

Evaluation of the Role of Local Government in Strengthening Flash Flood Disaster Mitigation Capacity in Teluk Wondama Regency

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ABSTRACT: Teluk Wondama Regency remains highly exposed to flash-flood hazards, particularly along the Wasior-Wondiboy-Rasiei corridor, where settlements, public services, transport networks, and government functions are concentrated. The 2010 Wasior flash flood demonstrated the severity of potential consequences, while current evidence indicates that mitigation capacity still requires systematic strengthening. This study evaluates the role of local government in flash-flood mitigation, identifies enabling and constraining factors, and formulates strategies to strengthen mitigation capacity. A qualitatively oriented mixed-methods approach was applied within an evaluative case-study design. Data were obtained from disaster-management, development-planning, spatial-planning, environmental, program, and budget documents; semi-structured interviews with nine purposively selected informants; field observations in Wasior, Wondiboy, and Rasiei; and descriptive quantitative scoring of 30 indicators across six mitigation-capacity dimensions. The local government has performed roles as regulator and planner, coordinator, facilitator, service implementer, development controller, and community enabler; however, these roles have not yet formed a fully integrated mitigation system. The overall capacity score was 54 of 120, equivalent to 45.0 on a 0-100 scale and categorized as less adequate. Policy-planning and spatial planning-watershed management each scored 50, whereas technical systems-early warning-evacuation and community capacity each scored 40. The principal finding is a persistent gap between normative capacity and operational functionality. Priority strategies include updating risk and disaster-management plans, strengthening inter-agency coordination, operationalizing the emergency operations center and sub-watershed-based early warning, testing evacuation networks, controlling risk-prone land use, sustaining preventive financing, and institutionalizing community preparedness.

KEYWORDS: flash flood, mitigation capacity, local government, disaster risk governance, Teluk Wondama

INTRODUCTION

Flash floods are difficult to manage through structural measures alone because they develop rapidly, may carry sediment, boulders, and woody debris, and can sever access routes, damage public facilities, and disrupt government functions within a short period. In steep catchments where settlements occupy narrow river-to-coast corridors, disaster consequences depend not only on rainfall intensity and channel characteristics but also on the quality of risk governance, institutional capacity, land-use control, early warning, and the ability of communities to act before hazardous flows reach built-up areas. Recent studies increasingly position local governments as central actors in disaster risk management because they are closest to decisions concerning land use, basic services, infrastructure investment, public communication, and community organization [1,2].

Research on governmental capacity shows a recurring pattern: formal mandates do not automatically become operational capability. Alcantara-Ayala et al. identify a structural gap between institutions as formulated in policy and institutions as they function in practice [3]. Vu et al. similarly show that clear legal frameworks may coexist with weak implementation when accountability, information sharing, personnel capacity, and collaboration remain inadequate [4]. In Indonesia, Lamato et al. demonstrate that the structure of local government expenditure can contribute to disaster-risk reduction, but meaningful effects require cross-sector integration and data-based planning [5]. These findings imply that evaluating local government should move beyond asking whether documents, institutions, and budgets exist toward assessing whether those instruments function, are maintained, are tested, and can be traced to actual changes in mitigation capacity.

This issue is particularly urgent in Teluk Wondama Regency, West Papua Province. The Wasior-Wondiboy-Rasiei corridor has developed as a concentration of settlements, public services, transportation networks, and government functions situated between the slopes of the Wondiboy Mountains, short river systems, and the coast. The flash flood of 4 October 2010 remains a critical institutional memory for the region. Meteorological analysis found that intense rainfall and atmospheric conditions supported the event [6], while a more recent spatial assessment of the Sanduai and Anggris catchments found that settlements, infrastructure, and riverbank areas remain exposed to high flash-flood hazard classes [7]. The continued presence of high-risk locations means that the 2010 disaster cannot be treated merely as a historical event whose policy relevance ended after rehabilitation and reconstruction.

The local government also carries a strong legal responsibility for pre-disaster risk reduction. Under Indonesia's disaster-management framework, local authorities are responsible for reducing risk, integrating risk reduction into development, allocating resources, and protecting communities [8-10]. Yet the presence of a disaster risk assessment, a disaster management plan, a contingency plan, spatial plans, BPBD programs, technical infrastructure, and annual budgets does not by itself demonstrate an operational mitigation system. Research on flood early warning in Johor shows that a system becomes meaningful only when warning information reaches end users and is understood by the public [11]. Likewise, an assessment of local disaster plans in Metro Manila found that governance and risk-identification components can be relatively strong while ecosystem protection and participation remain weak [12]. These comparisons are highly relevant to Teluk Wondama, where mitigation depends on the connection between technical information, spatial planning, services, and community action.

