Assessing Institutional Resilience Index of Surabaya City Against Earthquake Risk: A Case Study Using the CDRI Framework

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Abstract: Urban areas in Indonesia are increasingly exposed to seismic risk due to rapid urbanization and limited disaster risk reduction (DRR) integration in spatial planning. This study aims to reassess the institutional resilience of Surabaya City to earthquake disasters using the Climate and Disaster Resilience Initiative (CDRI) framework. A mixed-method approach was employed, combining stakeholder-based surveys and in-depth interviews with representatives from government, academia, civil society, and the private sector. The assessment covered five institutional indicators: DRR mainstreaming, crisis management effectiveness, knowledge dissemination, multi-actor cooperation, and governance. The results show that while Surabaya has demonstrated improvements in technical capacity, public outreach, and emergency response readiness, significant weaknesses remain in strategic planning, inter-agency coordination, and the use of localized hazard data. The city lacks a comprehensive disaster management plan, a functional early warning system, and fully operational contingency frameworks. Despite these limitations, Surabaya excels in emergency communication, community-based awareness programs, and operational response through units such as Command Center 112 and TRC Petir. The overall institutional resilience index indicates moderate progress, with urgent needs for data-based planning, inclusive collaboration, and capacity-building at the local level. These findings highlight the importance of embedding DRR into long-term urban governance and the need for anticipatory and participatory resilience strategies tailored to the city's seismic risk context.

Keywords: Institutional Resilience; Earthquake Disaster Risk; Disaster Risk Management; CDRI; Surabaya.

1. Introduction

Rapid urbanization in Indonesia has increased cities' exposure to disaster risks due to intensified economic activities, urban expansion, and population concentration (Choongik Choi, 2010; UNDRR, 2013; Pamungkas et al., 2019). By 2045, the urban population is projected to reach 220 million, or 70% of the national total (Safitri & Pradipta, 2023). Such density amplifies disaster impacts, particularly in cities where risk reduction is poorly integrated into spatial planning (Gencer, 2013; Zakina & Pamungkas, 2018).

The concept of urban resilience—the ability of a city to withstand, adapt to, and recover from disruptions (Mitchell & Garibay, 2011)—has gained attention in disaster risk management. Among its five core dimensions, institutional resilience plays a central role, encompassing governance, policy implementation, coordination, and resource management (Ostadtaghizadeh et al., 2015; Ribeiro & Gonçalves, 2019). Its importance is reinforced by international frameworks such as the Hyogo and Sendai Frameworks, which emphasize strong institutions as key to effective disaster governance (United Nations, 2005).

However, institutional barriers—such as limited capacity, poor coordination, and bureaucratic rigidity—remain challenges for many Indonesian cities (Coaffee et al., 2018; Achmad, 2023), especially when facing recurrent high-impact disasters like earthquakes (Sinambela et al., 2021). Surabaya, located near active fault zones (Yuliatmoko & Sulastri, 2023), is classified as having moderate seismic risk (IRBI, 2022) and is further threatened by the Kendeng Fault (Irsyam, 2017).

Previous assessments using the Climate and Disaster Resilience Initiative (CDRI) found Surabaya's institutional resilience score was only 2.57 out of 5 (Pamungkas et al., 2019). Despite subsequent efforts by the local government—such as simulations and risk-informed policy reforms (L. Arif, 2020)—a 2023 re-evaluation showed only marginal improvement to 2.81 (F. R. P. Putri, 2023). The weakest component was the city's crisis management framework, evidenced by its limited response to the Bawean earthquake in March 2024, despite neighboring areas like Gresik declaring emergency measures (CNN, 2024; Aprilia-CNBC, 2024).

Given Surabaya's increasing seismic exposure and its modest institutional improvements, this study seeks to re-examine the city's institutional resilience index and identify key areas requiring further capacity development. This evidence suggests that, despite some progress, institutional resilience in Surabaya remains insufficiently developed in relation to its growing seismic risks. A deeper understanding of current institutional performance is therefore essential to inform future disaster risk governance and urban resilience enhancement efforts.

2. Research Method

This study employs a positivist approach, consistent with the hypothetico-deductive model of scientific inquiry (Hoyle et al., 2002; Park et al., 2020). This approach emphasizes hypothesis verification through empirical testing by operationalizing relevant variables and measurements. As part of the hypothetico-deductive scientific model, positivism follows a cyclical process that begins with theory derived from the literature to: (1) formulate testable hypotheses, (2) design empirical procedures by operationalizing variables (i.e., identifying variables to be manipulated and measured through subject grouping), and (3) conduct empirical studies based on these procedures (Ponterotto, 2005). The results are then used to reinforce or refine the initial theory, completing the cycle (theory → hypothesis → variable operationalization → experimentation → theory) (Cacioppo et al., 2004; McGrath & Johnson, 2004).

