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Beyond Classic Implementation Dimensions: Developing the 25 Early Detection of Tuberculosis Framework for Context-Responsive Tuberculosis Policy Implementation

Spadini Putri[1*]
Institut Pemerintahan Dalam Negeri, Indonesia

Mansyur Achmad[2]
Institut Pemerintahan Dalam Negeri, Indonesia

Ika Sartika[3]
Institut Pemerintahan Dalam Negeri, Indonesia

Udaya Madjid[4]
Institut Pemerintahan Dalam Negeri, Indonesia

***Corresponding author:**
Spadini Putri, Institut Pemerintahan Dalam Negeri, Indonesia.
✉spadini.putri@gmail.com

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Abstract

Background: TB cases in 2024 in Bekasi City reached 14,788 from previous data that identified an implementation gap in TB control. Six distinct dimensions were identified from NVivo analysis and developed into the TB *DINI* model, where interagency coordination, digital reporting, and stigma reduction are priorities.
Objective: This study intends to describe the implementation of TB treatment policy and the factors that motivated this policy, in addition to an appropriate model for TB management in Bekasi City.
Methods: A descriptive qualitative research method was used. Data were collected through observation, document review, and interviews with 15 informants selected using purposive sampling. NVivo triangulation was applied to the six central variables present in the Van Meter and Van Horn model.
Results: Four implementation dimensions were identified by cluster analysis using the Van Meter and Van Horn model, with the national target as reference. The policy resources have the most significant impact, as shown by the hierarchy chart. The clustering was further informed by concepts such as governance, bureaucracy, early detection, innovation, and social values from a word frequency analysis. This new dimension made the policy implementation model better suited to the context of Bekasi.
Conclusion: The Early Detection of Tuberculosis implementation model is a suitable and strategic intervention for tuberculosis control in Bekasi, given its contextual fit, adaptability, sustainability, and comprehensive planning.

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INTRODUCTION

Tuberculosis (TB) remains one of the major global public health challenges and is still among the top 10 leading causes of infectious disease-related deaths globally (Bodaghi et al., 2012; Ockenga et al., 2023). Indonesia carries one of the highest TB burdens worldwide, with the number of cases increasing significantly over the past few years to 717,941 new national cases in 2022. At the local level, in 2024 Bekasi City reported 14,788 cases; this escalation is concerning due to urban density and high mobility as a buffer zone of the capital, which is epidemiologically at risk of transmission (Lestari et al., 2022; Sari, 2021). These facts highlight that TB is not just a

clinical issue, but a structural one that demands an adequate policy response and robust implementation.

The government of Indonesia has responded by issuing Presidential Regulation Number 67 of 2021 on Tuberculosis Control to adopt an integrated cross-sectoral approach and strengthen central-local coordination (Peraturan Presiden [Perpres] Nomor 67 Tahun 2021 Tentang Penanggulangan Tuberkulosis, 2021). This national policy is supported by local regulations that strengthen it, such as the Bekasi City Regional Regulation Number 8 of 2022 concerning the Regional Health System and the establishment of a Tuberculosis Control Acceleration Team (Peraturan Daerah [Perda] Kota Bekasi Nomor 8 Tahun 2022 Tentang Sistem Kesehatan Daerah, 2022; Keputusan Wali Kota Bekasi Nomor 400.7/Kep.539-Dinkes/IX/2025 Tahun 2025, 2025). This regulatory framework provides, in normative terms, an institutional basis with a clear distribution of functions and roles, and fosters a quasi-communal spirit toward TB elimination; however, regulations or formal structures do not guarantee effective implementation at the operational level. On one hand, legal inconsistencies are evident: Presidential Regulation 67/2021 governing TB control operates in a cross-sectoral form, whereas Local Regulation No. 8/2022, which regulates TB within the regional health system, carries operational substance leading to redundancy and overlaps in accountability and reporting among the Bekasi City Health Office, hospitals, and primary health care centers. Moreover, Mayor's Regulation No. 64.A/2020 introduces the "5T KebasTBC" strategy; however, there is no formal coordination mechanism to delineate operational jurisdiction among these three regulatory instruments, leading to overlap and fragmentation of activities and data flows.

Empirical evidence suggests a fundamental disconnect between the way policies are designed and how they are implemented in practice at the field level. In Bekasi City, for example, there is institutional friction: coordination meetings between the Health Office and the Department of Social Affairs regarding TB-affected households are conducted without a joint operational protocol, resulting in duplicated home-visit activities and inconsistent data recording. Based on field interviews, at least three Puskesmas reported conflicting directives from the Health Office and district-level supervisors regarding referral pathways for patients, demonstrating organizational coordination failures beyond mere integration impediments including inadequate capacity and insufficient numbers of TB cadres, suboptimal inter-Puskesmas coordination in reaching high-risk populations, and poor patient treatment adherence monitoring. Low health literacy and the social stigma that still accompanies TB also influence patterns of health-seeking behavior and the implementation of therapy (Apriani et al., 2025; Istiqomah & Naryati, 2023; Rindy Al Fitry et al., 2022). Such conditions indicate that TB policy implementation challenges are not simply a matter of regulatory availability, but also relate to governance dynamics, bureaucratic capacity, implementer behavior, and social context.

To address these gaps, the Van Meter and Van Horn policy implementation model Van Meter & Van Horn (1975) was selected; although more recent frameworks exist such as the Advocacy Coalition Framework (ACF), which focuses on belief systems and coalition dynamics (Nwalie, 2019), and the ambiguity-conflict-based framework that classifies implementation according to levels of ambiguity and conflict through Matland's Ambiguity-Conflict Model the operational dimensions identified in the Van Meter and Van Horn model closely reflect the administrative structure for TB control in Indonesia, and it was selected for its comprehensiveness, encompassing six operational dimensions. While the ACF requires longitudinal data on coalition behavior and the Matland model is better suited for comparative policy situations, Van Meter and Van Horn offer a formal diagnostic structure applicable to single-case evaluations of specific bureaucratic implementations, such as Bekasi City's governance context. This model has also been successfully applied in recent studies evaluating health policy implementation in urban local government settings in Indonesia (Saputro et al., 2024), making it appropriate to evaluate the implementation of TB control policies in Bekasi City. Using case study fieldwork including document analysis, in-depth interviews, and observations coded using NVivo the research attempts to identify drivers of implementation, track interconnections across policy elements, and develop an enhanced implementation model contextually strengthened through engagement with local realities. Consequently, this research contributes not only to the empirical evaluation of TB policy but also to the development of a more adaptive public health policy implementation framework for urban areas with a high TB burden.

