LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X
VOL. 23, NO. 10(2025)

DYNAMICS OF COLLABORATIVE GOVERNANCE IN MEDICAL WASTE MANAGEMENT DURING THE COVID-19 CRISIS AT THE LOCAL GOVERNMENT LEVEL

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Abstract
COVID-19 pandemic caused a drastic increase in medical waste, creating urgent challenges for health and environmental governance. This study aims to analyze how cross-sectoral collaboration was implemented in managing medical waste during the crisis in Kupang City, East Nusa Tenggara Indonesia. Using a qualitative exploratory design, data were collected through interviews, observations, and document reviews, Focus Group Discussion (FGD), then analyzed with coding and NVivo 12 Plus. Findings reveal that organizational involvement was mainly driven by legal mandates, institutional interests, and fear of contamination. Shared motivation was built through trust, mutual understanding, and legitimacy, while capacity for joint action relied on formal procedures (MoU, SOP), informal coordination, and knowledge sharing. Despite barriers such as sectoral ego, limited resources, and fragmented SOPs, collaboration enabled adaptive and coordinated responses. The study proposes a governance model emphasizing leadership, motivation, and organizational capacity as key factors for strengthening future crisis management.

Keywords: *Collaborative Governance; COVID-19; Medical Waste Management, Local Government*

INTRODUCTION

COVID-19 pandemic has become a global crisis affecting almost all aspects of human life, from health and economy to the environment, with cases increasing rapidly in various countries (El Keshky, Basyouni, & Al Sabban, 2020). The surge in COVID-19 patients directly increases the volume of medical waste, including personal protective equipment, isolation waste, and infectious waste from healthcare facilities, placing significant pressure on existing waste management capacity (Apriatman, Raintung, Karyadi, & Ngambut, 2021). Data from the Ministry of Environment and Forestry (KLHK) show that at the beginning of the pandemic, the generation of medical waste in Indonesia reached 6,417.95 tonnes, with a particular increase in Jakarta of 16% (Maalouf, 2021). This condition indicates that a health crisis has the potential to trigger an environmental crisis if medical waste management is not handled effectively, safely, and sustainably (Tushar, Alam, Bari, & Karmaker, 2023).

In the global context, the number of COVID-19 cases has continued to increase since it was first reported in Wuhan, China in December 2019 (Wu, Leung, & Leung, 2020). As of August 2021, over 200 million confirmed cases and approximately 4.3 million deaths have been recorded worldwide (LePan, 2020; WHO 2021). In Indonesia, as of the end of 2021, over 6.8 million positive COVID-19 cases and over 160,000 deaths have been recorded (Alexandra & Dzakwan, 2022). This surge in cases not only increases the need for medical care but also leads to a significant increase in the amount of medical waste. According to the Ministry of Environment and Forestry (KLHK), at the beginning of the pandemic, medical waste generation in Indonesia reached 6,417.95 tonnes, with a particular increase of 16% in Jakarta (Budihardjo et al., 2022).

A sudden increase in COVID-19 cases naturally puts greater pressure on the healthcare system and medical waste management (Chen et al., 2021) . One of these is Kupang City, where the increase in COVID-19 cases has led to a sharp rise in the

volume of medical waste from hospitals, community health centres, and self-isolation activities, while waste management infrastructure capacity is very limited. Kupang City, which only has one incinerator owned by the UPT B3 Waste DLHK of NTT Province, while similar facilities are only available in one unit in Labuan Bajo and one unit in Central Sumba, plus the number of waste transport vehicles that meet standards is very limited (Nong, 2022). These limitations result in suboptimal final disposal of medical waste, while management costs are high, ranging from IDR. 27,500 to IDR. 35,000/kg (Pos Kupang, 2022). This condition indicates that the COVID-19 pandemic not only caused a health crisis but also triggered an environmental crisis that demands the effective and coordinated involvement of many cross-sectoral actors (Arslan, Golgeci, Khan, Al-Tabbaa, & Hurmelinna-Laukkanen, 2021).