The research gap arises from the limited connection between two bodies of knowledge. Studies specific to Wasior have mainly explained the meteorological and spatial characteristics of flash-flood hazard [6,7]. A separate literature on local government examines institutions, financing, coordination, participation, and governance capacity in other settings [1-5,11,12]. What remains insufficiently examined is how flash-flood risk knowledge in Teluk Wondama is translated through the full chain from disaster documents to development planning, budgeting, technical assets, warning decisions, spatial control, watershed management, and community preparedness. This gap matters because mitigation capacity is intrinsically cross-sectoral: BPBD cannot operate warning functions without hydrological and meteorological information; public works agencies cannot manage river and drainage risks independently of upstream conditions and land-use decisions; and public education cannot create preparedness if it is disconnected from evacuation routes, safe locations, standard operating procedures, and drills.

This study therefore conceptualizes the role of local government as a functional chain rather than a list of administrative responsibilities. Its novelty lies in integrating six dimensions - policy and planning, institutions and coordination, financing and resources, technical systems and early warning, spatial planning and watershed management, and community participation - while tracing the relationship between policy, programs, budgets, outputs, and operational functions. The approach distinguishes normative capacity from operational capacity and treats Wasior, Wondiboy, and Rasiei as one interconnected risk system shaped by river corridors, sub-watersheds, transport links, public-service networks, and administrative responsibilities. The study aims to evaluate the role of the Teluk Wondama Regency Government in flash-flood mitigation, analyze enabling and constraining factors, and formulate an integrated, phased strategy for strengthening local mitigation capacity.

LITERATURE REVIEW

Disaster Risk Governance and Local Government Capacity

Disaster risk governance shifts analysis away from disaster response as an isolated emergency function and toward the institutional arrangements through which risk is understood, allocated, financed, regulated, and reduced. The Sendai Framework emphasizes understanding disaster risk, strengthening governance, investing in resilience, and enhancing preparedness [13]. At the local level, governance involves not only a designated disaster agency but also planning institutions, public works, environmental agencies, finance authorities, district and village governments, vertical agencies, communities, and other stakeholders. Tierney argues that disaster governance is fundamentally shaped by social, political, and economic institutions and by the interactions among governmental and nongovernmental actors [14]. For flash-flood mitigation, this perspective is particularly important because no single institution controls the complete chain from upstream rainfall monitoring to evacuation and post-warning community action.

Local government capacity can be understood as the ability of institutions to mobilize authority, knowledge, human resources, financial resources, technical assets, coordination mechanisms, and learning processes to achieve risk-reduction objectives. Abu Bakar and Mohamad found that local-government disaster capacity is constrained by financing, specialized expertise, organizational arrangements, and networking capacity [15]. Ibrahim et al. emphasize that proactive flood-risk management depends not only on plans but also on enforcement, institutional commitment, and adequate resources [16]. More recent research suggests that institutional and organizational capacities are multidimensional and context-dependent rather than fixed assets [2]. In practical terms, this means that a district government may possess documents, vehicles, equipment, and legal mandates yet still have weak operational capacity if those resources are not connected through procedures, staffing, maintenance, data flows, and regular testing.

Collaboration is another central element. Fajar et al. show that flood-governance partnerships may exist through voluntary and informal cooperation but remain weakly institutionalized [17]. Alhadi et al. found that local government remains a dominant actor in disaster risk governance, although stronger community participation, financing, coordination, and partnerships are still needed [18]. Participatory risk governance research in Seoul similarly shows that meaningful participation must go beyond information provision and consultation toward greater influence in risk-management decisions [19]. A recent study in Malang also demonstrates that collaborative flood governance can remain symbolic and administratively dominated by government actors when facilitative leadership and deliberative mechanisms are limited [20]. These findings support an evaluative distinction between the existence of coordination and its regular, institutionalized functionality.

Financial capacity must also be assessed as a functional relationship rather than simply the size of annual expenditure. Lamato et al. found evidence that spending in selected government functions can contribute to lower disaster risk, while emphasizing the importance of cross-sector integration [5]. The implication for local evaluation is that budget execution should be connected to priority risks, program continuity, asset maintenance, technical staffing, and measurable functions. Expenditure that produces a document, a training session, or a piece of equipment may still fail to strengthen capacity if the document is outdated, training is not followed by drills, or equipment is not maintained and integrated into operational procedures.