METHOD

Study Design

This study employed a descriptive qualitative design to evaluate the implementation of tuberculosis (TB) control policy in Bekasi City, Indonesia. The study was carried out from January to November 2025. The analysis was underpinned by the policy implementation model of Van Meter and Van Horn, which conceptualizes implementation performance through six interrelated dimensions: policy standards and objectives; policy resources; interorganizational communication; characteristics of implementing agencies; implementer disposition; and socioeconomic and political environment.

The primary data were collected from key informants (local government officials, health office representatives, puskesmas personnel, TB program officers, and community cadres) who were involved in policy formulation and implementation. Secondary data were collected from policy documents, standard operating procedures (SOPs), epidemiological reports, and health service records. Using purposive sampling, fifteen informants were purposefully selected to represent a diversity of institutional roles to avoid elite bias. Data collection intentionally included TB patients and community health volunteers (Kader TB) to reflect community-level values and sentiments.

Table 1. Profile of Key Informants

No.	Position / Role	Institution / Affiliation	TB DINI Dimension Represented
1	Head of TB Control Program	Bekasi City Health Office (Dinas Kesehatan)	Governance; Bureaucracy
2	Head of Bekasi City Health Office	Bekasi City Health Office	Governance
3	Puskesmas TB Program Officer	Puskesmas Bekasi Jaya	Early Detection; Bureaucracy
4	Puskesmas TB Program Officer	Puskesmas Mustikajaya	Early Detection; Implementers
5	Hospital TB Coordinator	RSUD Bekasi (Regional Public Hospital)	Early Detection; Innovation
6	Head of Sub-District Health Section	Kecamatan Bekasi Utara	Governance; Implementers
7	NGO / Advocacy Partner Representative	USAID Prevent TB / Project HOPE Partner	Innovation; Social Values
8	Community Health Volunteer (Kader TB)	Kelurahan Jatiwaringin	Social Values; Implementers
9	Community Health Volunteer (Kader TB)	Kelurahan Margahayu	Social Values; Implementers
10	TB Patient (active treatment)	Puskesmas Pondok Gede	Social Values; Early Detection
11	TB Patient (completed treatment)	Puskesmas Bekasi Jaya	Social Values; Implementers
12	Private Clinic TB Doctor	Private Health Facility, Bekasi Timur	Innovation; Bureaucracy
13	SITB Digital Reporting Operator	Bekasi City Health Office	Innovation; Bureaucracy
14	Religious Leader / Community Figure	Local Mosque / Community Organization	Social Values; Norms
15	Local Government Planning Official	Bappeda Bekasi City	Governance

Data Collection Procedures

Data were collected using in-depth semi-structured interviews, fieldwork observations, and document review. Interview guides were aligned with the six dimensions of the Van Meter and Van Horn model, focused on perceptions, operational challenges, coordination mechanisms, and contextual factors affecting policy implementation (Van Meter & Van Horn, 1975). Direct observations were conducted using a data collection tool specifically designed for capturing the real-world processes of implementation, coordination, and service delivery. Document review involved the examination of regulations, TB program reports, epidemiological data, and administrative records. The use of these methods was complemented by methodological triangulation to enhance data reliability.

Data Analysis

All interviews were transcribed verbatim and imported into QSR NVivo 15 for qualitative analysis. Data were analyzed using a sequential mixed-methods approach: First, the six theory-driven Van Meter and Van Horn dimensions were applied as primary nodes for deductive coding, followed by inductive open coding to allow themes of broad importance to surface from the raw interview transcripts. Next, axial coding created connections between parent and child nodes, and selective coding consolidated these into the six TB DINI dimensions. To assess inter-rater reliability, two researchers independently coded a random 20% sample of transcripts; Cohen's kappa coefficient was 0.81, indicating strong agreement between coders. Thereafter, node verification was conducted via member checking with three senior informants who confirmed that the resultant themes accurately represented their institutional experiences. Data were categorized by source type and coded according to a node-based system consistent with the six dimensions of the Van Meter and Van Horn model. Sub-nodes were created inductively to elaborate on new operational indicators and contextual details. Coding was conducted iteratively to maintain analytical rigor and thematic refinement. Data analysis took place in four stages: cluster analysis to group themes, hierarchical chart analysis to identify dominant dimensions of implementation, word frequency analysis using NVivo to identify new themes and related terms outside the original theoretical framework, and relational analysis to examine how those dimensions relate to one another. Triangulation of analytical techniques and data sources was employed to validate the research findings and ensure reliability. To better reflect the empirical realities of TB control policy in Bekasi City, relational data were used to fine-tune and recalibrate the implementation framework.

RESULTS AND DISCUSSION

Results

Implementation of Tuberculosis Control Policy in Bekasi City

The TB control policy implementation in Bekasi City shows a very strong orientation toward achieving national targets and the larger agenda of the Roadmap of TB Elimination. Based on previous literature, document review, interviews, and observations, these findings were subsequently mapped in a structured manner using a bucket-method systematic NVivo analysis, including cluster analysis, hierarchy charting, word frequency, and relational analysis.

Cluster Analysis

Four clusters of themes from the TB policy implementation were identified through the cluster analysis (Figure 1). Mediating policy dimensions are variably scored for clusters and summarized post hoc. Cluster 1 comprises national targets, health priorities, and the Bekasi City Medium-Term Development Plan (RPJMD), which together represent the macro policy dimension; national targets manifest as an overarching governing frame of reference that provides context for understanding how local priorities and planning directions (RPJMD) are framed. While they represent operational areas of service delivery and information governance, Cluster 2 situates psychosocial support, private sector support, SITB reporting, and communication forums as themes that highlight how care provision cannot exist in isolation from inward-facing actors (i.e., health systems professionals), and how successful program coordination requires both a functioning reporting system and cross-actor communication mechanisms to reinforce patients' support. Barriers to addressing these components of TB

control, present in Cluster 3 and integrated with implementation outputs and outcomes of the health promotion and prevention domains, reflect that program achievements are inherently dynamic, alongside field-level challenges requiring promotive preventive interventions to build on results. Cluster 4 addresses infrastructure within the macro policy environment; human resources, TB control policy budgets, and interagency coordination illustrate the bureaucratic support base and system capacity encompassing funding, human resources, facilities, and institutional coordination as the foundational backbone required for effective implementation.