The study adopts a mixed-methods design, integrating both qualitative and quantitative approaches to explore key respondents' preferences and field conditions related to the institutional resilience of Surabaya City to earthquake hazards. According to Creswell & Clark, as cited in Yu (2008), mixed methods research involves procedures for collecting, analyzing, and integrating both qualitative and quantitative data within a single study to comprehensively understand a research problem.

2.1.   Research Variables

The indicators and variables used are hypothesized to contribute to increasing institutional resilience in the face of natural disasters, particularly earthquakes. The following is a synthesis of the literature on the indicators and variables used.

Table 1. Research Variables

Indicators	Variables	Operational Definition
Mainstreaming Disaster Risk Reduction	Disaster risk reduction in urban spatial planning and urban development plans	The existing condition of the level of integration of DRR principles into RTRW & RPJMD documents covers the pre-disaster, during-disaster, and post-disaster phases as well as technical plans/programs
	Capacity (labor) and technical capacity to produce spatial plans and urban development plans	The existing condition of the number and quality of technical personnel supporting DRR-based spatial planning/development
	Level of community participation in the process of developing spatial plans and urban development plans	The existing condition of the level of community involvement in the preparation of development or spatial planning documents related to DRR
	Disaster risk reduction in urban housing development plans	The level of integration of DRR into urban housing development plans (RP3KP) that consider hazard zones and safety standards
	Disaster risk reduction in education curricula	The level of integration of DRR material into primary and secondary education curricula in urban areas
	Disaster risk reduction in regulations related to urban transportation policy	The level of integration of DRR principles into urban transportation plans (Tatralok), including the extent to which DRR plans/programs are operationally incorporated into all phases of a disaster (pre, during, post)
	Existence of regulations and implementation of building standards	The level of availability and implementation of policies or technical regulations regarding earthquake-resistant building standards in accordance with SNI, covering both new and old/non-standard buildings
Effectiveness of the Urban Crisis Management Framework	Existence and effectiveness of disaster response plans	The existence and effectiveness of Disaster Management Plan (RPB) documents in guiding disaster management
	Availability of evacuation centers and emergency infrastructure services	The number and distribution of evacuation infrastructure and emergency services available and usable during disasters
	Existence and effectiveness of trained emergency teams during and after disasters	The level of training and operational readiness of emergency teams in handling crisis situations
	Efficiency of trained emergency teams during disasters	The ability of emergency teams to provide a quick and efficient response during a disaster
	Taking alternative/backup measures during disasters	The existence and effectiveness of contingency plan documents
Disemination and Management of Disaster-related Knowledge	Learning from previous disasters	The existence of post-disaster evaluation reports and recommendations for improvements that have been implemented in new policies or programs
	Availability of disaster training programs for emergency workers	The availability, frequency, and suitability of training for emergency workers
	Existence of disaster awareness programs for the community	The existence and scope of disaster awareness campaigns for the public
	Capacity of institutions to disseminate disaster awareness programs	The number of media, channels, and communication strategies used to disseminate disaster risk reduction information
	Level of community satisfaction with disaster awareness programs	The level of public satisfaction with disaster awareness programs based on surveys or feedback
Cooperation between Institutions and Other Stakeholders and Institutions	Coordination and cooperation between city governments and surrounding city institutions	The existing conditions of cooperation between Surabaya City institutions and institutions in the surrounding area
	Coordination and cooperation between city governments and central governments	The existing conditions of cooperation between institutions at the Surabaya City level and institutions at the provincial and national levels

	Coordination and cooperation between institutions within the city	The existing conditions of cooperation between institutions within the city for disaster risk management
	Coordination and cooperation between city governments and community groups	The existing state of cooperation between city agencies and community groups
	Coordination and cooperation between city governments and the private sector	The existing state of cooperation between city agencies and the private sector
Good Governance	Existence of an early warning system	The existence of a system that can provide early warnings about disaster risks to the public, which functions actively and can reach disaster-prone areas
	Timeliness of the city government in disseminating emergency information to the public during disasters	The average time required for the city government to disseminate emergency information from the onset of an incident
	Accountability/transparency of the city government in disseminating accurate emergency information	The openness and accuracy of emergency information provided by the government to the public
	Access to the latest technology for collecting and classifying information	The existence of technology used to support the collection and analysis of information during disasters
	Facilities and readiness of urban organizations to update information during crises	The existence and effectiveness of the latest communication devices to update information during crises