Flash-Flood Mitigation, Early Warning, Spatial Control, and Community Capacity

Flash-flood mitigation requires a combination of structural and nonstructural measures. Structural measures may include river protection, sediment-control structures, drainage, bridge protection, and other infrastructure, whereas nonstructural measures include risk assessment, land-use controls, monitoring, early warning, evacuation planning, public education, and preparedness. The Wasior context illustrates why these components cannot be separated. Renggono and Syaifullah documented the meteorological conditions surrounding the 2010 event [6], and Mamengko et al. later identified high-hazard zones in the Sanduai and Anggris river systems [7]. Hazard knowledge becomes a governance resource only when it is used to determine development controls, monitoring priorities, warning thresholds, evacuation scenarios, and public investment.

Early warning is particularly sensitive to breaks in the functional chain. Sa'adi et al. show that flood early warning should be evaluated alongside public knowledge, preparedness, communication channels, and institutional arrangements rather than as a stand-alone technology [11]. In operational terms, a complete chain includes hazard monitoring, threshold or trigger analysis, a defined decision authority, warning-message formulation, redundant dissemination channels, confirmation that messages reach exposed groups, and predetermined actions by households and institutions. Failure at any point can make technically available data ineffective. This systems perspective is central to the evaluation used in Teluk Wondama.

Spatial planning and watershed management form another critical layer. Flood risk is produced through the interaction of hazard, exposure, vulnerability, and decisions about where development is allowed and how river corridors and upstream areas are managed. Rifati and Pamungkas demonstrate the relevance of built-environment and infrastructure variables in flood-risk reduction [21]. For Teluk Wondama, the issue extends to river setbacks, settlement expansion, drainage, bridge and road continuity, upstream vegetation, sediment sources, and the location of government and public-service facilities. A spatial plan contributes to capacity only when its risk provisions influence permits, enforcement, infrastructure decisions, and adaptation of existing exposed areas.

Community capacity is equally important because flash floods may provide only a short time between detectable signs and damaging impacts. Community preparedness includes knowledge of warning sources, recognition of local signs, household plans, evacuation skills, support for vulnerable groups, community organizations, and regular drills. Local knowledge and social

networks can increase awareness and support conservation, but they do not replace formal warning protocols, safe routes, maintained infrastructure, or inclusive preparedness. Participatory governance therefore requires institutions that connect community experience with official monitoring, planning, exercises, and evaluation [18,19].

Previous Studies and Research Position

Study	Relevant findings	Position of this study
Renggono & Syaifullah (2011) [6]	Wasiar: meteorological analysis of the 2010 flash flood; heavy rainfall and atmospheric conditions supported the event, while local observation data were limited.	Provides the hazard-trigger context; this study evaluates whether hazard information is incorporated into monitoring and government decisions.
Mamengko et al. (2022) [7]	Sanduai-Anggris catchments: AHP, drone, and GIS analysis identified high-hazard settlements, infrastructure, and riverbanks.	Provides spatial risk evidence; this study traces whether hazard maps influence spatial control, programs, EWS, and evacuation.
Ner et al. (2022) [12]	Metro Manila: local DRRM plans showed relative strengths in governance and risk identification but weaknesses in ecosystem protection and participation.	Supports the distinction between strong documents and integrated resilience functions.
Fajar et al. (2022) [17]	Luwu Utara: flood governance depends on government-private-community partnerships, but many relationships remain informal.	Provides a basis for assessing whether pre-disaster coordination is institutionalized rather than situational.
Abu Bakar & Mohamad (2023) [15]	Malaysia: local DRR capacity is affected by financing, expertise, organizational arrangements, and networks.	Supports the institutional, human-resource, financing, and resource dimensions.
Ibrahim et al. (2023) [16]	Kumasi: proactive flood-risk management is constrained by enforcement, plan implementation, and resources.	Reinforces the focus on implementation rather than the mere existence of policies.
Alhadi et al. (2023) [18]	Padang: local government is a leading actor in risk governance, but community capacity, financing, coordination, and partnerships require strengthening.	Provides comparison for government leadership without excluding other actors.
Sa'adi et al. (2024) [11]	Johor: FEWS effectiveness depends on institutional management, public knowledge, preparedness, and the communication channels used by communities.	Supports evaluation of the complete EWS chain from monitoring to last-mile communication.
Lamato et al. (2025) [5]	363 Indonesian local governments: selected expenditure functions contribute to risk reduction and require cross-sector integration.	This study traces the budget-program-output-function relationship within one district.
Mutanda & Ngcamu (2026) [1]	Global South: systematic review calls for assessment of local government across the full disaster-risk-management chain.	Provides the conceptual basis for an integrated six-dimensional evaluation of pre-disaster mitigation.