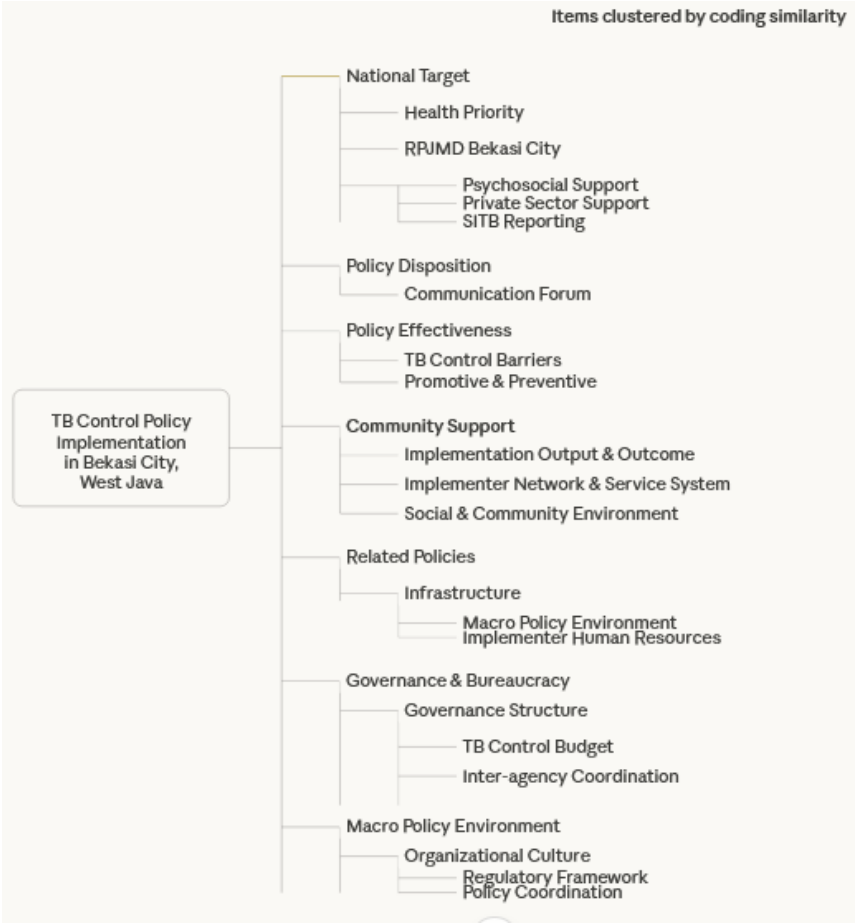

Figure 1. Cluster Analysis Visualization. The NVivo analysis provides four major thematic clusters of TB policy implementation in Bekasi City, depicted in the graph: (1) National Targets and Local Planning (RPJMD); (2) Service Delivery and Information Governance; (3) Program Implementation Assessment & Promotive Preventive Interventions; and (4) Bureaucratic Support Base & System Capacity.

Hierarchy Chart Analysis

Based on the hierarchy chart, it can be confirmed that the strongest theme in the implementation of TB policy in Bekasi City is policy resources, which consists of: (1) the budget for tuberculosis policy; (2) implementing human resources; and infrastructure [Figure 2]. Furthermore, the domain of implementing organization characteristics is also highlighted through implementation SOPs and their connection with SITB reporting; suggesting that organizational capacity does not only rely on the provision of clinical services but on procedural adherence and data governance processes as well. Inter-agency coordination and communication forums, exemplifying the inter-organizational communication dimension, highlight that all actors need to be interoperable at a level where resources, SOPs, and reporting function synchronously. Policy standards and objectives are reflected in the form of national targets, health priorities, and RPJMD. The socio-economic and political environment variable is mostly reflected through support from the private sector and community.

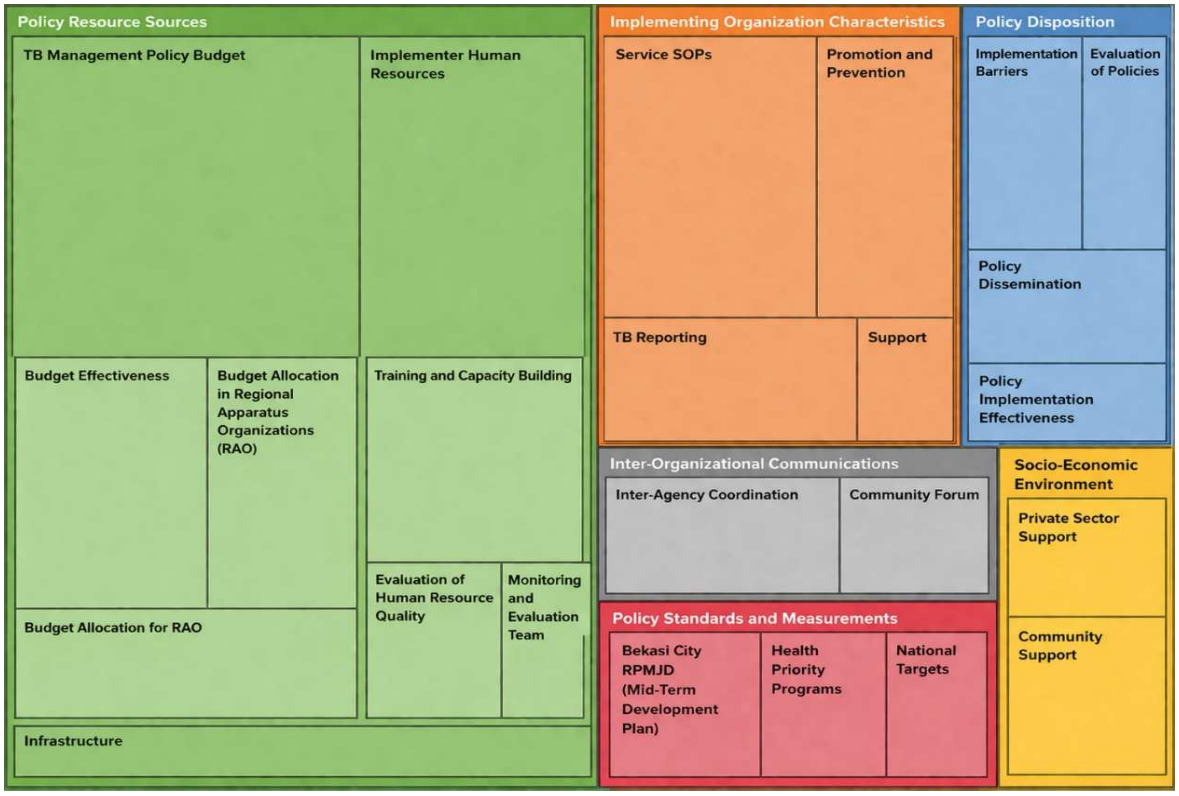

Figure 2. Hierarchy Chart Analysis Visualization. The chart describes the most dominant theme in the implementation of the TB policy in Bekasi City.