Source: Cutter et al. (2008); Joerin & Shaw (2011); UNDRR (2012); Van Well et al. (2018); Nikpour & Ashoori (2023); Nikkanen et al. (2024); (Woodall et al. (2024)

2.2.   Population and Sample

The population in this study includes all stakeholders involved in strengthening the institutional resilience of Surabaya City against earthquake disaster risks. A non-probability sampling method is employed for sample selection. Non-probability sampling refers to a technique in which not all elements of the population have an equal chance of being selected as respondents. Specifically, this study adopts purposive sampling, a method in which participants are deliberately chosen based on specific considerations relevant to the research objectives. In this context, the selection process focuses on key stakeholders, who are individuals or groups considered to have substantial roles, influence, or contributions in disaster risk reduction processes. In disaster management, stakeholders are defined as individuals or entities that can contribute to, influence, or participate in disaster planning, response, or recovery (Siddiqui, 2023).

The government stakeholders included key agencies such as the Regional Disaster Management Agency (BPBD), the Regional Development Planning, Research and Development Agency (Bappedalitbang), and the Housing, Settlement, and Land Agency (DPRKPP) of Surabaya. From the academic sector, institutions involved were the Center for Disaster Mitigation and Climate Change (MKPI) at ITS, the Center for Disaster and Environmental Studies (PSBL) at Dr. Soetomo University, and the Indonesian Association of Urban and Regional Planning Schools (ASPI). Community stakeholders included organizations such as the Indonesian Resilient Community Network (MTI), the Emergency Response Community (KTGD), and Wahana Visi Indonesia (WVI). From the private and professional sectors, respondents were drawn from the Indonesian Association of Planners (IAP), the Indonesian Institute of Architects (IAI), and the Indonesian Construction Experts Association (ATAKI) of East Java Province.

2.3.   Data Collection and Analysis Methods

This study employed both primary and secondary data collection methods. Primary data were obtained through structured questionnaires completed by selected stakeholders, as well as in-depth interviews conducted to gather more detailed qualitative insights. Secondary data were collected from relevant literature and institutional documents associated with the research topic, specifically the acceleration of institutional resilience enhancement in Surabaya City against earthquake disaster risks. The use of literature also served to

validate the questionnaire responses, ensuring that stakeholder assessments were grounded in rational justification and supported by empirical evidence.

For data analysis, this study utilized the Climate and Disaster Resilience Initiative (CDRI) framework developed by Joerin and Shaw (2011). The CDRI is a tool designed to assess the resilience status of a city at a given point in time and to support the development of sustainable urban systems aimed at enhancing resilience capacities. The interpretation of Surabaya City's institutional resilience to earthquake risk will be calculated based on the following formula.

$$\text{Index} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} = \frac{w_1 x_1 + w_2 x_2 + w_3 x_3 + \cdots + w_n x_n}{w_1 + w_2 + w_3 + \cdots + w_n} + \cdots$$
$$w = weight \quad x = value$$

Based on the above formula, the index is then categorized into five groups. The grouping refers to (Joerin et al., 2011) with the following classification.

>4 - ≤5 = Very High; >3 - ≤4 = High; >2 - ≤3 = Moderate; >1 - ≤2 = Low; 0 - ≤1 = Very Low