METHODS

The study used an evaluative case-study design with a qualitatively oriented mixed-methods approach. The qualitative component was dominant because the central questions concern how policies are translated, how institutions coordinate, why programs do or do not function, and what mechanisms produce implementation gaps. Limited quantitative analysis was used to summarize budget information and to score the condition of mitigation-capacity indicators. This design follows mixed-methods principles in which quantitative evidence complements interpretation rather than replacing contextual explanation [22]. Qualitative analysis followed iterative data condensation, display, and conclusion verification [23].

The unit of analysis was flash-flood mitigation carried out by the Teluk Wondama Regency Government. Field analysis focused on Wasior, Wondiboy, and Rasiei because they form a strategic corridor of settlements, services, government functions, and river systems affected by or exposed to flash-flood risk. The document-analysis period concentrated on policies and programs from 2020-2025, with the 2010 disaster and earlier risk documents used as historical and institutional reference points. The study did not conduct hydrological modeling, flood-discharge estimation, structural design, or an official institutional performance audit; technical hazard information was used to evaluate whether the local mitigation system appropriately translated existing risk knowledge into government functions.

Data were collected from multiple sources to permit triangulation. Primary data included semi-structured interviews with nine actual informants selected purposively according to authority, experience, and knowledge of disaster mitigation, as well as field observations of river corridors, drainage, evacuation access, warning facilities, BPBD operational facilities, settlements, and watershed-related conditions. Secondary data included the disaster risk assessment (KRB), disaster management plan (RPB), contingency plan, RPJMD, annual RKPD documents, RTRW/RDTR, environmental documents, BPBD strategic and annual plans, budget and realization data, performance reports, regulations, technical asset records, and relevant research. Evidence was cross-checked between documents, interviews, program and financial records, asset information, and observations.

The analytical framework consisted of six capacity dimensions, each operationalized into five indicators. The dimensions were derived from disaster risk governance, local-government capacity, national disaster-management responsibilities, early-warning principles, spatial and watershed governance, and community preparedness. Equal weighting was used because the study did not employ AHP, Delphi, or quantitative expert weighting. The resulting scores were treated as a diagnostic synthesis rather than an official BNPB index or inter-regional ranking.

Dimension	Main indicators
Policy and planning	KRB/RPB; regulation; RPJMD/RKPD integration; contingency plan/SOP; risk-data updating
Institutions and coordination	BPBD mandate; inter-agency coordination; competence; DRR forum/partnerships; information management/Pusdalops
Financing and resources	Allocation; preventive continuity; realization; personnel/equipment; operation and maintenance
Technical systems, EWS, evacuation	Monitoring; thresholds/decisions; warning dissemination; routes/shelters; testing
Spatial planning and watershed management	Risk zoning; river setbacks; permits/enforcement; drainage; upstream/watershed protection
Community participation and capacity	Risk communication; preparedness groups; drills; local knowledge/last-mile communication; vulnerable groups/participation

Each indicator was scored on an ordinal scale from 0 to 4 after triangulation. A score of 0 indicated that the element was unavailable or unsupported by verifiable evidence; 1 indicated a very limited or incidental condition; 2 indicated partial availability with weak consistency, coverage, updating, or functionality; 3 indicated relatively consistent functioning with important remaining deficiencies; and 4 indicated a component that was available, functional, maintained, tested, inclusive,

resourced, and documented. Each dimension had a maximum score of 20, and the six dimensions had a maximum of 120. Scores were converted to a 0-100 scale. The analytical categories were 0-20 very inadequate, >20-40 inadequate, >40-60 less adequate, >60-80 adequate, and >80-100 very adequate. These categories were developed for this study and should not be interpreted as statutory classifications or official government performance scores.

Policy and budget consistency was analyzed vertically and horizontally. Vertical analysis traced risk information from KRB/RPB to development plans, annual programs, budgets, realization, outputs, operational functions, and observable capacity changes. Horizontal analysis examined consistency among BPBD, planning agencies, public works, environmental agencies, finance institutions, districts, villages, and vertical agencies. Findings were separated into three analytical layers: verified facts, interpretation of patterns or gaps, and recommendations. This separation was used to prevent proposed actions from being presented as empirical results.