Word Frequency Analysis

To identify themes outside of the original Van Meter and Van Horn model, document, interview, and observational data were analyzed as a group via word frequency analysis using a large display threshold (up to 1,000 words; minimum length = 3 characters), after which the most frequent words for the interviews were selected and displayed in a word cloud (Figure 3). The word cloud shows the dominance of "patients" as a major focus of intervention along with other key terms including "community health center (puskesmas)," "government," "private sector," and "community" collectively providing a bio-geo-political assemblage of implementation actors. The inclusion of the words "cadres" and "coordination" is a reminder that community health centers are the first points of service and of community mobilization. Similarly, the phrases "human resources" or "facilities," and even references to being strapped for medicines, weigh on resource issues. Keywords with operational connotations "screening," "detection," "diagnosis," SOP, and the names of program innovations (e.g., KebasTB) embody the program's focus on case finding and standardizing services. In the word cloud, prominence is also given to terms around digital innovation, including "SITB," "digitalization," "integration," and "monitoring." The presence of words such as "governance," "bureaucracy," "RPJMD," and "APBD" reflects management–administrative dimensions, while terms informed by a socio-political lens such as "psychosocial," "stigma," and "family" reflect social determinants that formed points of direct entry for the program. Based on these findings, six contextual themes were identified that restructure the implementation dimensions into the following: governance, bureaucracy, early detection, innovation, social values and norms, and implementers, which then formed the basis for recoding according to these six themes.

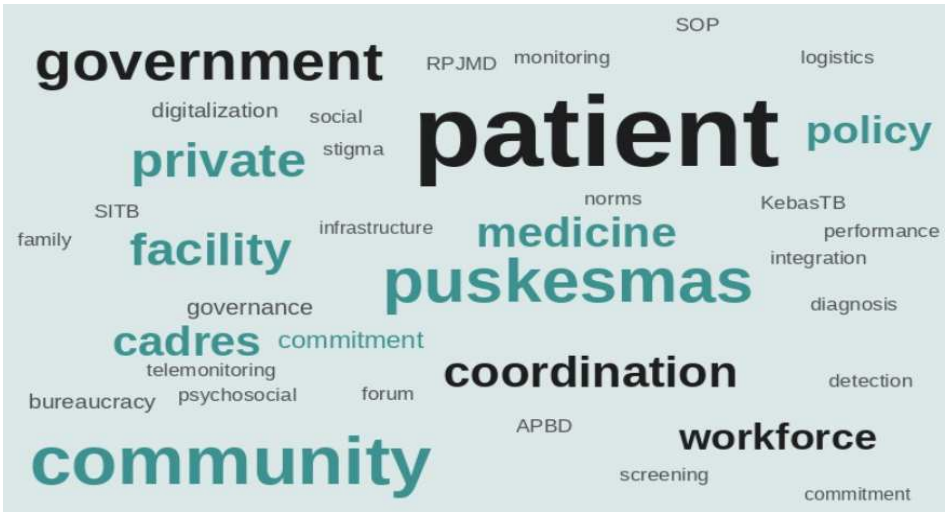

Figure 3. Visualization of Word Frequency by Word Cloud. The cloud provides themes beyond the initial Van Meter and Van Horn framework.

Relationships Analysis

Relationship analysis was carried out to map the linkages between the Van Meter–Van Horn dimensions (Figure 4) and the newly identified themes, as well as the relationships among the new themes themselves (Figure 5). The relationship map shows that policy standards/objectives and inter-organizational communication are connected to governance and bureaucracy, illustrating how targets/standards and communication mechanisms are translated into role arrangements, coordination, and administrative procedures. Policy resources are related to bureaucracy, implementers, and innovation, underscoring that the capacity of funding, human resources, and infrastructure is a prerequisite for executing SOPs and simultaneously serves as an accelerator for service improvements (for example, digitalization). The features of implementing organizations are correlated with early detection/diagnosis, innovation, and implementers, capturing the interrelation between organizational capacity and the core functions of the TB program. Socioeconomic and political environments are linked to social values, norms, and cross-sectoral innovation networks; policy dispositions position themselves close to implementers, who are the key actors initiating acceptance, commitment, and consistency of actions in the field.

Inter-theme relationships at the level of governance↔bureaucracy, governance↔innovation, bureaucracy↔implementers, bureaucracy↔early detection/diagnosis, innovation→early detection/diagnosis, innovation↔implementers, as well as social values & norms→implementers, and early detection/diagnosis→innovation are all noteworthy. In summary, this relationship pattern indicates that TB implementation in Bekasi City works as an interdependent system, meaning that if one dimension (e.g., bureaucracy or innovation) improves, it is likely to influence other dimensions (e.g., early detection and implementer performance), which provides justification for positioning these six themes as the conceptual basis for a better contextual model formulation for TB implementation in Bekasi City.