3. Result and Discussion
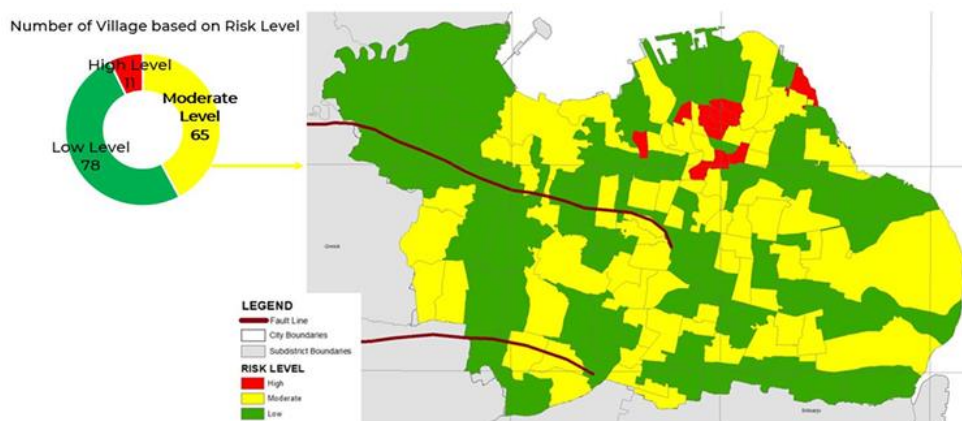### 3.1. Surabaya's Earthquake Risk

Figure 1. Surabaya Earthquake Disaster Risk Index
Source: Mott MacDonald, 2021

Risk assessment has been an integral part of the implementation of Law No. 24/2007 on Disaster Management and Government Regulation No. 21/2008 on the Implementation of Disaster Management. Furthermore, BNPB Regulation No. 4/2008 on Disaster Risk Reduction provides a risk assessment formula that evaluates three key components: hazard exposure, vulnerability, and adaptive capacity. Based on this framework, Surabaya's earthquake risk profile is categorized as moderate. Specifically, 11 urban villages (Subdistrict) are classified as high-risk, 65 as moderate-risk, and 78 as low-risk areas.

The high-risk areas are primarily clustered in the central-northern part of Surabaya, and their spatial distribution closely mirrors that of areas with high social vulnerability. The eleven high-risk Subdistrict include: Kedung Cowek, Kapasari, Peneleh, Dupak, Krembangan Utara, Ampel, Pegirian, Sidotopo, Sidodadi, Simolawang, and Tambakrejo. While all these areas exhibit elevated levels of economic and physical vulnerability, specific zones are prone to higher loss potentials.

For example, Subdistrict Pegirian and Peneleh are likely to experience the most severe physical losses. Pegirian is projected to suffer the greatest damage in terms of residential and public facilities, whereas Peneleh is exposed to high risks of loss involving commercial buildings and critical infrastructure. In contrast, Kedung Cowek may incur the most significant losses associated with GDP contributions and productive land areas. From

a social vulnerability standpoint, these Subdistrict exhibit diverse characteristics. Dominant factors contributing to high social vulnerability include age dependency ratios, low female education levels, high population density, and poverty rates. Meanwhile, disability ratios and the proportion of female-headed households are generally categorized as moderate across most high-risk Subdistrict.

3.2. Surabaya's Institutional Resilience Index in 2025

Results should be clear and brief. Discussion should explore the significance of the results of the work, not repeat them. Avoid extensive citations and discussion of published literature.

3.2.1. Mainstreaming Disaster Risk Reduction

Table 2. Mainstreaming Disaster Risk Reduction

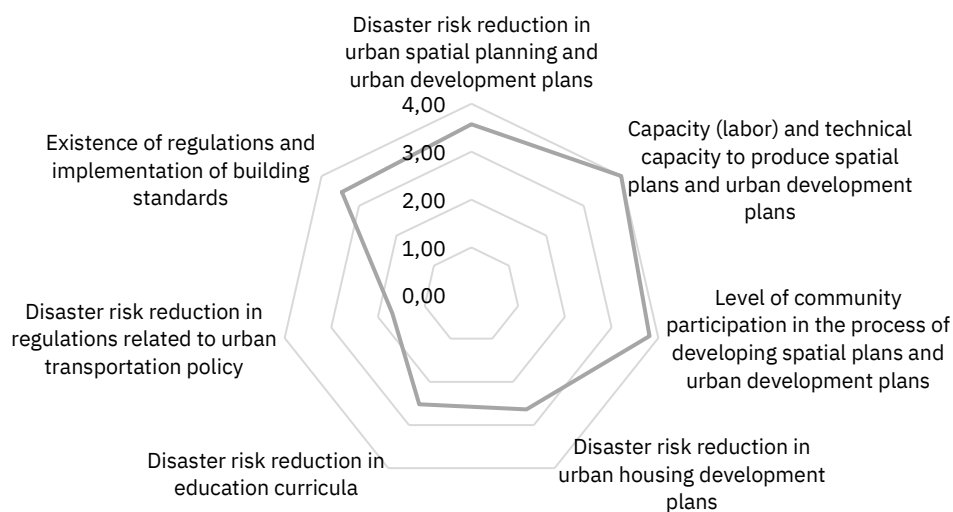| Variables	Value	Index
Disaster risk reduction in urban spatial planning and urban development plans	3,57	
Capacity (labor) and technical capacity to produce spatial plans and urban development plans	4,00	
Level of community participation in the process of developing spatial plans and urban development plans	3,81	
Disaster risk reduction in urban housing development plans	2,64	3,1
Disaster risk reduction in education curricula	2,52	
Disaster risk reduction in regulations related to urban transportation policy	1,69	
Existence of regulations and implementation of building standards	3,46	