RESULTS AND DISCUSSION

Local Government Roles and the Implementation Gap

The Teluk Wondama Regency Government has performed all six roles evaluated in this study, but the depth of operationalization differs substantially. As regulator and planner, the government has established BPBD, enacted local disaster-management regulations, prepared KRB and RPB documents, maintained a contingency plan, and incorporated disaster-related provisions into development and spatial-planning documents. As coordinator, BPBD can connect local agencies and activate command arrangements under specific conditions. As facilitator, the government allocates budgets, personnel, vehicles, equipment, and programs. Service functions include warning communication and field operations; development-control functions are reflected in disaster-risk provisions within RTRW/RDTR; and community-enabling functions have been expressed through communication, information, education activities and training. These findings demonstrate that the local mitigation system does not start from institutional absence.

The principal weakness lies in the connections among these instruments. The 2018-2022 KRB and 2019-2023 RPB were available as references, but their periods had expired and valid updates or formal adoption of current versions could not be fully verified. Disaster-risk issues appear in planning documents, yet traceability from risk recommendations to location-specific programs, outcome indicators, responsible agencies, budgets, and measurable capacity changes remains incomplete. The 2019 contingency plan contains scenarios, command arrangements, evacuation, and logistics, but evidence of systematic updating, testing, and comprehensive pre-disaster SOPs remains limited. This pattern closely reflects the distinction between institutions-in-form and institutions-in-use identified by Alcantara-Ayala et al. [3].

Coordination and information management provide another clear illustration. Inter-agency coordination is easier to activate when threats rise or an emergency occurs than as a permanent pre-disaster working cycle. Normative provisions for a multi-stakeholder Disaster Risk Reduction Forum exist, but an active decree, secretariat, recurring meetings, work plan, and activity records could not be consistently verified. A permanent emergency operations center (Pusdalops) was not functioning at the time of the study; command posts can still be established ad hoc when needed. This situational capacity is useful, but it is dependent on individuals, immediate circumstances, and available resources. Similar problems have been observed where collaboration exists but remains informal [17], and where multi-actor governance lacks sufficiently strong institutional design and deliberative mechanisms [20].

Financing shows the same distinction between availability and functionality. BPBD receives annual budget allocations, yet the proportion specifically supporting preventive flash-flood mitigation is difficult to trace consistently because allocations also cover administrative support, response, and post-disaster activities. Preventive communication, training, and drills did not form a stable annual cycle over 2021-2025. Some activities achieved financial realization, but links between expenditure, coverage, asset functionality, maintenance, and mitigation outcomes were often incomplete. This local evidence adds an implementation perspective to the broader findings of Lamato et al. [5]: the effectiveness of public expenditure depends not only on budget size but on whether it is aligned with priority risks and sustained through operation, maintenance, staffing, and evaluation.

Six-Dimensional Mitigation-Capacity Profile

Dimension	Score	Value (%)	Category
Policy and planning	10/20	50.0	Less adequate
Institutions and coordination	9/20	45.0	Less adequate
Financing and resources	9/20	45.0	Less adequate
Technical systems, EWS, and evacuation	8/20	40.0	Inadequate
Spatial planning and watershed management	10/20	50.0	Less adequate
Community participation and capacity	8/20	40.0	Inadequate
TOTAL	54/120	45.0	Less adequate

The combined score was 54 of 120, equivalent to 45.0 on a 0-100 scale and categorized diagnostically as less adequate. The figure is not an official government index; its purpose is to reveal imbalance among functions and identify weak links. No dimension reached the adequate category. Policy-planning and spatial planning-watershed management received the highest relative values, each at 50.0. These scores reflect the existence of core documents, regulations, risk-related spatial content, and programmatic recognition of watershed issues. Nevertheless, both dimensions remain constrained by outdated risk documents, incomplete implementation traceability, weak land-use enforcement evidence, and limited outcome measurement for watershed rehabilitation.

Institutions-coordination and financing-resources each scored 45.0. The local government has a formal BPBD structure, defined mandates, annual budgets, personnel, vehicles, and equipment. However, pre-disaster coordination is not yet a permanent working cycle, technical competencies are not comprehensively mapped, information remains fragmented, and preventive programs and maintenance are not consistently sustained. This pattern is consistent with local-government capacity research emphasizing that organizational structure and resource availability are necessary but insufficient unless supported by competence, networks, and functional processes [15]. It also aligns with more recent work showing that institutional capacity and data integration strongly influence flood-governance effectiveness [24].