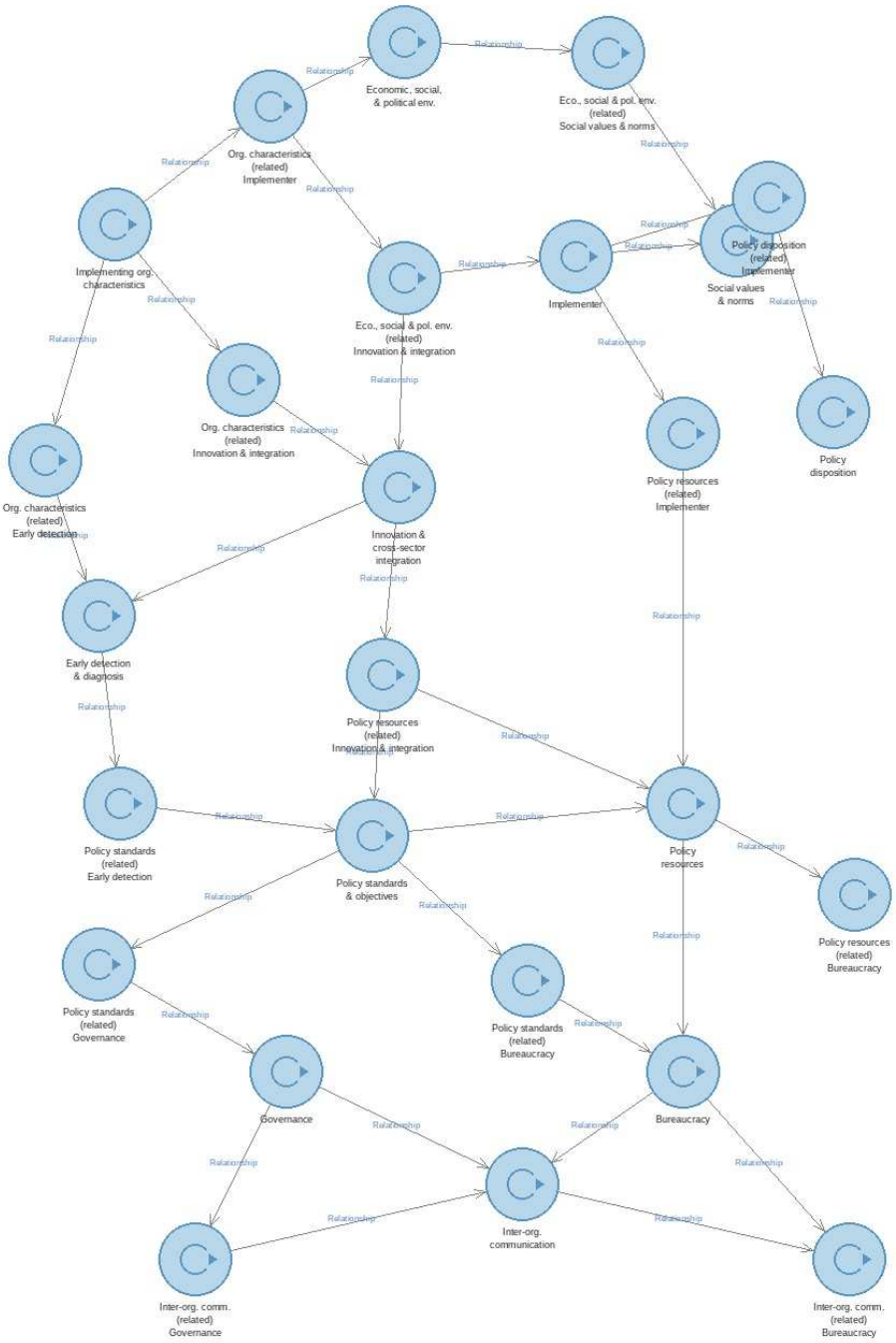

Figure 4. Visualization of the Connection of New Themes with Van Meter and Van Horn dimensions

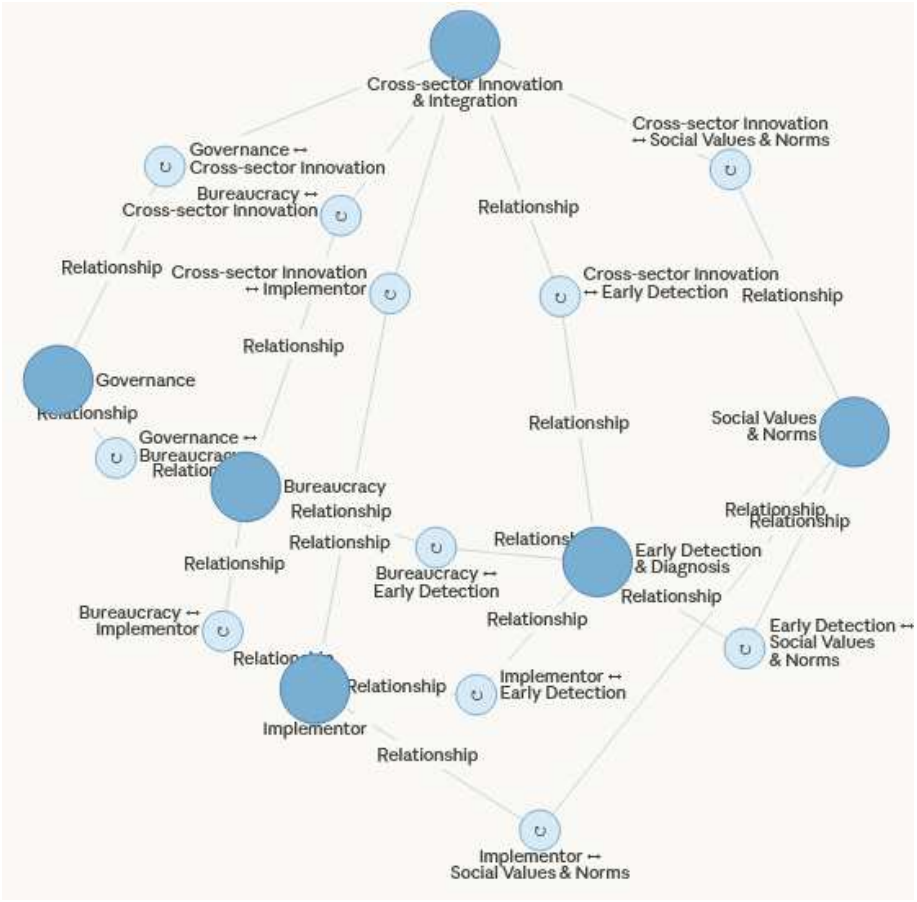

Figure 5. Visualization of New Themes Relationships Analysis. The diagram provides a dynamic connection at each dimension

Supporting and Hindering Factors in the Implementation of TB Control Policy in Bekasi City

Based on document review, interviews, and direct observation, findings indicate that TB control policy implementation in Bekasi City was mostly influenced by the combination of structural factors and characteristics (resource capacity, cross-actor coordination process), implementer disposition, and both inner-network and outer main actor system dynamics. In the Van Meter and Van Horn framework, these findings point to forces in favor of policy implementation (i.e., facilitation) as well as barriers that may work against program fidelity.