Figure 2. Mainstreaming Disaster Risk Reduction

The integration of earthquake disaster risk reduction (DRR) into Surabaya's urban planning and governance systems has shown promising developments, although significant challenges persist across institutional dimensions. The revised spatial plan (RTRW) has begun to incorporate earthquake risks through designated disaster-prone zones and land-use restrictions, marking a positive shift toward risk-sensitive planning. However, this integration remains technically limited due to the absence of microzonation data and the asynchronous preparation of critical planning documents such as the Disaster Risk Assessment (KRB). Institutional technical capacity is relatively strong, supported by personnel with backgrounds in spatial planning, civil engineering, and GIS, and reinforced by collaboration with academic institutions. Nevertheless, these competencies have not been fully translated into risk-informed planning documents, and there is continued dependence on external experts for advanced hazard modeling and seismic analysis. Public participation is well-facilitated through structured consultations and forums, exceeding regulatory minimums, which reflects a

procedural commitment to inclusion. Yet, the participatory process remains largely representative and formalistic, with limited engagement from grassroots communities and local volunteer groups, undermining its transformative potential.

In the housing sector, while disaster awareness has influenced preliminary zoning considerations, the integration of earthquake risk into housing policy and the RP3KP document is still in early stages and primarily focused on settlement quantity and service provision. In education, efforts such as simulations and school outreach have been conducted under the SPAB program, indicating awareness and localized action. However, these remain episodic and are not yet embedded in the formal curriculum, constrained by institutional and regulatory hurdles. The transportation sector exhibits the weakest DRR integration, with planning documents still emphasizing connectivity and efficiency, and lacking systemic consideration of evacuation routes or hazard-sensitive infrastructure. On the regulatory side, the city has enacted robust building codes and verification mechanisms, particularly through the SLF system, which is now mandatory. This represents a solid institutional commitment to structural safety in new developments. Nonetheless, enforcement remains uneven in informal settlements, where many buildings lack permits and retrofitting policies for older structures are absent. Overall, Surabaya demonstrates a growing institutional awareness and willingness to mainstream DRR, but technical, regulatory, and participatory gaps must still be addressed to ensure a comprehensive and resilient urban governance framework.

3.2.2. Effectiveness of the Urban Crisis Management Framework

Table 3 Effectiveness of the Urban Crisis Management Framework

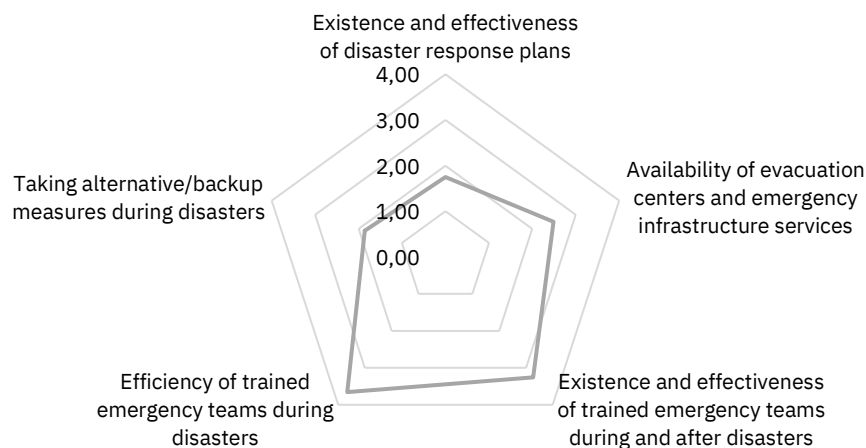| Variables	Value	Index
Existence and effectiveness of disaster response plans	1,75	
Availability of evacuation centers and emergency infrastructure services	2,49	
Existence and effectiveness of trained emergency teams during and after disasters	3,26	2,60
Efficiency of trained emergency teams during disasters	3,66	
Taking alternative/backup measures during disasters	1,86	

Figure 3. Effectiveness of the Urban Crisis Management Framework

The crisis management framework in Surabaya still faces notable structural limitations, particularly in terms of strategic planning and institutional readiness. The city has not yet finalized its Disaster Management Plan (RPB), which remains dependent on the completion of the Disaster Risk Assessment (KRB). This delay has been compounded by ongoing harmonization issues with provincial-level frameworks and the absence of essential technical data, such as microzonation maps. Although several interim regulations and SOPs exist, they are

limited in scope and function more as operational guidelines than as comprehensive planning documents. Institutional coordination remains underdeveloped, as evidenced by the absence of a city-level Disaster Risk Reduction Forum (FPRB), which hinders collaborative planning across sectors. In terms of evacuation infrastructure, most designated sites—such as schools or public fields—were not designed for seismic safety and lack supporting assessments or standards. The lack of dedicated contingency planning also reflects a reactive rather than anticipatory approach to disaster management, with no formal scenarios or predefined alternatives for evacuation, logistics, or command operations. These gaps reflect a fragmented planning process and a limited integration of disaster risk into long-term urban governance.