Urgency of collaborative medical waste management needs to be addressed considering the risks of contamination, disease spread, and environmental damage that arise if waste is not handled properly and quickly (Tushar et al., 2023). COVID-19 waste, including used PPE, diagnostic tools, and self-isolation waste, is categorised as infectious hazardous waste requiring special handling in accordance with regulations SE.2/MenLHK/PSLB/PLB.3/3/2020 and Minister of Health Decree No. 573 of 2020 (Kementerian Kesehatan RI, 2021). Cross-actor collaboration allows for the consistent and responsive implementation of these regulations to the dynamics of the pandemic, while also reducing health and environmental risks (Therrien & Normandin, 2020).

Therefore, managing medical waste during the COVID-19 pandemic cannot be the sole responsibility of the Health Department (Chen et al., 2021). Various cross-sectoral actors, ranging from relevant ministries, local governments, hospitals, community health centres, to professional organisations and NGOs, play a role in regulation, facilitation, execution, and supervision (Maalouf, 2021; Nong, 2022). This involvement demands clear coordination and effective collaboration, in line with the principles of collaborative governance, which are key to public health crisis responses at the global level (Ansell & Gash, 2008; Emerson & Nabatchi, 2015).

Within the field of public administration, managing issues involving multiple actors is known as collaborative governance, where the public and non-public sectors work together formally and informally to achieve goals that would be impossible to reach individually (Bassi, 2023). This model emphasises facilitative leadership, communication, trust, and shared understanding and commitment among actors (Mohd Som, Ismail, Omar, Alias, & Asimiran, 2023). This approach is highly relevant in managing COVID-19 medical waste due to the complex, dynamic, and multi-dimensional nature of the problem, ranging from massive waste production and facility limitations to health and environmental risks.

Although research on cross-sectoral collaboration has been widely conducted on topics such as crisis management, public health, natural disasters, and environmental issues, specific studies related to collaboration in medical waste management are still very limited. This gap highlights the need for deeper research to explore how public and non-public actors in Kupang City formed collaborative patterns in managing medical waste during the COVID-19 pandemic. The importance of exploring how actors in Kupang City formed collaborative patterns in managing medical waste during the COVID-19 pandemic will provide insights into collaborative governance practices in the context of a health crisis.

Therefore, based on the above description, this study aims to analyse collaborative governance practices in medical waste management in Kupang City during the COVID-19 pandemic. The two main questions answered are:

(1) How do the dynamics of the cross-sectoral collaboration process take place in medical waste management?
(2) What are the organisational barriers to such collaboration?
The findings are expected to contribute to the development of medical waste management policies at the local and national levels, as well as enrich the international literature on collaborative governance in the context of public health crises.

LITERATURE OVERVIEW

Collaborative Governance

Since the 1980s, the concept of governance has become increasingly prominent in public administration studies as a paradigm distinct from government, which refers only to political institutions and executive, legislative, and judicial power (He, 2025). Governance emphasises the processes by which government is run, including the involvement of the private sector, civil society, and both formal and informal social networks. This development aligns with the complexity of 21st-century public problems, which demands that governments no longer dominate public services, but rather function to steer (row) through efficiency, output control, and resource discipline in the style of New Public Management (Christensen & Lægreid, 2022). Thus, the government's role is transforming from sole regulator to facilitator of multi-actor collaboration in solving public problems.

Collaborative governance emerged as a response to the need for cross-sectoral involvement in managing complex public issues. This concept emphasises constructive interaction between public institutions and non-state stakeholders through deliberative, formal, and consensus-oriented processes (Ansell & Gash, 2008; Emerson, Nabatchi, & Balogh, 2012). Freeman (1997) showed that collaboration is necessary to find common ground for multi-party problems, while Emerson & Nabatchi (2015) emphasised the importance of collaborative structures and processes that cross bureaucratic, sectoral, and civil society boundaries. In other words, collaborative governance is not just coordination, but a shared mechanism for creating public policies, programs, or services that cannot be achieved individually.