Supporting Factors

In relation to policy standards and targets, the regulatory foundation of Bekasi City is already relatively clear and in accordance with national policy, that TB indicators have been integrated into local planning documents (RPJMD as well as strategic plans from relevant agencies). In establishing measurable program targets (for instance case-finding coverage, number of eligible patients recognised as having acceptable treatment success), this clarity of direction strengthens TBs place in the local health development agenda and its location on the pathway to the TB elimination agenda (Peraturan Daerah (Perda) Kota Bekasi Nomor 19 Tahun 2024 Tentang Penanggulangan Penyakit Menular, 2024; Peraturan Wali Kota Bekasi Nomor 64.A Tahun 2020). Regarding policy resources, the TB program is supported by multi-source financing (national budget, local budget, and external grants/support such as the Global Fund, USAID Prevent TB, and Project HOPE), which is utilized to strengthen services, ensure the availability of anti-TB drugs, improve staff competencies, and enhance community education (Dinas Kesehatan Kota Bekasi, 2020). From an infrastructure perspective, the network of community health centers and hospitals, the availability of diagnostic tools (including TCM), and specialized services such as an integrated pulmonary building at the regional public hospital strengthen access to diagnosis and case management, while the provision of free drugs reduces patients' financial barriers (Dinas Kesehatan Kota Bekasi, 2024).

With respect to the characteristics of implementing organizations and inter-

organizational communication, the Health Office functions as the coordinator of the public–private TB service network, supported by a documented work structure and SOPs (Peraturan Wali Kota Bekasi Nomor 64.A Tahun 2020). Digitalization of reporting through SITB/e-TB Manager facilitates case recording, program monitoring, and reporting transparency. Cross-sectoral coordination is also strengthened through regular forums, field supervision, and informal communication channels (such as messaging groups) involving territorial and community actors, enabling more rapid responses to operational constraints (Ashari et al., 2021; Maher, 2010; Rasman, 2022). In terms of implementer disposition and the socio-political environment, program implementers at the health office and community health center levels demonstrate strong operational commitment, which is maintained through regular training, on-the-job training for SITB, and routine mentoring. Support from professional organizations and media-based health promotion strategies expands the reach of health education. Political support is reflected in sustained budget allocation and the issuance of technical policies, while cross-sector partnerships (PPM TB, NGOs/advocacy partners, as well as cadres and community activities) strengthen education, patient support, and case-finding functions (Adiwinoto, 2024; Rahmat, 2025).

Hindering Factors

For policy standards and objectives, a key barrier lies in the lack of uniformity in the detail and operationalization of targets between national and local levels. Several national indicators are not fully or specifically reflected in local regulations, which may lead to variations in the interpretation of performance achievements and standards across implementing units. The complexity of cross-sectoral programming also makes policy objectives relatively broad and not always easy to measure uniformly at the implementation level. Regarding policy resources, the limited number of TB-dedicated staff at community health centers emerges as a dominant issue. On the one hand, TB officers often serve too many programs, thus increasing their work burden and reducing the intensity of patient monitoring; on the other hand, when staff changes occur that do not adequately transfer knowledge, this turns into a breaking point for program continuity. Funding sources are diverse; however, TB allocations tend to be separated within program lines, and as such, specific monitoring is suboptimal, while scarcity of domestic operational funds at the community or sub-district level restricts regular active screening and health education implementation.

Disparities in diagnostic capacity between facilities (for instance, the inconsistency of laboratory/X-ray availability in community health centers) limit the pace of analysis at the level of implementing organization characteristics and information systems. Some private sector facilities are still only partly following DOTS due to a shortage of human resources, a lack of operational support aimed at strengthening coordination flows between service providers, and weakened supervision. Digital reporting (SITB and other systems) integration and compliance remain incomplete and untimely, especially from private facilities, creating deficiencies in reported data that lead to ineffective data-driven planning. Vertical and horizontal coordination remains fragmented in terms of inter-organizational communication and the external environment, whereby even within local government units and non-health partners there are multiple frameworks based on differing priorities and understandings of TB impact that do not optimize collaboration for mitigating the socioeconomic consequences for TB patients. Coordination forums likewise appear contingent on key individuals as well as the permanence (or lack thereof) of officeholders; high turnover of local actors, for instance, frequently leads to the need to re-establish communication channels. Socially, TB stigma, low treatment adherence, lack of family support, and economic constraints (such as transportation costs) contribute to loss to follow-up. Administrative obstacles as well as concerns about service delivery implications (e.g., confidentiality issues) have also limited the participatory role of the private sector, suggesting that integration into TB control remains partial and that the governance of partnerships will need to continue addressing incentive mechanisms.

Restructuring Implementation of TB Control Policy Model in Bekasi City

A. ACSR 2019 – Identification of Problem and Objectives for Modelling Optimal Implementation Tuberculosis Control Policy in Bekasi City

Tuberculosis (TB) is a global infectious disease problem, and Indonesia as well as West Java Province are among the regions with a high TB burden. Data from the Health Office of Bekasi City show that in 2023 there was an increase in detected cases, namely 13,562 cases (per 100,000 population), whereas in 2022 there were only 6,134 cases. Such an increase shows improved early detection, but conversely supports the iceberg theory, as cases in the community are thought to remain largely unnoticed by health services. Spatial analysis indicated that cases were clustered (hotspot) with area-specific determinants including poverty and environmental factors. This suggests that TB control needs go beyond a clinical perspective; they are essentially a problem of public policy in a social and environmental context; thus, an implementation model considering only the administrative aspects may not be sufficient for understanding complexity at the ground level.

Implementation barriers in Bekasi, as revealed by document review, interviews, and observations, include limited TB human resources; dual-role issues; fragmented inter-agency coordination; inequalities in diagnostic infrastructure; idiosyncrasies between information and reporting systems; and social barriers (stigma), along with economic factors and poor treatment adherence that result in patients being lost to follow-up. In addition, community engagement is not yet optimal due to heterogeneous cadre capacity and inadequate logistical and financial support. The interconnected barriers uncovered from the 22 papers highlight a conceptual gap when implementation is perceived only through generic dimensions, because this does not allow for capturing how key mechanisms jointly influence TB program performance at the city level, implying that the existing implementation model deserves restructuring.

However, there are policy assets that can accelerate implementation beyond the regulatory framework, including strong national policy alignment through Presidential Regulation No. 67/2021 and Mayor Regulation No. 64. Integration of the TB program into the *Rencana Pembangunan Jangka Menengah Daerah* (RPJMD) (2020) presents opportunities for synergies with international partners and private sector actors. The implementation model is reformulated based on the dominant barriers and possible facilitators, toward fostering implementation capacity and governance with clearer objectives for human resource competencies, inter-agency coordination, destigmatization through community-based education, infrastructure and reporting/monitoring technologies, and community participation requirements for program sustainability. Structuring the implementation model is therefore a strategic necessity to make TB policy evaluation and improvement in Bekasi City more contextual, operationally sound, and target-oriented toward elimination.