In contrast, Surabaya has demonstrated significant progress in operational emergency response. The city has developed a well-coordinated emergency management system, centered around the TRC Petir rapid response unit and supported by a 24/7 Command Center and decentralized response posts across multiple zones. Personnel deployment is relatively strong, and information flows between neighborhood, district, and city levels are streamlined, enabling real-time monitoring and action. During recent events such as the Bawean earthquake, the city's emergency apparatus showed commendable agility in mobilizing response teams and managing initial evacuation. The structure allows for quick validation, inter-agency coordination, and public service deployment, with emergency units capable of adjusting dynamically to field conditions. While these strengths do not compensate for the lack of strategic frameworks, they provide a robust foundation on which to build a more anticipatory and integrated disaster risk management system. Aligning operational capacity with formalized planning and cross-sectoral coordination will be key to enhancing the city's overall resilience.

3.2.3. Disemination and Management of Disaster-related Knowledge

Table 4 Disemination and Management of Disaster-related Knowledge

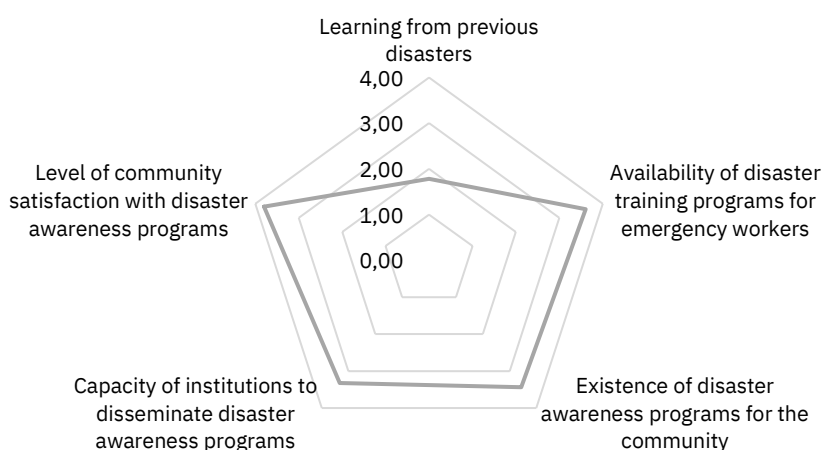| Variables	Value	Index
Learning from previous disasters	1,78	
Availability of disaster training programs for emergency workers	3,61	
Existence of disaster awareness programs for the community	3,44	3,19
Capacity of institutions to disseminate disaster awareness programs	3,32	
Level of community satisfaction with disaster awareness programs	3,80	

Figure 4. Disemination and Management of Disaster-related Knowledge

While Surabaya has made commendable progress in disaster awareness programs and emergency training, institutional learning from past disasters remains limited. There is no established mechanism for systematic evaluation or reflection on previous events, particularly earthquakes, due in part to a lack of historical seismic data and the city's relatively limited experience with direct earthquake impacts. Lessons from other cities, such

as Palu or Cianjur, have not yet been operationalized into local spatial planning or risk governance, largely due to the absence of detailed fault mapping and incomplete microseismic assessments. Although academic institutions such as MKPI have conducted relevant research, institutional uptake remains slow, constrained by budget limitations and delayed inter-agency coordination. The absence of a structured post-disaster review process further underscores the reactive nature of Surabaya's institutional memory. Additionally, while public education and awareness efforts are visible and consistent, they still tend to be short in duration, primarily focused on cognitive-level messaging, and rarely inclusive of vulnerable groups or those outside formal education systems.

Nevertheless, the city demonstrates strong performance in preparedness training and public outreach. Emergency response personnel—including TRC Petir and disaster response units—undergo regular technical training, including simulations, vertical rescue operations, and water-based emergency drills. These programs are embedded in BPBD's strategic planning documents, reflecting institutional prioritization of disaster preparedness. Public awareness initiatives are conducted across schools, early childhood centers, and community groups through simulation exercises, digital campaigns, and interactive media such as educational games and animated videos. These efforts have been positively received, with satisfaction surveys showing high public approval for the content, format, and engagement strategies. Nonetheless, challenges remain in ensuring inclusivity and depth: awareness programs are often less effective for elderly, disabled, and socioeconomically marginalized groups, and the reach of educational messaging remains uneven across the city. Despite these limitations, Surabaya's emphasis on preparedness and public outreach provides a critical foundation to build a more resilient civic culture—one that must be complemented by deeper institutional learning and sustained risk communication tailored to all segments of society.