The weakest dimensions were technical systems-EWS-evacuation and community participation-capacity, each at 40.0. Five rainfall stations and one water-level station were recorded in the wider system, in addition to river-control assets. Yet the study could not comprehensively verify operational status, data continuity, calibration, telemetry, routine BPBD access, or integration into a district decision protocol. No sub-watershed-specific rainfall or water-level thresholds were found to be formally connected to warning levels, decision authority, standard messages, and predetermined actions. Warning information continues to rely heavily on telephone calls, WhatsApp, loudspeakers, district and village officials, and direct communication. These channels are valuable as social infrastructure, but they do not yet constitute a standardized and auditable last-mile warning system. The Johor study similarly demonstrates that FEWS effectiveness must be judged together with institutional management, public knowledge, preparedness, and communication channels [11].

Evacuation arrangements present a comparable problem. Roads, public buildings, and higher ground provide potential routes and safe locations, but formal designation, capacity assessment, signage, accessibility for vulnerable groups, alternative routes when bridges or road segments fail, and evidence of testing remain incomplete. Without drills, evacuation capacity remains partly assumed rather than demonstrated. At community level, the memory of the 2010 disaster has fostered vigilance, mutual assistance, and informal warning behavior. Indigenous knowledge and practices related to conservation, river protection, and social obligations are also present. However, active village preparedness teams, regular drills, vulnerable-group protocols, and participatory program evaluation were not verified consistently across the study area. This finding supports participatory-governance research showing that information and consultation are not equivalent to meaningful influence over risk-management decisions [18,19].

The most important interpretation, therefore, is not that Teluk Wondama lacks capacity altogether. Rather, normative and administrative capacity is more developed than operational capacity. The government possesses institutions, documents,

programs, budgets, assets, and disaster experience. The weak point is the chain linking monitoring data to analysis, decisions, warning, evacuation, community action, and feedback. This interpretation is consistent with Oda et al. [2], who show that disaster-management capacities are diverse, context-dependent, and difficult to capture through resource inventories alone. Adding new documents or equipment without strengthening relationships among components risks expanding administrative capacity while leaving actual risk-reduction capability unchanged.

Spatial Planning, Watersheds, and the Wasior-Wondiboy-Rasiei Risk System

Spatial planning is one of Teluk Wondama's relatively stronger foundations. RTRW/RDTR materials include hazard areas, river setbacks, drainage, evacuation networks, and watershed-protection directions. However, observations identified built uses near some river corridors, including settlements, roads, and gardens, while parcel-level audits, permit histories, mitigation conditions attached to permits, and follow-up enforcement data were not available comprehensively. This distinction is critical: inclusion of risk in a spatial plan does not mean that risk is already controlling day-to-day development decisions. Flood-risk planning research in Indonesia highlights the importance of built-environment and infrastructure variables [21]; in Teluk Wondama this must be extended to the regulation of river setbacks, existing exposed settlements, drainage continuity, and upstream-downstream interactions.

Wasior, Wondiboy, and Rasiei should not be treated as three separate mitigation systems. Wasior contains a dense concentration of exposure, economic activity, public services, and institutional memory from 2010. Wondiboy is characterized by connections among steep slopes, roads, settlements, and access toward safer elevations. Rasiei concentrates government functions and continuing development. The main road, bridges, health facilities, schools, government offices, markets, communication networks, and possible evacuation facilities serve populations across district boundaries. A disruption in one corridor can therefore restrict evacuation, logistics, or service continuity elsewhere. The appropriate functional units for programming are risk corridors and sub-watersheds, connected to administrative boundaries for responsibility and budgeting.

This territorial perspective changes the meaning of individual projects. River normalization cannot be evaluated independently if upstream sediment sources remain uncontrolled; revegetation cannot be considered successful if survival rates and erosion outcomes are unknown; a rainfall station does not strengthen warning capacity if its data do not enter a decision process; and community education does not ensure preparedness if residents do not know what to do when a bridge, road segment, or communication channel fails. The implementation challenge identified in Teluk Wondama thus reflects the good-governance barriers described by Vu et al. [4], particularly information sharing, coordination, personnel capacity, and responsiveness, as well as the integration gaps identified in local disaster-management plans elsewhere [12].

