouse gas emissions after electricity generation (Kementerian Lingkungan Hidup dan Kehutanan, 2019). These conditions place motor vehicle emission control within the broader agenda of urban environmental management.

One policy instrument used to control emissions from motor vehicles is emission testing. In the Indonesian regulatory framework, emission testing is linked to roadworthiness, environmental protection, and vehicle administration. Law No. 22 of 2009 on Road Traffic and Transportation regulates vehicle testing within the context of traffic and road transport. Ministry of Transportation Regulation No. PM 19 of 2021 regulates periodic motor vehicle testing, while Ministry of Environment and Forestry Regulation No. 08 of 2023 regulates the implementation of emission standards for motor vehicle categories M, N, O, and L. These regulations show that emission testing is not located in a single policy domain, but intersects with transportation, environmental governance, vehicle registration, and local implementation.

Bandung City is an important context for examining this policy because motor vehicle exhaust has been identified as a dominant source of air pollution in the city, accounting for approximately 60–70% of pollution (Dinas Lingkungan Hidup Kota Bandung, 2022). Bandung also has a local regulatory basis through Bandung Mayor Regulation No. 572 of 2010 on the testing of motor vehicle exhaust emission thresholds. The regulation sets provisions on designated emission testing units, annual testing obligations for certain vehicles, emission test certificates, and stickers. It also became one of the references for Bandung Mayor Regulation No. 121 of 2022 on off-street parking management, including priority parking allocation for vehicles that pass emission testing.

The regulatory provisions show the expected condition of the policy: emission testing should function as a routine mechanism for identifying vehicle emission levels, encouraging compliance, and supporting pollution control. The empirical condition shows a different pattern. In 2023–2024, free emission testing conducted by the Bandung City Environmental Agency covered only a small share of the vehicle population, with

preliminary data showing an average coverage of around 0.52% for four-wheeled vehicles and 0.25% for two-wheeled vehicles. As of February 2026, the Bandung City emission testing website recorded 6,528 vehicles and 7,312 emission tests (Asbekindo Bandung, 2026). At the same time, Bandung City had not yet entered its vehicle emission testing data into the Ministry of Environment and Forestry's vehicle emission testing information system (Dinas Lingkungan Hidup Jawa Barat, 2026).

Preliminary observation also shows that independent emission testing through private workshops has not become a strong implementation channel. Bandung has 76 four-wheeled vehicle workshops identified as potential emission testing implementers, but active testing equipment is unevenly distributed across workshops. For two-wheeled vehicles, dedicated emission testing facilities remain unavailable, even though motorcycles form the largest share of the city's vehicle population. Workshops also face low public demand, equipment costs, calibration requirements, and uncertainty over enforcement. This empirical condition shows a gap between the regulatory expectation of routine emission testing and the operational capacity needed to implement it.

Previous studies on vehicle emission testing in Indonesia have identified several barriers to implementation. A group of studies emphasises weak law enforcement as a cause of ineffective emission testing (Aryasena et al., 2023; Chaote et al., 2021). Another group focuses on public awareness and socialisation, showing that vehicle owners often do not understand the obligation or practical importance of emission testing (Aryoputro & Ridwan, 2025; Hakim & Sitabuana, 2021). Other studies highlight the cost of emission testing and vehicle repair as factors that reduce public willingness to comply (Rizali et al., 2017). In the Bandung context, Purmayanti, (2022) identifies the increase in vehicle numbers, the absence of mandatory private vehicle testing, and low public awareness as factors affecting the implementation of free emission testing.

These studies provide a useful basis for understanding direct implementation barriers. However, the literature has not sufficiently examined how those barriers are connected to fragmented authority, uneven institutional capacity, weak inter-organisational coordination, and cross-level governance relations. Emission testing involves actors from different sectors and levels, including transportation agencies, environmental agencies, SAMSAT, police institutions, private workshops, and

intermediary associations. The issue is not only whether vehicle owners are willing to test their vehicles, but also how the implementation system connects testing services, reporting, repair follow-up, compliance monitoring, and enforcement.

This study aims to examine the implementation of motor vehicle emission testing policy in Bandung City through the policy implementation framework of Kearns and Lawson, (2008) and the perspective of multilevel governance. Kearns and Lawson, (2008) framework is used because it allows the analysis of implementation through four dimensions: the policy itself, implementation agencies, inter-organisational relations, and social-political factors. These dimensions correspond to the empirical issues found in Bandung, including regulatory inconsistency, logistical readiness, actor coordination, and changing social-political conditions. Multilevel governance is used to analyse how authority is distributed vertically across national, provincial, and city levels and horizontally across government and non-government actors (Hooghe & Marks, 2020).

The uniqueness of this study lies in its focus on emission testing as an implementation and governance problem, rather than only as a matter of enforcement, awareness, facilities, or cost. By combining the implementation framework of Kearns & Lawson, (2008) with multilevel governance (Hooghe & Marks, 2020), this study examines why an early local regulation in Bandung has not developed into a sustained compliance system. The study offers an analytical basis for understanding how regulatory harmonisation, division of authority, integrated reporting, public-private coordination, and follow-up mechanisms shape the implementation of motor vehicle emission testing at the city level.

## RESEARCH METHODS

This study employed a qualitative case study design to examine the implementation of motor vehicle emission testing policy in Bandung City. The design was selected because the study analyses a policy implementation process bounded by location, actors, institutions, and time, and requires an in-depth understanding of how policy is translated into practice (Creswell, J. W., & Creswell, J. D., 2018).

The study used primary and secondary data (Creswell, J. W., & Creswell, J. D., 2018). Primary data were collected through in-depth interviews and field observations from

October 2025 to February 2026. Interviews involved 38 informants from 24 institutions related to policy formulation, planning, implementation, supervision, and private-sector participation. Observations covered emission testing activities organised by government agencies, private workshops, PT Biofarma, SAMSAT confirmation points, and an emission testing equipment provider.

Informants were selected using non-probability sampling, specifically purposive sampling supported by snowball sampling (Creswell, J. W., & Creswell, J. D., 2018). Purposive sampling was used because the study sought information from actors directly involved in or supporting the policy, not statistical generalisation. The criteria covered policy-making institutions, planning bodies, local implementers, road compliance supervisors, private workshops, intermediary associations, participating companies, and equipment providers. Institutional informants were determined through official disposition, while snowball sampling was used when field data identified other relevant actors.