3.2.4. Cooperation between Institutions and Other Stakeholders and Institutions

Table 5 Cooperation between Institutions and Other Stakeholders and Institutions

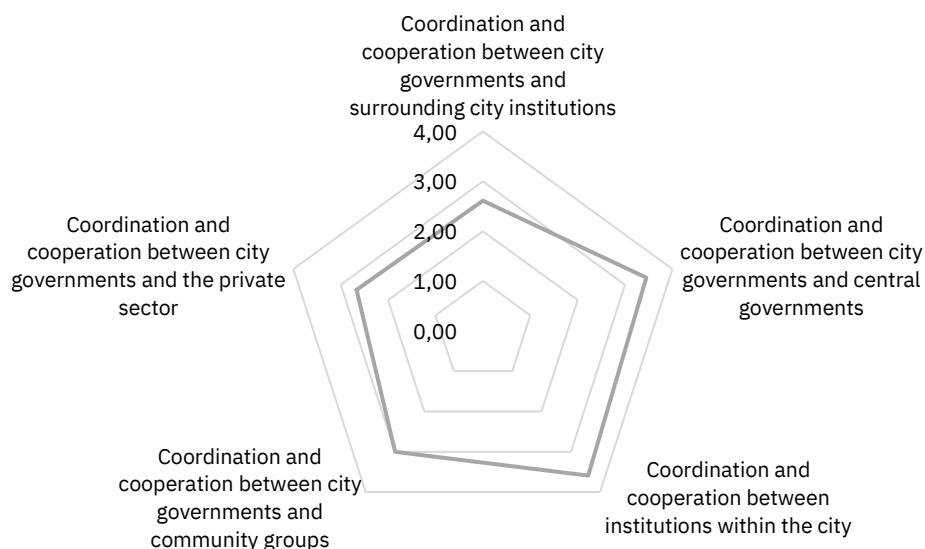| Variables	Value	Index
Coordination and cooperation between city governments and surrounding city institutions	2,61	
Coordination and cooperation between city governments and central governments	3,45	
Coordination and cooperation between institutions within the city	3,59	3,06
Coordination and cooperation between city governments and community groups	3,00	
Coordination and cooperation between city governments and the private sector	2,67	

Figure 5. Cooperation between Institutions and Other Stakeholders and Institutions

Inter-institutional coordination in Surabaya's disaster risk governance reflects a varied landscape of progress and limitations across different scales and actors. At the inter-city level, the municipality has initiated formal collaborations with neighboring regions such as Gresik and Sidoarjo, with concrete coordination emerging only after the 2024 Bawean earthquake, underscoring the reactive rather than proactive nature of such partnerships. Similarly, provincial government plays a legally mandated strategic role, yet the current multi-level governance system struggles to address the cross-border complexity of urban agglomerations like Gerbangkertosusila, where disaster risks are interlinked. Coordination with the national government, particularly with BNPB and BMKG, is comparatively more structured, focusing on technical assistance, early warning systems, and the preparation of seismic risk assessments. However, the full integration of such initiatives—such as the completion of a comprehensive disaster risk study (KRB)—remains pending, often constrained by limited local technical capacity and prolonged bureaucratic processes.

Within the city itself, horizontal coordination among local agencies has shown more maturity, especially in emergency response through the Command Center 112 and cross-agency forums. Institutional restructuring and inclusion of disaster issues into spatial and public consultation forums reflect growing awareness. Coordination with community groups and civil society organizations has also improved, with actors like Wahana Visi Indonesia (WVI) and Masyarakat Tangguh Indonesia (MTI) contributing through community-based programs and grassroots capacity-building. Nonetheless, challenges persist regarding the inclusiveness and continuity of such collaboration. Community participation is often limited to symbolic roles, hindered by rigid administrative requirements and a lack of structured platforms for engagement. Engagement with the private sector, while guided by national policies on CSR in disaster management, is still largely ad hoc and reactive activated mostly during emergency response rather than incorporated into proactive mitigation or preparedness efforts. To realize a more resilient urban governance model, Surabaya must deepen multi-actor and multi-level collaboration, institutionalize participatory mechanisms, and transform ad hoc engagements into structured partnerships that span the full disaster management cycle.