B. Sustainable Initiatives in TB Control Policy Strategy Model "TB DINI"

To increase the effectiveness of TB programs in Bekasi City and achieve national TB elimination targets requires a restructuring of the TB control policy implementation model. Findings from NVivo word frequency analysis reveal important themes that go beyond the Van Meter and Van Horn framework, including cross-sectoral engagement beyond health, digital technology shaping reporting standards, and social values impacting stigma (these are discussed below). Relationship analysis confirms that these themes are not limited to isolated functions: they intersect and interact with the classical dimensions of policy implementation inputs, activities, outputs, and outcomes and have mutually determining relationships that influence program performance on the ground. This indicates that the evaluation of TB implementation needs a broader and more contextual framework that could accommodate the real dynamics, both operational and social, in Bekasi City.

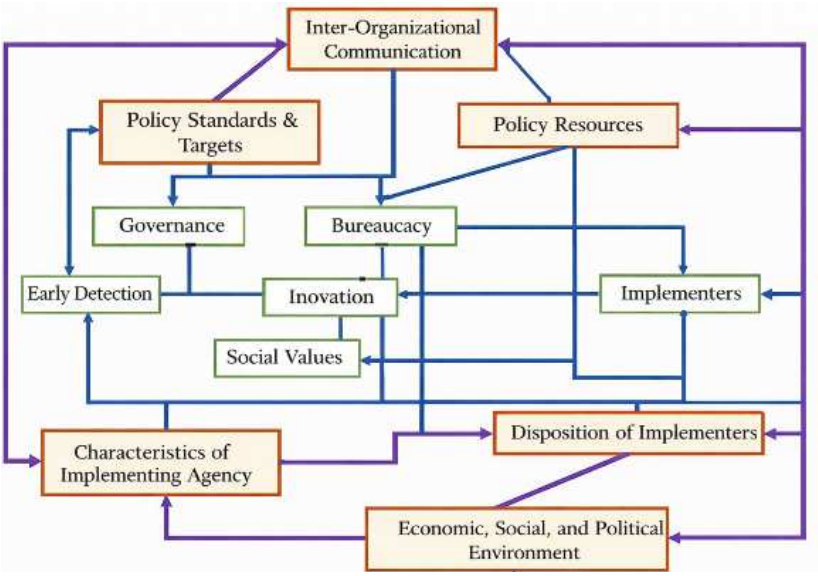

Figure 6. Implementation model of "TB DINI" visualization in Bekasi City. The figure depicts the various — dynamic — linkages across the "TB DINI" dimensions, as well as their relation to the Van Meter and Van Horn framework.

On this basis, the Van Meter–Van Horn model is restructured into the "TB DINI" model, which comprises six dimensions: Governance, Bureaucracy, Early Detection, Innovation, Social Values, and Implementers (Figure 6). TB DINI is designed as a model that is adaptive to local realities by placing the interlinkages among dimensions as the main mechanism that shapes implementation effectiveness. Conceptually, this model broadens the focus of implementation from mere administrative compliance to the dynamic interaction between system governance, bureaucratic capacity, speed of detection, use of innovation, social determinants, and the role of frontline implementers (Table 2).

Table 2. Indicators Framework of "TB DINI" implementation model in Bekasi City.

Components of TB DINI	Operational Definition	Indicators / Measured Aspects
T – Governance	Setting policy direction, commitment, cross-sectoral coordination, and accountability mechanisms in TB control. Focus on the strategic-macro level.	1. Clarity of regional regulations (*Perwali*, TB macro SOPs) 2. Cross-sector coordination (Health Office–Hospital–Prison–NGO–Private) 3. Frequency & quality of coordination/monitoring meetings 4. Transparency and accountability of inter-agency reporting
B – Bureaucracy & Administrative Capacity	The government's internal system regulates processes, procedures, workflows, human resources, and operational facilities in TB implementation. Focus on the technical-operational level.	1. Availability of trained TB human resources 2. Availability of drugs, logistics, and diagnostic tools 3. TB drug supply chain efficiency (*supply chain*) 4. TB staff workload & task shifting
D – Early Detection & Precise Diagnosis	The system's capacity to find cases as early as possible & establish accurate diagnoses.	1. *Active Case Finding* (ACF) scope 2. The use of *GeneXpert* as a diagnostic standard 3. Detection speed 4. Quality of contact tracing

Components of TB DINI	Operational Definition	Indicators / Measured Aspects
I – Cross-Sector Innovation & Integration	The use of technology and non-health collaboration to accelerate TB control.	1. Utilization of digital applications (SITB, e-TB, telemonitoring) 2. Collaboration with the business world/schools 3. Local innovation programs & Inter-agency data integration
N – Social Values & Norms	Norms, social attitudes, and community support for TB patients and TB programs.	1. The level of stigma of society 2. Family support 3. Community participation in TB socialization 4. The Role of Religious Leaders

In theory, TB DINI bridges research on health policy implementation with practice by documenting the need for a middle-range model based on local contextualization while also melding literature from diverse fields including those examining aspects of health systems, service innovation/digital health, and social determinants into one coherent framework. In practical terms, TB DINI can serve as a roadmap for planning, monitoring-evaluation and cross-sector advocacy, as each dimension can be linked to measurable indicators. Thus, reconceptualizing the implementation model does not just result in a change of terms, but rather strategically aims to produce an appraisal framework that is more relevant, applicable, and beneficial for fortifying TB control in Bekasi City. The prominence of Budgetary Resources at the top levels of the hierarchy chart is not an arbitrary artifact but a manifestation of deeper structural and political realities in Bekasi City. Politically, both TB and the health budget are generally allocated in different municipality-level governments through legislative bargaining in the Regional People's Representative Council (DPRD), where TB programs must compete with higher-visibility infrastructure projects. Sociologically, the preponderance of budget as a salient implementation node is in accord with the "resource dependency" pattern documented in decentralized health governance in Indonesia (Rakmawati et al., 2019), wherein service quality is reported to be more limited by cycles of APBD allocation than by technical capacity, according to reports from Puskesmas directors. These patterns indicate how the governance system in Bekasi is structurally biased toward input-based governance, where program legitimacy is often measured only through spending compliance a condition that the TB DINI model seeks to address by placing Early Detection and Social Values as equally important dimensions.