Secondary data were collected through document analysis, including regulations, planning documents, implementation reports, meeting minutes, socialisation materials, performance targets, greenhouse gas reduction plans, draft tax-sanction regulations, budget documents, emission testing data, and ministerial circular letters (Creswell, J. W., & Creswell, J. D., 2018).

Data collection used semi-structured interviews, structured observations, and document review (Creswell, J. W., & Creswell, J. D., 2018). The interview guide was developed from the research question and analytical framework. Observations examined testing procedures, equipment use, service delivery, reporting practices, coordination, and supporting facilities. Document review traced regulations, institutional roles, targets, reporting mechanisms, budget support, and policy interactions across government levels.

Data analysis followed the interactive model of Miles and Huberman: data reduction, data display, and conclusion drawing/verification (Sugiyono, 2024). Data were reduced by selecting, summarising, and classifying transcripts, observation notes, and documents into four dimensions: policy content, implementation agency capacity, inter-organisational relations, and social-political factors. Data display used narratives, tables,

implementation flow mapping, and actor network visualisation. Conclusions were verified iteratively across interviews, observations, and documents.

Gephi was used to visualise inter-organisational networks. Nodes represent actors or institutions, while edges represent coordination relations. In-degree, out-degree, degree centrality, and eigenvector centrality identified receiving actors, initiating actors, highly connected actors, and actors connected to influential actors (Napitupulu & Carnia, 2022). Gephi supported, but did not replace, qualitative interpretation (Kasiwi & Nurmandi, A, 2021).

Credibility was strengthened through source and technique triangulation (Sugiyono, 2024). Interview findings were compared with observations and documents so conclusions did not depend on one informant, institution, or data type. Potential institutional bias was recognised because several informants were accessed through official disposition. Therefore, institutional statements were cross-checked with observations, documents, and information from other actors. Interview data were used for research purposes, and findings emphasised institutional roles and policy processes rather than personal attribution.

## RESULTS AND DISCUSSION

The results section presents field findings obtained through interviews, observation, and document analysis. The findings are organized into five operational themes related to the implementation of motor vehicle emission testing policy in Bandung City. These themes show how the policy is implemented across actors, institutions, regulations, resources, inter-organisational relations, and social-political contexts. The organization of the findings follows the policy implementation framework of Kearns & Lawson, (2008), particularly the aspects of policy itself, implementation agency, inter-organisational relations, and social and political factors, while the multilevel governance perspective is used to read the vertical and horizontal distribution of authority among national, provincial, city-level, and non-governmental actors (Hooghe & Marks, 2020).

## Fragmented Implementation of Motor Vehicle Emission Testing across Sectors

Field findings indicate that motor vehicle emission testing in Bandung City is implemented through several sectoral channels. The implementation is distributed across the transportation sector, environmental sector, private workshops, and taxation-related administration. Each sector has a different mandate, service mechanism, facility capacity, personnel arrangement, and reporting practice. This condition shows that emission testing has been carried out, but the implementation process has not yet appeared as a single integrated service chain.

In the transportation sector, emission testing is attached to the periodic vehicle inspection system for public and commercial vehicles. The Bandung City Transportation Agency has four emission testing devices, consisting of two devices for diesel-fuel vehicles and two devices for gasoline-fuel vehicles. This sector is also supported by 24 testing personnel assigned according to vehicle type and testing level. In 2023/2024, the agency recorded 66,000 emission tests. However, this number should be read carefully because the service also covers vehicles from outside Bandung City, not only Bandung-registered public and commercial vehicles.

In the environmental sector, emission testing is mainly conducted through activity-based programmes rather than a regular service mechanism. The Bandung City Environmental Agency has two testing devices, one for gasoline-fuel vehicles and one for diesel-fuel vehicles. The agency is supported by one certified emission testing personnel and approximately six to seven operational field personnel who assist with probe installation, equipment reading, recording, and data input. These activities are commonly carried out through free emission testing, Urban Air Quality Evaluation, and Clean Emission Zone initiatives, with support from DISHUB, Polrestabes, Satpol PP, and private workshops.

Private workshops also participate in emission testing, especially for four-wheeled vehicles. Field data identified 76 workshops, but there was no consolidated official inventory confirming the number of active testing devices. Observations in several major-brand workshops showed different levels of readiness. Some workshops had testing devices and internal SOPs, while others shared devices across branches or no longer operated the equipment because it was damaged or inactive. For two-wheeled vehicles,

field data did not find a dedicated motorcycle emission testing workshop in Bandung City.

The difference between sectors can be seen from the number of vehicles tested in 2023/2024.

**Table 1. Number of Motor Vehicle Emission Tests by Sector in Bandung City in 2023/2024**

| Sector | Data Source | Vehicles Tested | Vehicles in Bandung City | Percentage |
|---|---|---|---|---|
| Transportation | Bandung City Transportation Agency | 66,000 | Public/commercial vehicles: 11,071 | 596.15% |
| Environment and Private Sector | Ministry of Environment SiUmi reporting platform and ASBEKINDO emission testing website | 6,528 | Private vehicles: 1,516,533; official vehicles: 15,917; total: 1,532,450 | 0.426% |
| Taxation/SAMSAT | Observation and interview at SAMSAT Kawaluyaan | Emission testing was not conducted | Total vehicles at SAMSAT Kawaluyaan service branch: 528,385 | 0% |

Source: Analyzed from field findings, processed by the author (2026)

Table 1 shows that the transportation sector recorded the highest number of tests, although the figure includes vehicles from outside Bandung City. In contrast, the environmental and private-sector channels recorded 6,528 tests, equal to 0.426% of private and official vehicles in Bandung City. In the taxation-related channel, emission testing had not been implemented in the observed service flow at SAMSAT Kawaluyaan, although it is administratively linked to the five-year vehicle registration and Motor Vehicle Tax payment process.