Collaborative governance practices occur within complex systems, influenced by socio-economic conditions, culture, political dynamics, and the history of inter-actor conflict (Emerson et al., 2012). Driving factors include situational uncertainty, interdependence, collaborative incentives, and leadership initiatives, with voluntary involvement as the main foundation (Emerson & Nabatchi, 2015). However, ideological conflicts, uneven power distribution, and misaligned goals can hinder collaboration (Keast & Mandell, 2014; Giese, 2020). Therefore, building trust, legitimacy, and shared capacity is key for public and non-public actors to work constructively, adaptively, and sustainably in solving complex public problems.

Medical Waste COVID-19

Healthcare is one of the fastest-growing industries globally, nationally, and locally, driven by population growth and increasing healthcare service needs (Kenny & Priyadarshini, 2021). This growth impacts increased resource utilisation and the production of medical waste, including sharps, pathological waste, chemical, radioactive, infectious, and pharmaceutical waste. The COVID-19 pandemic is further worsening this situation, as the volume of medical waste has increased drastically with the rise in positive cases. Global data shows that one in three healthcare facilities in developing countries do not safely manage waste, increasing the risk of virus transmission (Mol & Caldas, 2020; World Health Organization, 2022). Research notes

an increase in waste volume of up to 120.2%, with an average production of 3.4 kg per patient per day (Kalantary et al., 2021; Peng et al., 2020).

COVID-19 medical waste consists of 80% domestic waste and 15% hazardous waste World Health Organization (2022), including personal protective equipment (PPE), used masks, gloves, tissues, and sharp objects (Sharma et al., 2020). Health risks increase because the SARS-CoV-2 virus can survive on surfaces for hours to days, depending on the material; for example, plastic 3 days, silicone 5 days, glass 4 hours, and disposable PPE 24 hours (Kampf, Todt, Pfaender, & Steinmann, 2020). This condition makes COVID-19 medical waste a serious threat to public health and the environment, making its management a major public service issue that requires adequate facilities, infrastructure, and handling procedures (Janik-Karpinska et al., 2023).

Managing medical waste during the pandemic requires effective cross-sectoral collaboration, yet collaborative governance models in the context of COVID-19 waste have not been extensively researched to date (Arslan et al., 2021). The increasing number of cases and volume of waste requires a coordination mechanism between the government, healthcare facilities, and non-state actors to ensure the safe collection, transportation, and disposal of waste (Abdulai, Fuseini, & File, 2024). Developing management models is crucial to simplify this complex reality into a systematic representation that can be applied practically, whether in descriptive, normative, or simulation form (Aumann, 2007). This model serves as a bridge between theory and real-world practice, enabling strategic planning, risk mitigation, and data-driven decision-making in the management of COVID-19 medical waste.

METHODS

An exploratory qualitative approach was employed in this study (Creswell & Creswell, 2022). As it allows for a comprehensive explanation of the research phenomenon concerning medical waste. The research was conducted in Kupang City, East Nusa Tenggara, with data collected through in-depth interviews, observation, and literature review, and Focus Group Discussion (FGD). Informants were drawn from both the public sector (*government*) and the non-public sector, including private entities (*entrepreneurs*), academics, mass media, NGOs, and professional organisations. Public sector participants included leaders of waste-generating institutions such as Hospital Directors, Heads of Public Health Centres, Sanitarians, the Head of the Environmental and Sanitation Department, the Head of the Technical Implementation Unit for Hazardous Waste in NTT Province, the Head of the Regional Disaster Management Agency (BPBD) of Kupang City, and the Head of the Infrastructure and Facilities Division of the Kupang City Development Planning Agency (Bappeda). Meanwhile, professional perspectives were represented by the Indonesian Environmental Health Experts Association (HAKLI) of NTT Province and the PLAN Indonesia Foundation, while academics were engaged from universities around Kupang City.

This study focuses on the phenomenon of medical waste and the dynamics of its collaborative management. Data interpretation and processing applied Glaser's method of coding to capture key dimensions of the phenomenon, followed by analysis using NVivo 12 Plus as part of the validation process (Salahudin, Nurmandi, & Loilatu, 2020). Validation served as a crucial step to ensure the reliability of findings by synthesising primary data with supporting sources.