3.2.5. Good Governance

Table 6 Good Governance

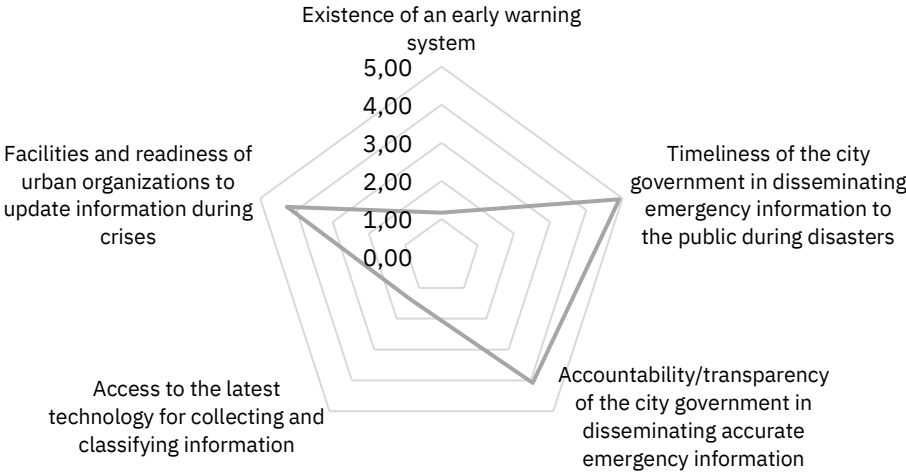| Variables	Value	Index
Existence of an early warning system	1,17	
Timeliness of the city government in disseminating emergency information to the public during disasters	4,91	
Accountability/transparency of the city government in disseminating accurate emergency information	4,08	3,16
Access to the latest technology for collecting and classifying information	1,38	
Facilities and readiness of urban organizations to update information during crises	4,26	

Figure 6. Good Governance

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The assessment of Surabaya's early warning and emergency information systems reveals a polarized landscape between technological preparedness and institutional responsiveness. A key shortcoming lies in the absence of a city-level earthquake early warning system (EEWS), as the management of seismographic instruments remains under national agencies such as BMKG. While this significantly limits the city's autonomous capacity for hazard detection, efforts have been made to build community-based resilience through the establishment of 154 Kelurahan Tangguh Bencana since 2019. This grassroots model aligns with the findings of Garcia and Fearnley (2012) and Rahayu et al. (2020), emphasizing that effective early warning requires participatory approaches involving local actors such as mosque communities and volunteer networks. In contrast, the municipal government excels in real-time dissemination of emergency information through Command Center 112, official websites, and social media channels. This system demonstrates high responsiveness, often broadcasting alerts within an hour of an event. Yet, challenges persist regarding inclusivity, particularly for marginalized groups lacking digital access.

Transparency and accountability in information delivery are also relatively strong, supported by the use of community-based communication platforms like neighborhood WhatsApp groups and trusted local media. However, the absence of granular seismic risk data—such as microzonation maps—impedes the dissemination of detailed and context-specific information. Access to advanced technologies for disaster information management remains limited; while an internal dashboard exists to monitor incident parameters, it is not publicly accessible and lacks interoperability with academic and civic platforms. Long-term plans for open-access disaster data are under development, but progress has been slow. Despite these constraints, Surabaya has demonstrated readiness to update crisis information via real-time validation by its Rapid Response Teams and media partnerships. The integration with Suara Surabaya radio, known for its wide reach and credibility, further enhances the city's emergency communication network. To fully operationalize a comprehensive and inclusive disaster information system, the city must address gaps in localized data generation, technology access, and structured community engagement.

2. Conclusion

This study reveals that the institutional resilience of Surabaya City against earthquake disaster risk is progressing, yet remains insufficient in several key areas. While operational capabilities—such as emergency communication, rapid response systems, and community education—have developed significantly, foundational planning mechanisms still lack coherence and technical depth. The absence of a finalized disaster management plan, incomplete seismic risk data, and limited local ownership of early warning systems underscore the city's vulnerability in the face of a major earthquake. Additionally, despite collaborative efforts across sectors, coordination with surrounding municipalities, national agencies, and the private sector remains largely reactive and fragmented.

The analysis confirms that strengthening institutional resilience requires more than responsive actions; it necessitates anticipatory governance rooted in multi-level cooperation, data-driven planning, and inclusive community engagement. To move from procedural compliance to transformative resilience, the City of Surabaya must institutionalize disaster risk reduction within strategic development agendas, bridge the gap between knowledge and policy, and enhance its ability to act autonomously and adaptively across all phases of the disaster cycle. These steps are critical not only for reducing earthquake impacts but also for shaping a more resilient urban future.

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