The separation of implementation is also reflected in the operational flow. As shown in Figure 1, emission testing in Bandung City operates through several streams. In the transportation stream, testing is attached to periodic inspection for public and commercial vehicles. In the environmental stream, testing is conducted through activity-based programmes and cooperation with other actors. In the private-sector stream, workshops provide testing services depending on equipment availability, internal readiness, and coordination with ASBEKINDO. In the taxation-related stream, emission

testing is connected to vehicle registration and tax administration, but the observed SAMSAT location had not provided emission testing as part of the service flow

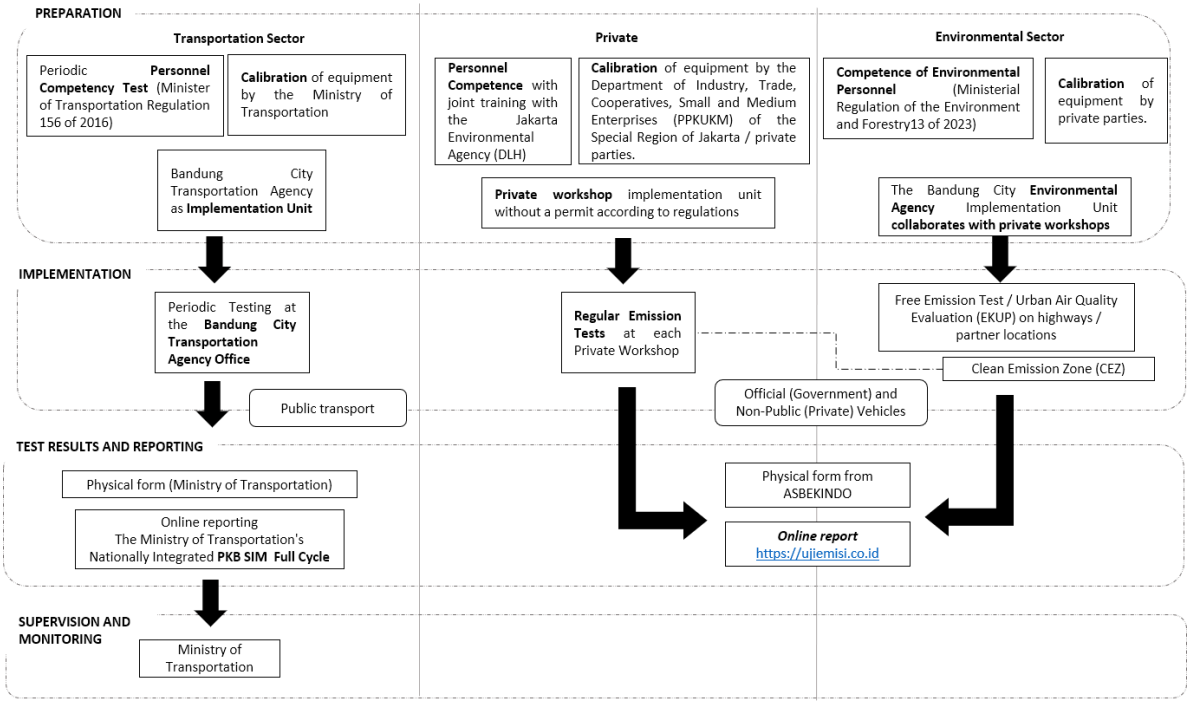


**Figure 1. Implementation Flow of Motor Vehicle Emission Testing Policy in Bandung City**

Source: Analyzed from field findings, processed by the author (2026)

This finding indicates that motor vehicle emission testing in Bandung City has been implemented, but its implementation remains separated across sectors. The transportation sector uses the term "periodic testing," while the environmental sector uses "emission testing." These terms reflect different service targets, institutional priorities, and reporting mechanisms. The field findings also suggest that the preparation, service delivery, data reporting, monitoring, evaluation, and follow-up for vehicles that do not meet emission standards have not yet been organised within an integrated implementation chain.

## Regulatory Inconsistency and Unclear Policy Parameters

The second field finding concerns regulatory inconsistency in motor vehicle emission testing in Bandung City. Document analysis indicates that emission testing is regulated through different sectoral instruments in the transportation, environmental, taxation-related, and city-level regulatory domains. These instruments set different obligations, vehicle targets, implementing units, reporting mechanisms, and personnel

requirements. As a result, the regulatory arrangement has not yet appeared as a single operational framework for local implementation.

The most visible distinction lies between "periodic testing" in the transportation sector and "emission testing" in the environmental sector. In the transportation sector, emission testing is embedded in periodic vehicle inspection, mainly for public and commercial vehicles. In the environmental sector, emission testing is treated as a pollution-control instrument with broader vehicle coverage, including private vehicles and motorcycles under certain regulatory categories. At the city level, Bandung Mayor Regulation No. 572 of 2010 introduced an annual emission testing obligation for non-public four-wheeled vehicles and government-owned vehicles. However, this local initiative operates within a newer regulatory environment that has not fully clarified the division of tasks for private vehicle emission testing. The differences among sectoral regulations can be seen in Table 2.

**Table 2. Cross-sectoral Regulatory Differences in Motor Vehicle Emission Testing Policy**

| Aspect | Transportation Sector | Environmental Sector | SAMSAT | Bandung City |
|---|---|---|---|---|
| Implementation obligation | Once every six months | Once a year | Once every five years | Once a year |
| Vehicle categories | Vehicles subject to periodic testing, mainly public and commercial vehicles | Motor vehicles in categories M, N, O, and L, including vehicles used for more than three years | Vehicles undergoing five-year registration renewal | Non-public four-wheeled vehicles and government-owned vehicles |
| Main implementing arrangement | Transportation agency and authorised testing units | Units designated by governor, mayor, or regent | SAMSAT service system | Workshop units designated through local mechanism |
| Reporting mechanism | Periodic vehicle inspection system | Ministry of Environment reporting system and SiUmi | Linked to vehicle registration documents | Certificate and sticker mechanism, including ASBEKINDO/local platform |
| Personnel competence | Periodic testing personnel certification | Mobile source emission measurement personnel certification | Not specified in the observed mechanism | Follows the supervising sector |

Source: Literature study and field research, processed by the author (2026)

Table 2 shows that emission testing is not regulated through one operational standard. The transportation sector applies a six-month testing obligation, the environmental sector uses an annual orientation, SAMSAT is linked to the five-year registration process, and Bandung City regulation also introduces an annual obligation for specific non-public vehicles. These differences are followed by different vehicle categories, implementing authorities, reporting systems, and competence standards.