RESULT

The Dynamics of Collaboration Process

Principle Engagement

Organisational involvement in medical waste management collaboration during the COVID-19 crisis is primarily influenced by three factors: legal mandates, organisational interests, and fear. The legal mandate arises from regulations requiring the management of medical waste, while organisational interests relate to their mission or needs in public service. Additionally, psychological factors such as fear of virus transmission and the impact of environmental pollution also drive involvement. This finding shows that organisational participation is more driven by institutional obligations and needs than by shared values, consistent with institutional theory and resource dependence theory.

Regarding the organization's responsibility in managing medical waste during the COVID-19 pandemic, it shows recognition of the mandate given by the government through legal regulations. This is in line with Article 59 of Law Number 32 of 2009 concerning Environmental Protection and Management, which states that every person who generates B3 waste is obliged to manage the B3 waste they generate (KemenLHK, 2009). This obligation is not only moral but also has a strong legal basis and is binding on all parties. As stated in the interview results with the Head of the UPT LB3 of NTT Province, which stated that:

> "...regarding the permit for medical waste management, at that time there was a circular from the Ministry of Environment regarding COVID-19 management. The circular stated that if a region or regional hospital had an incinerator for burning at a temperature between 800-1200 degrees Celsius, it could be used for burning medical waste from COVID-19. That circular is what we used as the basis for managing medical waste during the COVID-19 period..."
>
> *Anonymous Informant (31/5/2023).*

Implementation of this principle of engagement was carried out through a process of deliberation or consultation, conducted both in person and online. Government institutions acted as initiators, while the actors involved were diverse, ranging from public and private organisations, professional associations, to the media and academics. Deliberation produced both formal and informal consensus regarding waste management flow, role division, and collection points.

Results of the deliberation was then implemented in role division, resource allocation, and a consensus, both formal and informal. Formal agreements provide certainty, while non-formal mechanisms make cooperation more flexible. This decision, made through mutual agreement, will make all actors feel involved. So, this collaboration didn't just stop at discussion, but resulted in concrete action in the management of medical waste during the COVID-19 crisis. Although most organisations initially got involved due to obligations or practical interests, the open and inclusive consultation process was able to increase active participation and build shared understanding.

Shared Motivation

Shared motivation in the COVID-19 crisis collaboration is significantly influenced by the presence of mutual trust among the actors. This research found that trust grows through open and accountable communication, both vertically between hierarchies and horizontally between equal organisations. Digital media such as WhatsApp, Zoom, and phone calls have become the primary means of communication, given the limitations on face-to-face interaction during the pandemic. This finding

suggests that communication technology can accelerate trust-building, contrary to the traditional view that emphasises the need for lengthy face-to-face interaction. Therefore, mutual trust becomes an important foundation that allows actors to feel safe sharing information, making quick decisions, and coordinating effectively in situations full of uncertainty.

Besides trust, shared motivation is also strengthened by the presence of mutual understanding built through formal and informal communication. The process of coordination meetings, cross-sectoral discussions, and protocol socialisation serves as a means to unify understanding of each party's capacities and limitations. This understanding is not static, but rather continues to evolve through repeated interaction and open dialogue. The reciprocal relationship between mutual understanding and trust strengthens both. When actors understand the roles and responsibilities of their collaborative partners, the level of suspicion decreases and predictability increases, allowing for smoother coordination in medical waste management.

Shared understanding is also evident through informal communication practices and coordination meetings that bring together various actors. Evidence from an interview with one of the officials at Kupang General Hospital confirms:

> "It's very important that we sit down together with the Provincial Health Office, the Environmental Agency, and also the private sector. Initially, there was indeed confusion about who was responsible for this waste when the volume increased drastically. But, after several coordination meetings and everyone outlining their respective capacities and limitations, we started to get a complete picture...."
> *Anonymous Informant (23/5/2023).*

This interview excerpt shows that mutual understanding is key to formulating a workflow that is efficient, safe, and compliant.

Shared motivation is also strengthened by the presence of internal legitimacy and commitment. Internal legitimacy grows when each actor believes the other party has the capacity and authority to contribute, which is strengthened through transparency, accountability, and joint monitoring mechanisms. On the other hand, the COVID-19 crisis actually sparked a sense of shared commitment, as the urgency and fear of the pandemic's impact drove organisations to collaborate. However, this commitment requires a leadership role to translate into concrete action. With trust, mutual understanding, legitimacy, and commitment maintained, cross-sectoral collaboration in medical waste management not only survives but also adapts and remains productive in the face of the COVID-19 crisis.