Enabling and Constraining Factors

Several internal enabling factors provide a realistic basis for strengthening the system. BPBD has a formal institutional mandate; the 2010 disaster has generated institutional memory; disaster, planning, spatial, environmental, and budget documents provide a substantial evidence base; annual government financing creates a platform for preventive programming; and personnel across BPBD, planning, public works, environmental agencies, districts, and villages possess contextual knowledge and field experience. These factors mean that capacity building does not begin from zero. They allow the government to prioritize updating, integration, and operationalization rather than recreating every institutional component.

External enabling factors are equally important. Community social capital includes mutual assistance, informal warning, and strong memory of the 2010 event. Customary knowledge - including practices related to protected areas, vegetation, and obligations to care for rivers and forests - can support watershed conservation and risk communication when integrated carefully with technical evidence. Vertical agencies also contribute resources: hydrological assets are associated with the river-basin authority, meteorological information is available from BMKG, and national or provincial institutions can provide policy, financing, technical, and emergency support. Mobile phones, WhatsApp, digital maps, and hydrological information systems offer additional opportunities for communication, provided that redundant channels are maintained for power or network failure.

The main internal constraints are incomplete operational regulations, inconsistent cross-agency coordination, limited technical competencies, discontinuous preventive financing, weak asset maintenance and information management, and performance indicators that emphasize administrative outputs rather than functionality. Technical gaps in GIS, hydrometeorological analysis, Pusdalops operations, early-warning design, inspection, and community facilitation can prevent available data and equipment

from becoming operational capability. Budget shifts can interrupt communication-training-drill cycles, and equipment procurement may not be followed by operation and maintenance. These problems are consistent with broader evidence that analytical and institutional capacity are decisive in local flood governance [24].

External and territorial constraints increase the consequences of these institutional weaknesses. Settlements occupy narrow areas between steep catchments, rivers, roads, and the coast; short and steep streams can reduce warning time; sediment and woody debris can intensify damage; and access to upstream areas can be difficult. Electricity and telecommunications may fail under extreme weather, while exposed development already exists near river corridors and strategic facilities. Responsibilities are distributed across BMKG, river-basin authorities, local agencies, districts, villages, and communities. Without protocols across levels of government, each actor can perform its own task without producing one coherent mitigation system.

Priority Strategy for Strengthening Local Government Capacity

Stage	Main priorities	Expected functional result
0-1 year: foundational consolidation	Update and formally establish KRB/RPB; update the contingency plan; develop cross-agency SOPs; audit Pusdalops, rainfall/water-level stations, technical assets, evacuation routes/shelters; identify vulnerable groups; introduce DRR budget tagging and a competence map.	A verified baseline of functions, responsibilities, locations, responsible persons, and operation-and-maintenance needs is available.
1-3 years: operationalization	Operate a minimum viable Pusdalops; connect BMKG/BWS information; develop sub-watershed warning thresholds and protocols; formally designate and improve evacuation routes/shelters; conduct tiered drills; maintain drainage/river corridors; audit risk-prone land use; activate village preparedness teams.	The monitoring-decision-warning-evacuation chain is tested; community preparedness and spatial-control functions can be verified.
3-5 years: residual-risk reduction	Outcome-based sub-watershed rehabilitation; adaptation of existing exposed areas; protection of strategic facilities and access redundancy; shared data systems; multiyear financing; outcome-based system evaluation.	Capacity shifts from component availability toward reduced exposure, continuity of essential services, and sustained institutional learning.

The strategy was derived from the magnitude of capacity gaps, the consequences of function failure, cross-dimensional linkages, urgency, local authority, and the feasibility of sustaining operation and maintenance. The 0-1 year phase is intentionally dominated by verification and consolidation rather than large new construction. Updated and legally clear KRB/RPB documents, a revised contingency plan, cross-agency SOPs, an audit of Pusdalops and technical assets, verified evacuation networks, vulnerable-group registers, DRR budget tagging, and a technical-competence map are prerequisites for later investment. This sequence addresses the central empirical problem: several components exist administratively, but their current function, maintenance status, operational authority, and interconnection are not fully verified.

During the 1-3 year phase, the verified baseline should be converted into an operational chain. A minimum viable Pusdalops should have designated staff, duty arrangements, logs, maps, redundant power and communication, and access to relevant information. Existing rainfall and water-level monitoring assets should first be audited and integrated before new equipment is procured. Initial warning thresholds can then be developed collaboratively by BPBD, the river-basin authority, BMKG, public works agencies, and technical experts, and refined through observation and simulation. Each warning level should specify the data source, decision authority, message content, communication channels, recipients, and expected action. This approach responds directly to the EWS weaknesses identified in the study and to the broader literature on end-user preparedness [11].