The ambiguity is most visible in the regulation of private vehicles. While the environmental policy objective is to control emissions from motor vehicles more broadly, the operational chain for private vehicles remains unclear. Field findings do not yet show a clear arrangement regarding who must test, who must report, who must supervise, and who must enforce compliance for private vehicles that do not meet emission standards.

A similar issue appears in reporting. The transportation sector records emission-related data through the periodic vehicle inspection system, while the environmental sector uses a specific emission testing reporting mechanism. Bandung City also has a certificate and sticker mechanism connected to ASBEKINDO and the local emission testing platform. This separation makes it difficult to consolidate data on tested vehicles, vehicles that pass, vehicles that fail, and vehicles requiring repair. Field findings also indicate that available certificates and stickers do not contain clear repair recommendations for vehicles exceeding emission limits. The unclear policy parameters are also reflected in performance measurement. Emission testing is linked to broader indicators such as greenhouse gas emission reduction, Air Quality Index, Air Pollution Standard Index, and environmental quality indicators. These indicators are relevant to environmental control, but they do not directly measure the effectiveness of emission testing implementation.

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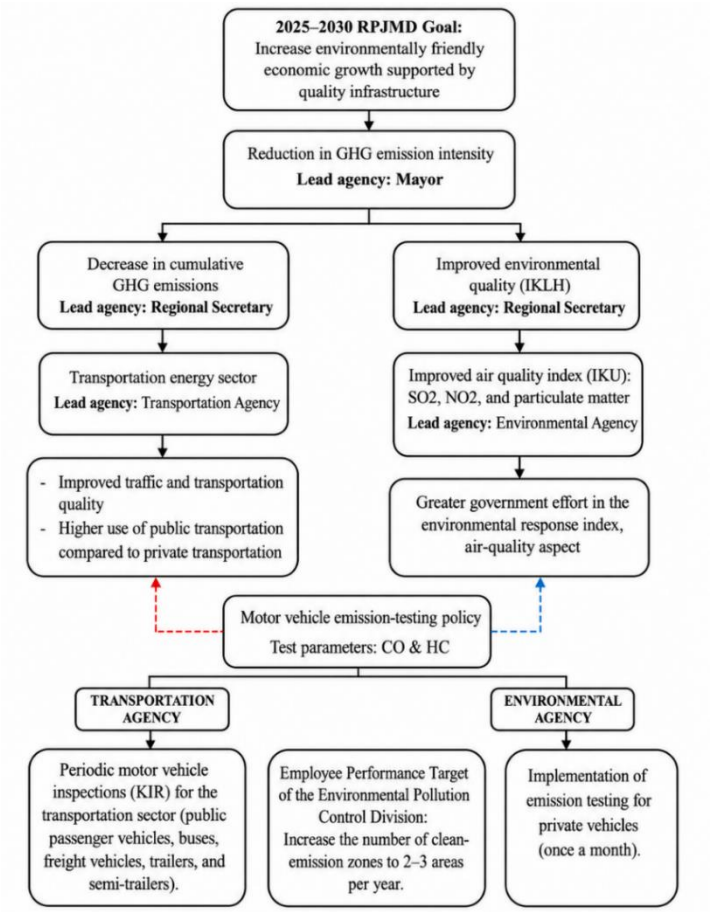


**Figure 2. Relationship between Motor Vehicle Emission Testing and Policy Performance Parameters**

Source: Primary data processed by the author (2026)

Figure 2 shows that emission testing is connected to broader environmental performance indicators, but the relationship remains indirect. More specific operational measures are still needed, such as the number of vehicles tested by category, testing coverage compared with the registered vehicle population, pass and fail rates, repair follow-up, reporting integration, and enforcement actions for non-compliant vehicles.

Bandung Mayor Regulation No. 572 of 2010 remains important as an early city-level regulation on emission testing for non-public vehicles. It also became one of the bases for Bandung Mayor Regulation No. 121 of 2022 on off-street parking management, particularly priority parking for vehicles that pass emission testing. However, the regulation is now more than fifteen years old and operates under a changed regulatory context, especially after Government Regulation No. 22 of 2021 and Ministry of

Environment Regulation No. 08 of 2023. Field findings indicate that harmonisation is still needed in relation to vehicle categories, institutional responsibilities, reporting systems, enforcement mechanisms, and follow-up procedures.

## Implementation Agency Capacity and Logistical Readiness

The third field finding concerns the capacity of implementing agencies and the logistical readiness required to operate motor vehicle emission testing in Bandung City. In the implementation framework of Kearns & Lawson, (2008), agency capacity is reflected in resources, implementer skills, institutional commitment, and the ability to translate policy into operational practice. In this study, capacity is not only related to testing devices and certified personnel, but also to budget support, calibration access, reporting systems, institutional authority, and the continuity of service delivery.

Field findings indicate that implementation capacity is uneven across actors. The Bandung City Transportation Agency has the clearest technical structure because emission testing is embedded in the periodic vehicle inspection mechanism. The agency has four emission testing devices and 24 testing personnel, and in 2023/2024 recorded 66,000 vehicle tests through the periodic testing system. However, this capacity remains mainly attached to public and commercial vehicles and does not automatically cover private vehicles, government-owned vehicles, or motorcycles through the same operational chain.

The Bandung City Environmental Agency has a broader environmental mandate, particularly in relation to private vehicle emission testing, but its resources remain limited. The agency has two testing devices and one certified emission testing personnel, supported by approximately six to seven operational field personnel. These personnel assist technical tasks such as probe installation, equipment reading, result recording, and data input. This arrangement allows emission testing activities to operate, but the activities remain largely activity-based through free emission testing, Urban Air Quality Evaluation, and Clean Emission Zone initiatives.