Capacity for Joint Action

Collaboration procedures in medical waste management during the pandemic were initially informal, but were later formalised through cross-sectoral MoUs and SOPs. This combination of formal and informal mechanisms is important because it allows for a quick response while also providing legal legitimacy for sustainability. The guidelines from the Ministry of Health and the Ministry of Environment and Forestry are indeed the main framework, but on-the-ground coordination still relies on horizontal networks such as the Regional Disaster Management Agency (BPBD), sub-district heads, and village heads. This finding confirms that the governance of the COVID-19 crisis requires a combination of a hierarchical structure that provides direction and a flexible network capable of adapting. In this way, collaboration not only responds quickly to emergencies but also has a strong regulatory foundation for long-term accountability.

This expression indicates that in the face of the medical waste crisis during the COVID-19 pandemic, the ability to work in a structured manner based on clear guidelines and procedures, both from the centre and internal agreements with partners, is demonstrated. Confirmation came from an official of the Kupang City Disaster Management Agency (BPBD), who stated that:

> "…in crisis management, all parties must know their 'playing field'. We can't play by ourselves anymore. As the volume of COVID-19 medical waste increased drastically, we immediately coordinated with the Health Department, the Environment Department, and even with the District Head and Village Head. We developed emergency protocols together, for example, regarding temporary collection points for non-medical waste from self-isolation, or special transportation routes. There is a regular coordination forum whose schedule we agreed on, where each agency reports obstacles and needs..."

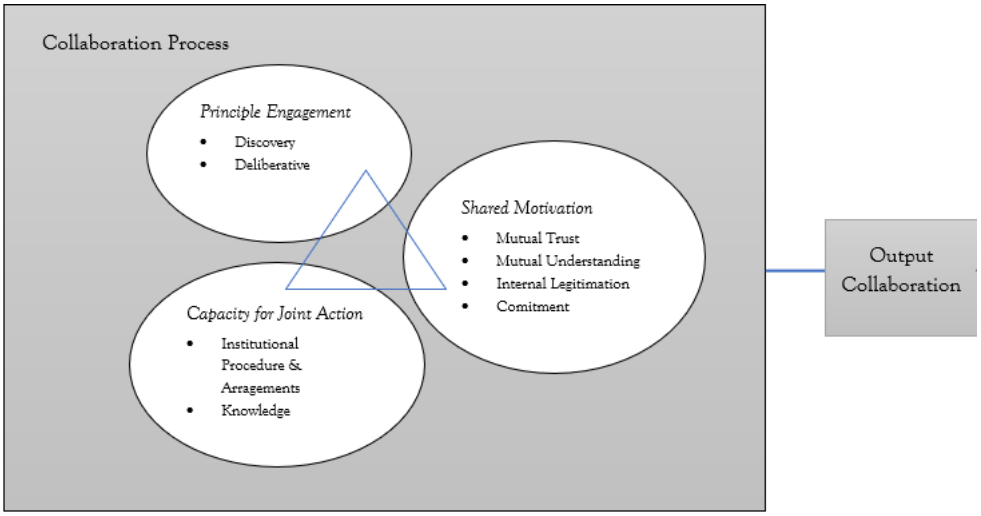
Anonymous Informant (23/5/2023).

A regular coordination forum was also established so that each agency could report obstacles and needs. This arrangement must also be quickly adapted so that each step is connected, does not overlap, and collaboration functions as an adaptive whole.

Besides procedures, the capacity for joint action is also determined by the flow of knowledge between actors. The research results show that knowledge about B3 waste management is still limited, so technical information such as strict sorting, packaging techniques, and incineration criteria must be acquired, adapted, and disseminated immediately. In the context of the COVID-19 crisis, formal knowledge of central regulations is transformed into practical skills at the operational level through rapid socialisation, training, and inter-organizational sharing of experiences. Local governments, particularly the City Health Department, play a crucial role as intermediaries, translating central regulations into working guidelines for hospitals and community health centres. Thus, the flow of knowledge is not static, but moves dynamically from the centre to the regions and is enriched again through field experience.