Evacuation should be treated as a network rather than a set of signs. Routes and shelters require formal designation, capacity estimates, travel-time assessment, alternative paths, facilities for vulnerable groups, responsible managers, and recurring inspection. Drills should be tiered: communication tests can be frequent; cross-agency tabletop exercises should be conducted

regularly; village simulations should rotate across exposed corridors; and integrated field exercises should follow once warning protocols and evacuation infrastructure are ready. The purpose of exercise is not ceremonial compliance but identification of bottlenecks, timing, communication failure, and corrective action.

Spatial and watershed measures should likewise shift from generic programs to risk-based functions. Hazard maps, river setbacks, parcel and building information, permits, roads, public facilities, and protection structures should be overlaid to distinguish new development, existing exposed development, strategic facilities, and areas requiring adaptation or relocation. Preventive spatial control should be strongest for new development, while existing areas require a graded approach including restrictions on intensification, drainage improvement, access protection, retrofit, riverbank protection, land consolidation, or phased relocation where in-situ protection is not feasible. Upstream rehabilitation should be measured through location, area, species, survival, maintenance, and erosion or sediment indicators rather than the number of seedlings planted.

Community strengthening should institutionalize existing social capital rather than replace it. Village preparedness teams should have formal structures, risk maps, contact lists, vulnerable-group registers, basic equipment, and exercise schedules. Customary, religious, women's, youth, and volunteer actors should be included in warning design and simulation, not simply listed as beneficiaries. Local knowledge can strengthen legitimacy for watershed conservation and risk communication, but it should be tested and combined with technical data. Evidence from participatory risk governance indicates that stronger systems allow communities to evaluate program functionality and exercise results, moving participation beyond one-way consultation [18,19].

Scientifically, the proposed strategy reinforces the argument that capacity is not the sum of documents, budgets, and assets. Capacity improves when relationships become traceable: risk information influences planning; plans obtain financing; financing produces outputs; outputs perform functions; functions are tested; and evaluation changes subsequent decisions. This formulation extends the full-chain perspective on local government DRM [1] and the contextual understanding of institutional capacity [2].

CONCLUSION

The Teluk Wondama Regency Government has performed six major roles in flash-flood mitigation: regulator and planner, coordinator, facilitator, implementer/service provider, development controller, and community enabler. However, implementation has not yet produced a fully integrated mitigation system. The 30-indicator diagnostic assessment produced a score of 54/120 or 45.0 on a 0-100 scale, categorized as less adequate. Policy-planning and spatial planning-watershed management were relatively more developed, while technical systems-EWS-evacuation and community capacity formed the weakest links. The key empirical conclusion is a gap between normative capacity - documents, mandates, programs, budgets, and assets - and operational capacity characterized by updated information, connected procedures, maintenance, testing, and observable preparedness outcomes.

Enabling factors include the formal BPBD institution, institutional memory of the 2010 disaster, planning and risk documents, annual funding, experienced personnel, community social capital, customary knowledge, vertical-agency support, and existing communication technologies. Their effect is reduced by incomplete operational regulation, sectoral coordination, limited technical expertise, discontinuous preventive financing, weak maintenance and information management, output-oriented indicators, challenging geography, and fragmented authority. Strengthening should therefore begin with updated KRB/RPB documents, clarified authority, asset and evacuation audits, and a verified baseline, followed by operationalization of Pusdalops and sub-watershed EWS, spatial and watershed control, drills, community preparedness institutions, and function-based financing and evaluation.

The study contributes an evaluative framework that links six capacity dimensions to a policy-program-budget-output-function chain and interprets Wasior-Wondiboy-Rasiei as one territorial risk system. This framework helps distinguish administrative availability from operational functionality and supports a more defensible sequence of local-government interventions. The study is limited by the qualitative dominance of the evidence, the nine actual informants, incomplete operational logs, permit and parcel records, maintenance evidence, and the absence of hydrological modeling or experimental measurement of EWS effectiveness. The scoring system is a research diagnostic rather than an official index. Future research should validate the indicators through expert panels or Delphi methods, explore risk-based weighting, measure warning lead time and evacuation performance, and use longitudinal designs to determine whether institutional reforms produce sustained improvement in system function and reduced exposure.

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