**Table 3. Capacity and Logistical Readiness of Main Implementing Actors**

| Actor/Institution | Available Capacity | Main Logistical Constraint |
|---|---|---|
| Bandung City Transportation Agency | Four testing devices and 24 testing personnel | Service scope remains attached to periodic testing for public and commercial vehicles |

| Actor/Institution | Available Capacity | Main Logistical Constraint |
|---|---|---|
| Bandung City Environmental Agency | Two testing devices, one certified personnel, and 6–7 field personnel | Activities remain event-based; certified personnel and fixed testing locations are limited |
| Clean Emission Zone institutions | Provide locations and basic field support | Continuity depends on institutional commitment and leadership support |
| Private workshops and ASBEKINDO | Workshop network, several testing devices, internal SOPs, and coordination support | Equipment, certification, calibration, maintenance, and form costs are borne by workshops |
| SAMSAT | Vehicle registration and taxation data | Emission testing has not been conducted substantively in the observed service flow |
| Polrestabes Bandung | Potential field support and traffic enforcement authority | Enforcement has not operated because supporting data and formal requests were not available |
| Calibration providers outside Bandung | Annual calibration services are available outside the city | Bandung does not yet have a certified local calibration facility |

Source: Primary data processed by the author (2026)

Table 3 shows that capacity exists across several actors, but it is not yet connected into one logistical system. Clean Emission Zone activities, for example, depend on cooperation with institutions that provide locations, tables, chairs, tents, internet access, and internal vehicle participation. However, several locations became passive when leadership support declined or when cooperation was not strengthened through routine evaluation and binding commitments.

In the private sector, workshops can expand service coverage, but their logistical burden is high. Field data show that emission testing devices may cost between Rp25 million and Rp100 million per unit. Annual calibration costs around Rp750,000 per device, while maintenance, including oxygen sensor replacement, may reach around Rp1.5 million to Rp3 million per year. Workshops also purchase test-result forms at around Rp10,000 per sheet. These costs are difficult to recover when regular public demand for emission testing remains low and enforcement is still uncertain. Some workshops therefore share devices across branches, while others no longer operate damaged or inactive equipment. Field data also did not find dedicated motorcycle emission testing workshops in Bandung City.

Another logistical issue concerns calibration access. Several workshops and implementing actors depend on calibration services outside Bandung, including

institutions in Jakarta and Tangerang. This condition adds time and cost burdens, especially for workshops that must send devices outside the city for annual calibration. For private workshops, this becomes another consideration before investing in additional testing equipment.

SAMSAT has a different type of capacity. Its vehicle registration and taxation data could support compliance tracking, Based on observations, the vehicle physical check form for the 5-year vehicle tax also shows the exhaust gas aspect, but field observation at SAMSAT Kawaluyaan showed that emission testing was not conducted as an operational requirement in the observed service process.

Budget allocation also shapes implementation capacity. In the environmental sector, emission testing is located within broader pollution-control activities, including free emission testing, Urban Air Quality Evaluation, Clean Emission Zone development, and operational support. However, the budget has not been directly linked to the number of tested vehicles, failed vehicles repaired, service coverage expansion, or compliance follow-up. This finding shows that Bandung City already has several actors with relevant capacities, but the logistical chain has not yet connected testing, reporting, supervision, enforcement, and vehicle repair into an integrated implementation mechanism.

## Operational Influence of ASBEKINDO and Private Workshops in the Implementation Network

The fourth field finding concerns the inter-organisational network that supports motor vehicle emission testing in Bandung City. Network mapping was conducted using Gephi by measuring in-degree, out-degree, degree, and eigenvector centrality. In this subsection, centrality is used to identify the operational position of each actor in the implementation network. It does not indicate formal legal authority, but shows how strongly an actor is connected to other actors in the policy implementation process (Napitupulu & Carnia, 2022).

The network analysis shows that ASBEKINDO occupies the most central operational position. ASBEKINDO has the highest degree score, with 16 total connections, consisting of 8 incoming and 8 outgoing ties. It also has the highest eigenvector centrality score, at 1.00000000. This position indicates that ASBEKINDO is not only frequently connected to

other actors, but is also connected to actors that hold important positions in the implementation network.

**Table 4. Network Centrality of Main Policy Actors in Motor Vehicle Emission Testing**

| Actor | In-Degree | Out-Degree | Degree | Eigenvector Centrality |
|---|---|---|---|---|
| ASBEKINDO | 8 | 8 | 16 | 1.00000000 |
| DLH | 8 | 7 | 15 | 0.97680661 |
| DISHUB | 5 | 3 | 8 | 0.62936194 |
| Metrology Unit, PPKUKM DKI Jakarta | 4 | 4 | 8 | 0.35155624 |
| Clean Emission Zone | 3 | 3 | 6 | 0.65074878 |
| PT Biofarma | 2 | 3 | 5 | 0.49320795 |
| Polrestabes Bandung | 2 | 2 | 4 | 0.40099102 |
| PT Gojek | 2 | 2 | 4 | 0.49320795 |
| Suzuki, Toyota, Daihatsu, and Honda Workshops | 2 | 2 | 4 | 0.34267456 |
| Satpol PP | 1 | 1 | 2 | 0.24345019 |
| BAPPERIDA | 0 | 2 | 2 | 0.00000000 |

Source: Author's analysis of primary data, processed using Gephi (2026)

Table 4 shows that ASBEKINDO and DLH are the two most connected actors in the network. DLH remains a major public-sector actor because of its role in free emission testing, Clean Emission Zone activities, Urban Air Quality Evaluation, and coordination with private workshops. DISHUB also holds an important position through its connection to periodic testing, technical support, and the transportation-sector mechanism.

The visualisation of the network confirms this pattern. As shown in Figure 3, ASBEKINDO is positioned close to DLH, DISHUB, private workshops, and supporting institutions. This position can be read as an operational bridge between government-led emission testing activities and workshop-based service capacity.