Knowledge has also been shown to strengthen collaborative capacity by facilitating communication, sharing insights, and promoting collective problem-solving. The information transfer process doesn't just flow top-down; it also utilises digital platforms and interactive forums to accelerate knowledge dissemination. This dual distribution model shows that hierarchical structures remain important for maintaining policy consistency, but local innovation and adaptation cannot be ignored. The ability of actors to share, integrate, and leverage diverse skills results in more effective solutions in facing the COVID-19 pandemic crisis. In this way, knowledge becomes a fundamental asset that strengthens capacity while ensuring the success of cross-sectoral collaboration.

Figure 1. Conceptual elements in the collaborative process.



Gambar 1 menggambarkan tiga pilar penting dalam proses kolaborasi, meliputi prinsip keterlibatan organisasi dalam kolaborasi, motovasi bersama serta kpasitas bersama.
Figure 1. illustrates the key interconnected elements in the collaborative process: the principle of engagement, the capacity for joint action, and shared motivation. The principle of engagement emphasises the importance of discovery and deliberation in building the direction of collaboration. The capacity for joint action is demonstrated through the existence of clear procedures and institutional arrangements, as well as a supporting knowledge base. Meanwhile, shared motivation includes trust, mutual understanding, internal legitimacy, and inter-party commitment. Each of these three elements forms a collaborative dynamic that ultimately results in effective collaborative output.

DISCUSSION

Factors Hindering Collaboration

Sectoral Ego

Cross-sectoral collaboration plays an important role in addressing complex social issues, as no single actor is capable of solving them alone. However, the dynamics of this collaboration are often hampered by the emergence of sectoral egos. The concept of ego sectors refers to the interests, roles, and expectations that each actor brings from their sectoral background into the collaborative forum. When sectoral interests are prioritised over common goals, the partnership process that should be mutually supportive turns into an arena of competing interests. This situation reduces the chances of strong synergy developing between organisations.

Research results indicate that sectoral ego can weaken the effectiveness of cross-agency collaboration. The rigid bureaucratic structure further worsened the situation by reducing the participation of agency leaders in joint forums. This obstacle resulted in suboptimal communication, slow decision-making, and difficulty in achieving coordination, especially during the COVID-19 crisis. This condition is exacerbated by the lack of data access between agencies, resulting in each organisation not having the same understanding of the situation at hand. As a result, misunderstandings arose and trust diminished, further weakening the foundation of collaboration (Agranoff & McGuire 2003; Keast & Mandell, 2014; Bryson, Crosby, & Stone, 2015).

Sectoral ego can also threaten the long-term sustainability of collaboration. When organisations are reluctant to share knowledge, resources, or problem-solving

strategies, the effectiveness of crisis management also decreases. Additionally, the sectoral identity bias inherent in each organisation has the potential to influence perspectives, legitimacy, and even the final outcomes of the collaboration process. Therefore, the stronger sectoral ego is maintained, the greater the impact on the decline in cross-sectoral collaboration effectiveness, as confirmed by various research findings (Latonen et al., 2023; Lee & Kim, 2024).

Structural Challenges

Structural challenges in cross-sector collaboration often stem from differences in standard operating procedures (SOPs) across organisations. The lack of integration of SOPs between government agencies, private sectors, and other organisations complicates the alignment of roles, responsibilities, and coordination mechanisms. The absence of standardised procedures governing inter-agency interactions also increases the risk of disorganised responses, slowing down crisis management. Previous studies highlight that this gap is a critical factor undermining collaboration effectiveness during emergencies (Vivacqua, Garcia, Canós, Comes, & Vieira, 2016; K. J. Lee et al., 2023)

Beyond SOP differences, the structure of the collaboration network significantly affects decision-making quality during the COVID-19 crisis. Organisations occupying strategic network positions—such as those with high centrality or strong connections to other partners—tend to coordinate more effectively and make timely decisions under pressure. In contrast, less connected organisations often experience weak coordination and inefficiencies in emergency response (Hossain, Khalili, & Uddin, 2011; K. J. Lee et al., 2023). This suggests that the capacity and configuration of the collaborative network are critical determinants of joint response effectiveness.