This study has several limitations. First, the qualitative, single-city case study design limits generalizability; therefore, findings are specific to context and may not be generalizable to districts with different health-system capacity, governance arrangements, or rural/remote settings. Second, the analysis was based on NVivo-based coding and relational mapping: although this enhances transparency and traceability of results, interpretation of clusters/hierarchies/relationships is still sensitive to coding decisions as well as to the quality/coverage of source materials. Third, there was no statistical testing of the TB DINI dimensions applied in this study. The study found that even though the national digital healthcare strategy appears to be a unified paradigm, there exists a structural digital divide in Indonesia: field observations revealed at least seven peripheral Puskesmas with unstable internet connections and using offline spreadsheets as primary data recording tools a dichotomy not yet properly accommodated by the current framework. Future operationalization of the Innovation dimension must incorporate a digital equity assessment component, including infrastructure mapping and device availability audits, before SITB-based interventions can be uniformly applied. Further research is needed to construct or quantify the strength of relationships among dimensions and to operationalize the indicators and validate the framework using quantitative or mixed-method designs (e.g., survey-based measurement models, SEM). Finally, the evaluation focused on implementation determinants and dynamics rather than estimating causal effects on epidemiological outcomes; therefore, the study cannot attribute changes in TB indicators solely to the policy implementation process.

Discussion

Based on the findings of the study conducted in Bekasi City, the implementation of the Tuberculosis (TB) control policy demonstrates a strong orientation toward achieving national targets and the broader TB elimination agenda. This study used the Van Meter and Van Horn model to analyze the dimensions of policy implementation and found several factors influencing the success or challenges of policy implementation at the operational level.

Connection Between Policy Dimensions and Field Realities

The cluster analysis results show that there are four main clusters involved in the TB policy implementation in Bekasi, including national targets and local development planning integrated into the RPJMD. This means that a clear demarcation between national policies and local planning is important to determine regional priorities. However, problems emerge when national policy goals are reflected less clearly in local regulations, increasing the gap in interpretation of performance standards across implementing units. This draws attention to the divergence between how policy is designed and how it plays out in the field, highlighting the need for further contextual adjustments.

Resources as the Dominant Determinant Factor

Under the hierarchy chart analysis, the most significant aspect of TB policy implementation in Bekasi City is policy resources, consisting of: (1) policy budget; (2) human resources; and (3) infrastructure. Although resources are drawn from different sources state budget, local budget, and international grants analysis shows that, given field realities, these resources are not efficiently utilized. For example, the dearth of full-time TB staff in community health centers hinders patient monitoring and treatment. It is therefore essential to focus on human resource capacity and infrastructure so that the program can run smoothly.

The Importance of Inter-Agency Coordination

Inter-agency coordination is also a major implementation challenge. Although coordination is present, relational analysis finds that institutional differences and the absence of a common perspective often hamper coordination. Improved coordination forums across government sectors (especially public health), private sectors, and community groups are needed to collectively respond to operational constraints related to social stigma around TB and irregular reporting.

Innovation and Technology for Improved Detection and Reporting

Word frequency analysis findings show that digital innovations have centered on the use of the SITB application and other digital reporting systems, which are central to strengthening detection, confirmation, and notification that is, reliable identification of TB cases among at-risk patients presumably playing a crucial role in improving accuracy in the detection and reporting of tuberculosis notifications. Digitalization of reporting improves transparency and the speed of monitoring; however, the biggest hurdle remains uneven diagnostic capabilities across facilities and a lack of consistent digital reporting, particularly in private facilities. Further improvements in reporting systems and the promotion of technology use at all health facilities are therefore needed.

Social Factors and Stigma Hindering the Program

Stigma against TB and low patient adherence are also important social barriers to policy implementation. Despite increased health promotion, the ongoing stigma still causes many patients not to seek timely therapy. Community-based education, reinforced by family support, is essential to encouraging treatment adherence and reducing loss to follow-up.

The "TB DINI" Model as a Contextual Solution

Relational analysis results show that the process of successfully implementing TB control policy hinges on the incorporation of six new variables identified in this study: governance, bureaucracy, early detection, innovation capacity, social values, and expanded implementer

networks. The development of a new implementation model the "TB DINI" model also highlights the need to tailor policies according to local realities. If these dimensions are integrated into a more contextual model, then TB control policy will be more responsive to the social, economic, and political dynamics in Bekasi.

Limitations of the Study

Our study has multiple limitations that merit consideration when interpreting the findings. The qualitative single-city case study design limits generalizability to other urban municipalities with different governance structures, health system capacities, or demographic profiles. Second, the use of NVivo-based coding contributes to analytical transparency and traceability; however, the clusters, hierarchies, and relationships between different groupings remain contingent on how researchers code material and the extent to which source materials are covered. Third, statistical tests were not performed, and hence none of the relationships among dimensions was validated statistically or quantitatively through the introduction of survey-based measurement models or any form of Structural Equation Modeling (SEM); future research should address this. Fourth, field observations show that at least seven Puskesmas in Bekasi do not have a stable internet connection, and this digital readiness gap is not yet widespread, producing a gap in digital equity that must be addressed before the model can be fully operationalized. Fifth, this study did not estimate the causal impacts of policy implementation processes on epidemiological outcomes; therefore, changes in tuberculosis case notification rates or treatment success rates reported here cannot be simply attributed to the specific process by which these policies were implemented based on our study design alone.

CONCLUSION

The purpose of this study is to evaluate the implementation of tuberculosis (TB) control policy in Bekasi City by using the Van Meter and Van Horn model through document analysis, in-depth interview techniques, and field observations processed with NVivo, and to find that national targets serve as the main benchmark while policy resources (budget, human resources, and infrastructure) emerge as the most dominant determinant factors; community health centers (puskesmas) act as first-line, patient-centered services. Central and local regulatory commitment, infrastructure improvement and donor support, program innovations and digitized reporting, along with cross-territorial partnerships strengthen implementation; while limited coordination, underdeployment of TB-dedicated staff, high workloads, stigma, and decreased patient adherence to treatment limit SITB uptake; the study develops policy comprehension across levels, but at the operational level, two intermediary metrics (improved efficiency, access, and proximity)—yet uncertainty in sampling procedures, analytical frameworks, variance, and effect sizes temper generalizability. In addition to the three basic dimensions, this analysis groups related contextual themes governance, bureaucracy, early detection, innovation, social values, and implementers into a TB DINI model that can be used as a more adaptive and responsive implementation framework for the local realities found in Bekasi City.

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AUTHOR CONTRIBUTION STATEMENT

Spadini Putri conceptualised the work and methodology, collected data through interviews and document reviews, wrote the manuscript, and edited it. Mansyur Achmad was involved in the design of research, analysis and interpretation of data, as well as policy implication. Ika Sartika and Udaya Madjid helped collect, code, and review the literature as well as improve drafts of the discussion sections. Contributions of all authors gave final design, analysis and manuscript for the study.

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