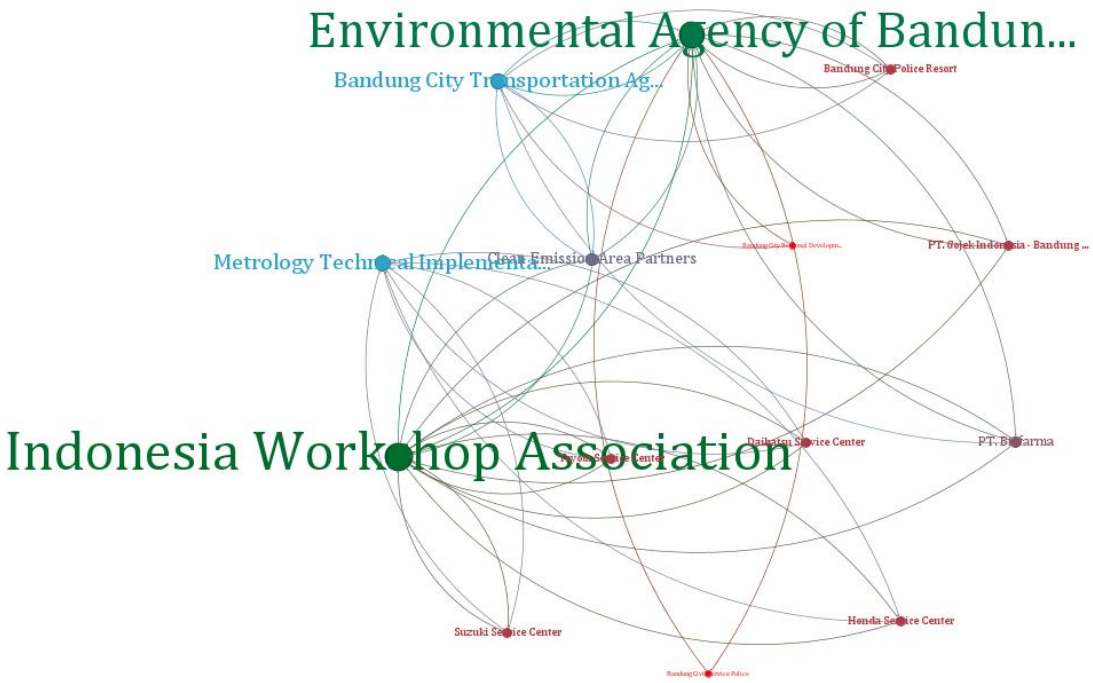


**Figure 3. Visualization of ASBEKINDO's Operational Centrality in the Emission Testing Network**

Source: Author's analysis of primary data, processed using Gephi (2026)

Field findings indicate that ASBEKINDO performs several practical functions in implementation. It facilitates communication between the Bandung City Government and private workshops, coordinates workshop participation in free emission testing, supports the circulation of physical test-result forms, and helps maintain workshop involvement in calibration, equipment maintenance, and service standards. These functions are important because regular public demand for emission testing remains limited and enforcement has not operated consistently.

Private workshops also have an important position because government capacity alone is not sufficient to reach the number of vehicles in Bandung City. Several workshops continue to provide emission testing through internal service standards, brand-level policies, or cooperation with ASBEKINDO and DLH. The presence of Suzuki, Toyota, Daihatsu, and Honda workshops in the network shows that private actors provide facilities, technical personnel, and direct access to vehicle owners.

The network also includes corporate actors. PT Biofarma is connected to emission testing through its Green Company orientation and Clean Emission Zone activities. PT Gojek is connected through internal requirements for driver partners to meet emission

standards through regular testing. These cases indicate that participation in emission testing can also be supported by internal organisational rules, not only by formal government enforcement.

ASBEKINDO's central position needs to be read carefully. Its high eigenvector centrality reflects operational influence in coordination, not formal regulatory authority. ASBEKINDO does not hold enforcement power, legal mandate, or public accountability equal to government institutions. Formal authority remains with government actors, especially in setting rules, enforcing compliance, integrating reporting systems, and determining policy direction.

The network also shows weaker institutional links. BAPPERIDA has no incoming ties and only two outgoing ties, although it has a planning and monitoring function in local government. Satpol PP also occupies a limited position, while Polrestabes Bandung has not become a central enforcement actor in emission testing. Field data indicate that road enforcement based on emission-test results has not been implemented because supporting data and formal requests from relevant agencies were not yet available.

This finding indicates that ASBEKINDO and private workshops help sustain parts of the implementation process, especially in coordination and service provision. However, their role cannot replace government authority in reporting integration, monitoring, enforcement, and policy direction. The implementation network has operated through practical coordination, but it has not yet formed a stable governance arrangement for emission testing in Bandung City.

### Political Priority, Economic Sensitivity, and Cross-regional Mobility in Emission Testing Implementation

The fifth field finding shows that the implementation of motor vehicle emission testing in Bandung City is shaped by social, political, economic, and cross-regional conditions. In the framework of Kearns & Lawson, (2008), these conditions are part of the social and political factors that influence policy decisions, actor commitment, and implementation continuity.

Field findings indicate that the continuity of emission testing policy in Bandung City has been affected by changes in political and institutional leadership. Bandung Mayor

Regulation No. 572 of 2010 was introduced during the administration of Mayor Dada Rosada and was supported by cooperation between the Bandung City Government and ASBEKINDO. In the early implementation period, particularly around 2010–2013, the policy was framed within the national Blue Sky Program *(Program Langit Biru)* introduced by the Indonesian Ministry of Environment and was operationalized locally through the designation of authorized workshops as emission-testing providers. However, the policy became less visible over time as leadership changed and institutional attention shifted to other urban environmental issues.

A similar pattern appears in the Clean Emission Zone mechanism. Several institutions that once received the Clean Emission Zone label did not maintain routine emission testing after leadership changes or shifts in institutional priorities. PT Biofarma became an exception in the field findings because it continued to conduct emission testing, maintain its Clean Emission Zone status, and provide special parking spaces for vehicles that passed the test. This continuity was supported by internal organisational commitment across leadership periods.

The social context of Bandung City has also changed since the issuance of Bandung Mayor Regulation No. 572 of 2010. The number of motor vehicles increased from approximately 1.19 million units in 2010 to 1.54 million units in 2024. At the same time, parking space in the city has become more limited. This condition affects the feasibility of parking-based incentives, which were more relevant when the policy was first designed.

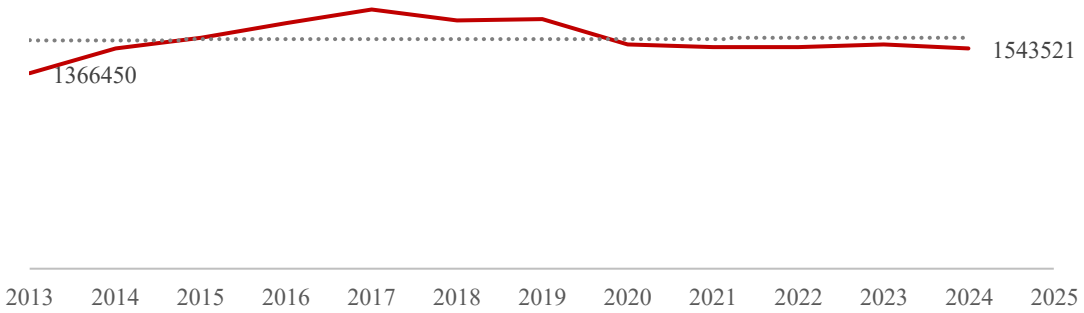


**Figure 4. Trend of Motor Vehicle Growth in Bandung City, 2013–2024**
Source: West Java Regional Revenue Agency, processed by the author (2026)

Figure 4 shows that the growth of motor vehicles changes the context of emission testing implementation. The parking incentive remains relevant as a policy idea, but field

findings indicate that its operational feasibility has weakened because the number of vehicles has increased while urban parking capacity remains limited.