Another challenge limiting collaboration lies in resource governance, particularly regarding waste treatment capacity, budget sufficiency, and supporting infrastructure. Mismatches between medical waste volumes and disposal capacity, coupled with limited budgets and minimal communication infrastructure, hinder cross-organisational coordination (Bryson et al., 2015; K. J. Lee et al., 2023). These issues are further exacerbated by ineffective communication and entrenched sectoral ego, which constrain opportunities for synergy. Consistent with prior research, factors such as non-integrated SOPs, hierarchical bureaucracies, sectoral bias, and weak network structures reduce collaboration effectiveness (Agranoff & McGuire, 2003; Ansell & Gash, 2008; Keast & Mandell, 2014). Therefore, enhancing resource governance, communication, and collaborative network structures is essential to achieving more effective cross-sectoral collaboration.

Cross-Sectoral Collaboration Model in the Critical Situation of COVID-19 Waste Management

Existing Model

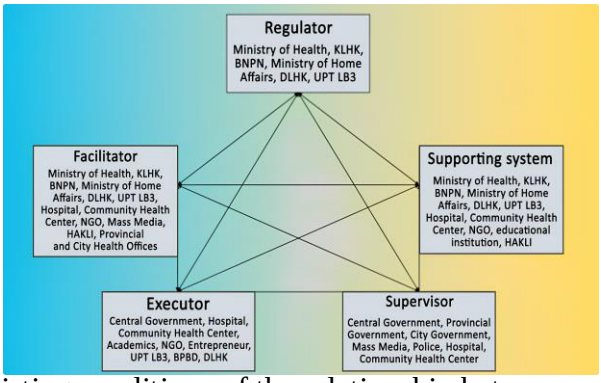


Figure 2. Existing conditions of the relationship between organisations in medical waste management in Kupang City during the COVID-19 pandemic crisis.

The existing conditions in medical waste management in Kupang City during the COVID-19 pandemic show a fairly complex relationship between organisations. This relationship involves five main roles: regulator, facilitator, executor, supervisor, and support system. The regulator sets policies and technical rules, the facilitator supports smooth coordination, the executor carries out the technical processes from waste collection to disposal, the supervisor ensures compliance, and the support system provides logistical and informational support. Every actor is interdependent, so they should be able to form collaborative governance in the face of the COVID-19 crisis.

However, in practice, coordination between actors in Kupang City has not been optimal. Although there is already a division of roles, in reality there is still overlap of authority, weak communication flow, and limited integration mechanisms. Some agencies work more frequently according to their respective sectoral mandates, without a clear common system for synchronising actions. This condition hinders collaborative decision-making, especially when the volume of medical waste increases sharply during the COVID-19 pandemic crisis.

Additionally, differences in resource capacity among actors also pose a major obstacle. Many field executors, such as healthcare facilities and transporters, lack adequate waste disposal facilities. On the other hand, facilitators and regulators are constrained by rigid bureaucracy, making it difficult to provide quick support. Budgetary constraints, inadequate infrastructure, and a lack of communication systems have worsened the situation, making it impossible for medical waste management to function optimally. This existing condition shows that although the organisational relationship structure is already in place, its effectiveness is still far from expectations, and it actually poses risks to public health and the environment in Kupang City.

Proposed Cross-Sectoral Collaboration Model in Crisis Situations

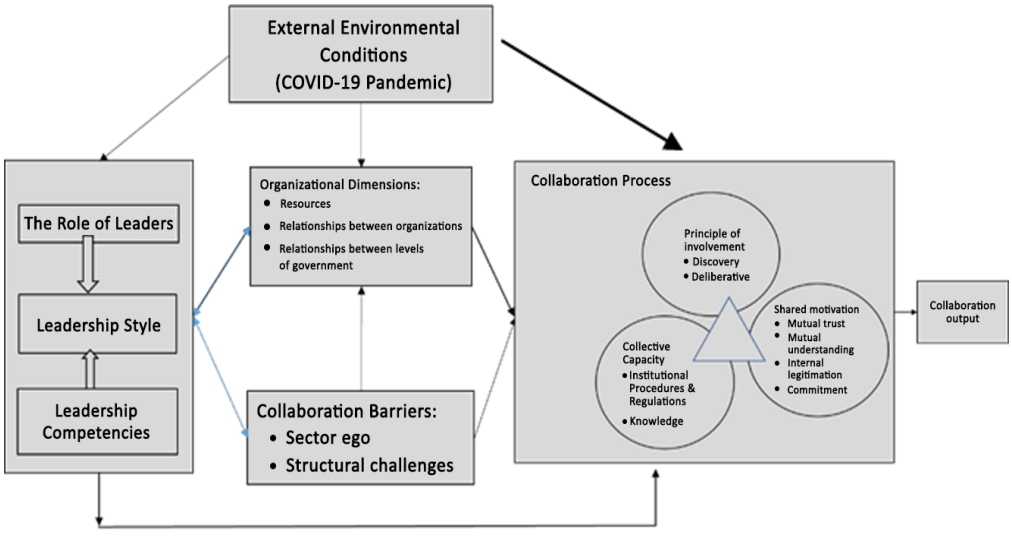


Figure 3. Proposed cross-sector collaboration model in crisis situations.

Figure 3. highlights the importance of strengthening cross-sectoral collaboration by considering leadership, organisational structure, collaboration barriers, and the collaboration process. Unlike existing models, which are often static, this framework positions the COVID-19 pandemic as an external context affecting all elements within it. This demonstrates that crisis situations directly influence collaboration dynamics,

including limited resources, time pressure, and urgent decision-making. As a result, effective collaboration cannot rely solely on role division but must also account for leadership, motivation, and synergy among actors.

Leadership serves as the central driving force in this proposed model. A leader functions as an initiator, facilitator, and connector between actors, applying an adaptive leadership style and strong competencies. Effective leadership guides organisations to become more open, reduces sectoral ego, and fosters mutual trust in collaboration. The model emphasises that the success of collaborative efforts depends heavily on leaders' ability to manage crisis dynamics swiftly and accurately.

Furthermore, the model illustrates that successful collaboration requires shared motivation, active engagement, and collective capacity. While obstacles such as sectoral ego and structural constraints remain, they can be mitigated if leadership and organisational dimensions are well balanced. Integrating these three elements within the collaborative process establishes a solid foundation for achieving positive outcomes. Therefore, this framework is more comprehensive than existing models because it not only outlines role relationships but also captures the dynamics of internal and external factors affecting collaboration effectiveness during the COVID-19 crisis.

CONCLUSIONS

This study demonstrates that medical waste management during the COVID-19 pandemic in Kupang City operated within a collaborative governance framework involving multiple cross-sector actors. Engagement principles were shaped by legal mandates, organisational interests, and crisis-driven fear, institutionalised through deliberative forums, formal and informal agreements, and clearly defined role allocation. The findings highlight that collaboration was largely triggered by institutional obligations, yet the process fostered active participation and a shared sense of ownership.

Shared motivation emerged from trust, mutual understanding, and legitimacy reinforced through open communication, formal and informal coordination, and transparency. These factors enabled the development of collective commitment amid pandemic pressures, although the realisation of such commitment heavily relied on adaptive leadership to translate it into concrete action. Trust and mutual understanding proved to be crucial foundations for maintaining coordination effectiveness and reducing potential sectoral conflicts.

Collective action capacity was strengthened through agreed-upon procedures, knowledge flows across actors, and an adaptive institutional framework. Despite challenges such as sectoral ego, differing SOPs, and infrastructure and budget limitations, the study shows that combining hierarchical structures with horizontal networks can produce a relatively coordinated response. The proposed model emphasises leadership, shared motivation, and collective capacity as key dimensions to reinforce cross-sector collaboration in addressing future health and environmental crises.

Acknowledgment: Authors would like to thanks of Kupang Health Polytechnic and Universitas Nusa Cendana for supporting this research.

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