Political priority also affects implementation. Field findings from BAPPERIDA and DPRD-related information indicate that air pollution from the transportation sector has not become a dominant issue in Bandung City's policy agenda. Environmental discussions are more often directed toward waste management, while congestion is generally discussed in relation to productivity and mobility rather than public health risks from vehicle emissions. Emission testing has also not become a major oversight issue in Commission III of the Bandung City DPRD. This indicates that the policy has not yet received strong political attention for sustained implementation.

Economic sensitivity is another important factor. Bandung Mayor Regulation No. 572 of 2010 uses a cost-based mechanism for emission testing services for non-public four-wheeled vehicles. This mechanism is related to the Polluter Pays Principle, which places pollution-control costs on the polluter, but field findings show that public ability to pay remains relevant in implementation (Purwendah & Erowati, 2021; Dietz & Atkinson, 2010).

**Table 5. Emission Testing Tariff for Four-wheeled Motor Vehicles**

| Type of Workshop | Emission Testing Fee |
|---|---|
| Construction/body workshop | Rp150,000 |
| Repair and spare-part workshop | Rp100,000 |
| Maintenance workshop | Rp50,000 |

Source: Bandung Mayor Regulation No. 572 of 2010, processed by the author (2026)

Table 5 shows that the regulation sets different tariffs according to workshop type. However, field findings from workshops suggest that price reduction alone has not been sufficient to increase public demand. Several workshops reported that discounts of up to 50% did not significantly increase the number of vehicle owners requesting emission tests. Demand remains low because emission testing is not consistently enforced and many vehicle owners do not see it as urgent unless it is linked to an administrative requirement, sanction, or clear service benefit.

The economic dimension is also visible in vehicle maintenance behaviour. Vehicles brought to official workshops are often those still covered by free service packages, while older vehicles are less frequently maintained at official workshops. This pattern matters

because vehicles that fail emission testing require not only testing fees, but also repair or maintenance costs. Without assistance, incentives, or credible enforcement, emission testing may remain limited to recording test results rather than improving vehicle compliance.

Law enforcement conditions also shape implementation. Direct road enforcement for emission-test violations has not been carried out in Bandung City. Field findings indicate that emission-test violations have not been used as the basis for road sanctions because supporting data and formal requests from relevant agencies were not yet available. This condition limits the connection between test results and compliance enforcement.

Cross-regional mobility adds another difficulty. Bandung is a tourism city and is closely connected to surrounding regions, including the Jakarta metropolitan area. Vehicles operating in Bandung are not limited to Bandung-registered vehicles. This makes local enforcement difficult when neighbouring regions apply different standards or when enforcement intensity varies across jurisdictions. Workshop findings also indicate that public interest in emission testing in Bandung increased when Jakarta's policy received stronger enforcement attention, but declined again when enforcement became less consistent.

At the national and provincial levels, efforts to link emission testing with motor vehicle tax instruments have not yet produced a settled mechanism. Field data show that discussions involving environmental, transportation, police, legal, economic, and revenue-sector actors faced difficulties because environmental objectives were weighed against public economic burden, taxpayer compliance, and regional revenue considerations. This finding indicates that emission testing in Bandung City depends not only on local technical readiness, but also on political commitment, feasible compliance costs, enforcement consistency, and coordination beyond Bandung's administrative boundary.

## DISCUSSION

The Bandung case suggests that weak implementation of motor vehicle emission testing should not be read only as a problem of public compliance, facilities, enforcement, or testing costs. Earlier studies have correctly identified these factors as

barriers in emission testing implementation in Indonesia (Aryasena et al., 2023; Aryoputro & Ridwan, 2025; Chaote et al., 2021; Purmayanti, 2022). However, the findings of this study indicate that those barriers are not isolated technical problems. They are symptoms of a broader governance problem in which policy design, institutional capacity, inter-organisational relations, and social-political conditions are not yet organised into a coherent implementation chain.

This argument strengthens the relevance of implementation theory. Van Meter & Van Horn, (1975) define implementation as actions carried out by public and private actors to achieve policy objectives. Kearns & Lawson, (2008) further argue that implementation is shaped by the policy itself, implementation agencies, inter-organisational relations, and social-political factors. The Bandung case confirms this framework, but it also shows that these dimensions do not operate separately. Regulatory inconsistency weakens agency capacity; uneven capacity limits network coordination; weak coordination reduces enforcement; and weak enforcement lowers public and private-sector incentives to comply. The implementation problem is therefore cumulative rather than linear. The first analytical point concerns fragmentation. Emission testing in Bandung City is distributed across the transportation sector, environmental sector, taxation-related administration, private workshops, and intermediary associations. This distribution is not inherently problematic. In multilevel and multi-actor governance, policy implementation often requires several institutions to share roles. Hooghe & Marks, (2020); Jänicke, (2017) show that environmental governance commonly involves vertical and horizontal distribution of authority. The problem in Bandung is not the presence of many actors, but the absence of a shared operational architecture. DISHUB, DLH, SAMSAT, Polrestabes, ASBEKINDO, and workshops are involved, yet their mandates, service mechanisms, databases, and follow-up procedures do not form one policy cycle.

This finding refines previous studies that emphasise weak enforcement, limited socialisation, low awareness, and cost barriers (Hakim & Sitabuana, 2021; Rizali et al., 2017). Those explanations remain valid, but the Bandung case shows why those barriers persist. Enforcement is weak because test results are not consistently connected to administrative sanctions, road supervision, or repair obligations. Socialisation has limited effect because citizens are not facing a stable compliance pathway. Facilities remain

underused because workshops cannot rely on predictable demand. Thus, the contribution of this study is to relocate the explanation from behavioural non-compliance to the governance structure that produces non-compliance.

The second analytical point concerns the policy itself. Bandung Mayor Regulation No. 572 of 2010 was an early local initiative because it recognised non-public vehicle emission testing before newer national regulatory references became dominant. Yet the same regulation now operates in a changed legal environment after Government Regulation No. 22 of 2021 and Ministry of Environment Regulation No. 08 of 2023. The issue is not simply that the city regulation is old. The issue is that transportation, environmental, taxation-related, and city-level instruments define obligations, vehicle categories, reporting formats, and institutional responsibilities differently. This supports the argument that unclear policy standards create multiple interpretations during implementation (Botah, 2023; Fowler, 2021). In Bandung, regulatory ambiguity becomes operational ambiguity.

This point also challenges a legalistic assumption that issuing regulation is sufficient to produce compliance. Regulations can mandate emission testing, but they do not automatically create a functioning implementation system. A policy instrument becomes effective only when it defines who must test, who records the result, who verifies compliance, who follows up failed vehicles, and what consequences apply after non-compliance. Hudson et al., (2019) describe policy failure as a gap between intention and implementation support. Bandung illustrates this gap: the policy intention to control vehicle emissions exists, but the supporting chain for reporting, repair, retesting, and enforcement remains incomplete.

The third analytical point concerns implementation agency capacity. DISHUB has equipment, personnel, and procedures through periodic vehicle inspection, but its mandate is mainly attached to public and commercial vehicles. DLH carries the environmental mandate through free emission testing, Urban Air Quality Evaluation, and Clean Emission Zone activities, but its resources and certified personnel remain limited. SAMSAT has vehicle registration and taxation data, but this data capacity has not been converted into substantive testing at the observed service location. Private workshops can expand coverage, but investment in devices, calibration, certification, and

maintenance is difficult when demand and enforcement are uncertain. This supports studies linking implementation weakness to limited infrastructure, funding, and human resources (Afita, 2024; Botah, 2023), while adding that Bandung's problem is also relational: several capacities exist, but they are not connected.

The literature on vehicle inspection and maintenance clarifies why this matters. Inspection and maintenance programmes are not designed merely to produce test certificates. They are intended to identify high-emitting vehicles, require corrective repair, and monitor whether vehicles return to legal emission limits (Hassani et al., 2021; Huertas et al., 2020). From this perspective, Bandung's emission testing is still closer to an activity-recording system than a compliance-correction system. Certificates, stickers, free testing, periodic inspection, and workshop services exist, but failed vehicles are not yet consistently directed into repair, retesting, and enforcement follow-up. Testing without correction weakens the environmental value of the policy.

The fourth analytical point concerns ASBEKINDO and private workshops. The Gephi analysis shows that ASBEKINDO occupies the most central operational position in the implementation network. This does not mean that ASBEKINDO holds formal authority. Its centrality indicates operational influence: it facilitates communication, coordinates workshop participation, circulates physical test-result forms, and supports service continuity. This confirms that public and private actors can complement each other in implementation (Cashore et al., 2021; Parulian & Afifah, 2024). Yet the finding also reveals a governance dilemma. A private association becomes central because government coordination has not fully integrated reporting, monitoring, enforcement, and compliance follow-up. Private actors can support implementation, but they cannot replace public accountability.

The fifth analytical point concerns social-political feasibility. Emission testing competes with other urban issues, especially waste management and congestion. This helps explain why the policy remains formally present but politically less visible. Political support matters because implementation requires budget, coordination, enforcement, and administrative follow-up (Efiyanti et al., 2022; Hartawan & Kosasih, 2023). Economic sensitivity reinforces this problem. Although the Polluter Pays Principle places pollution-control costs on polluters (Dolmans, 2021; Purwendah & Erowati, 2021), ability to pay

remains relevant in designing compliance instruments (Dietz & Atkinson, G., 2010). Field findings show that discounts alone did not create strong demand because testing is not perceived as urgent without administrative consequences, sanctions, or clear benefits.

This tension is important for policy design. Emission testing cannot rely only on coercion, but it also cannot rely only on voluntary compliance. Older vehicles may carry higher emission risks, yet their owners may also face higher repair-cost burdens. Assyifarizi et al., (2025) therefore offer a relevant caution: emission testing requires supporting solutions that help vehicle owners comply, including repair assistance for vulnerable groups. Bandung's cross-regional mobility adds another layer. Vehicles operating in the city are not limited to Bandung-registered vehicles, so local enforcement becomes weaker when neighbouring jurisdictions apply different standards or enforcement intensity.

The study therefore contributes to implementation research by showing that emission testing fails to function as an integrated environmental policy instrument when the chain between testing, reporting, repair, compliance tracking, enforcement, and cross-regional coordination is incomplete. Strengthening implementation requires more than free testing events, additional workshops, or public campaigns. It requires a coherent implementation architecture: harmonised vehicle categories, clarified institutional responsibilities, integrated reporting platforms, use of SAMSAT data for compliance tracking, repair and retesting pathways, enforceable follow-up procedures, and feasible support for vehicle owners facing repair-cost barriers.

## CONCLUSION

This study concludes that motor vehicle emission testing in Bandung City has not yet operated as an integrated environmental policy instrument. Although testing activities are carried out through the transportation sector, environmental sector, taxation-related administration, private workshops, and intermediary associations, these actors work through different mandates, service mechanisms, reporting systems, and policy interests. This condition leaves testing, reporting, repair follow-up, compliance tracking, and enforcement only partially connected.

The findings show that implementation is constrained by regulatory inconsistency, unclear outcome parameters, uneven logistical readiness, limited certified personnel,

weak data integration, fragile inter-organisational relations, and uncertain enforcement. ASBEKINDO and private workshops hold important operational positions in the implementation network, particularly in coordination and service provision. However, their role cannot substitute government authority in rule-setting, monitoring, reporting integration, compliance control, and enforcement.

The study contributes to policy implementation scholarship by reframing weak enforcement, low compliance, limited facilities, and compliance costs as symptoms of a wider governance problem, rather than as separate implementation barriers. It also offers a policy lesson for local environmental governance: emission testing requires a coherent implementation chain that clarifies institutional authority, integrates reporting platforms, links testing with repair and retesting, uses vehicle administration data for compliance tracking, and supports coordination beyond municipal boundaries. The study is limited to the Bandung City case and does not directly measure the impact of emission testing on air quality outcomes.

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