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Informational policy capacities for urban resilience: What drives them in local governments?

Capacidades informacionales del Estado para la resiliencia urbana: ¿qué las impulsa en los gobiernos locales?

Capacidades informacionais do Estado para a resiliência urbana: o que as impulsiona nos governos locais?

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Lisandro Iusry Abulatif
PhD Candidate, Universidade Federal do Rio Grande do Sul
https://orcid.org/0000-0002-2673-3902
labulatif@recursosurbanos.com.br

Ricardo Letizia Garcia
Professor Adjunto, Universidade Estadual do Rio Grande do Sul
https://orcid.org/0009-0009-3429-7256
ricardo-garcia@uergs.edu.br

Clara Natalia Steigleder
Professora Associada, Universidade Federal de Pelotas
https://orcid.org/0000-0002-2880-6802
nataliasteigleder@gmail.com

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Abstract

This study investigates the informational policy capacities of governments in the context of climate disaster prevention, response, and urban resilience. Drawing on the concept of informational capacities (Cingolani, 2013; Lopez et al., 2024; Marenco et al., 2025), it examines four dimensions: situational risk diagnostics, technologies for data collection and analysis, intersectoral articulation for information production, and projects for using produced information. We analyze the Contingency Plans of 70 of the 95 municipalities that declared public calamity after the May 2024 floods in Rio Grande do Sul, Brazil. The research combines primary data (documentary analysis of contingency plans) and secondary data (explanatory variables on disaster exposure and technical, administrative, regulatory, and institutional capacities). Results suggest that municipalities' exposure to disaster risk has low explanatory power for informational capacities and correlates weakly with technical and

administrative capacity indices. Corroborating Wang and Feeney (2016) and Marenco and Abulatif (2025), the findings reinforce a weak relationship between Weberian characteristics and the use of informational instruments for disaster management. The study shows that municipal governments depend on external induction to develop capacities, and highlights intersectoral articulation as strategic for sharing informational resources among municipalities.

Keywords: informational policy capacities, policy capacity, urban resilience, disaster risk reduction, local government.

Resumen

Este estudio investiga las capacidades informacionales del Estado en el contexto de la prevención y respuesta a desastres climáticos y la resiliencia urbana. Con base en el concepto de capacidades informacionales (Cingolani, 2013; Lopez et al., 2024; Marenco et al., 2025), examina cuatro dimensiones: diagnósticos situacionales de riesgo, tecnologías para la recolección y el análisis de datos, articulación intersectorial para la producción de información y proyectos para el uso de la información producida. Se analizan los planes de contingencia de 70 de los 95 municipios que declararon calamidad pública tras las inundaciones de mayo de 2024 en Rio Grande do Sul, Brasil. La investigación combina datos primarios (análisis documental de planes de contingencia) y datos secundarios (variables explicativas sobre exposición a desastres y capacidades técnicas, administrativas, regulatorias e institucionales). Los resultados sugieren que la exposición de los municipios al riesgo de desastres tiene bajo poder explicativo para las capacidades informacionales. En concordancia con Wang y Feeney (2016) y Marenco y Abulatif (2025), los hallazgos refuerzan la débil relación entre las características weberianas y el uso de instrumentos informacionales. El estudio muestra que los gobiernos municipales dependen de la inducción externa para desarrollar capacidades y destaca la articulación intersectorial como estratégica para el intercambio de recursos informacionales entre municipios.

Palabras clave: capacidades informacionales de políticas públicas, capacidad de políticas públicas, resiliencia urbana, reducción del riesgo de desastres, gobierno local.

Resumo

Este estudo investiga as capacidades informacionais do Estado no contexto da prevenção e resposta a desastres climáticos e da resiliência urbana. Com base no conceito de capacidades informacionais (Cingolani, 2013; Lopez et al., 2024; Marenco et al., 2025),

examina quatro dimensões: diagnósticos situacionais de risco, tecnologias para coleta e análise de dados, articulação intersetorial para produção de informação e projetos para uso da informação produzida. Analisamos os planos de contingência de 70 dos 95 municípios que decretaram calamidade pública após as enchentes de maio de 2024 no Rio Grande do Sul, Brasil. A pesquisa combina dados primários (análise documental dos planos de contingência) e dados secundários (variáveis explicativas sobre exposição a desastres e capacidades técnicas, administrativas, regulatórias e institucionais). Os resultados sugerem que a exposição dos municípios ao risco de desastres possui baixo poder explicativo para as capacidades informacionais. Corroborando Wang e Feeney (2016) e Marenco e Abulatif (2025), os achados reforçam a fraca relação entre características weberianas e o uso de instrumentos informacionais. O estudo evidencia que os governos municipais dependem de indução externa para desenvolver capacidades e destaca a articulação intersetorial como estratégica para o compartilhamento de recursos informacionais entre municípios.

Palavras-chave: capacidades informacionais de políticas públicas, capacidade de políticas públicas, resiliência urbana, redução do risco de desastres, governo local.

Introduction

The increasing frequency and intensity of extreme climate events across regions worldwide pose major challenges for national and subnational governments in preparedness and response (UNDRR, 2022). The literature highlights that local governments, as a rule, bear responsibility for absorbing disaster impacts and for formulating strategies and implementing policy instruments to promote urban climate resilience (Büyükozkan et al., 2022). In this sense, the use of information is considered a strategic asset for the implementation of urban resilience policies by local governments (UNDRR, 2022). However, Wang and Feeney (2016) find that local governments may lack the capacities to produce and use information to formulate strategies and implement policy instruments, that is, informational policy capacities.

This study aims to analyze the composition of informational policy capacities in local governments and the factors that can drive their presence or absence in the context of urban resilience to climate disasters. The theoretical lens draws on the literature on policy capacities of national and subnational governments (Cingolani, 2013; Wu et al., 2015; Brenton et al., 2023), with a focus on the dimension of informational policy capacities (Whitehead, 1995; Peeters et al., 2023; Marenco et al., 2025) for local governments. This literature is associated with the theme of urban resilience, incorporating the Sendai Framework for Disaster Risk Reduction and the City Resilience Framework (UNDRR, 2015; ARUP, 2024).

The empirical analysis examines the contingency plans of 70 Brazilian municipalities in the state of Rio Grande do Sul that declared a state of public calamity during the extreme hydrometeorological events of May 2024. The case is suited to this research for two main reasons. Brazilian legislation requires municipal governments in the national registry of disaster-prone areas to prepare Civil Protection Contingency Plans, making the plans comparable instruments across cities. Plans prepared before the May 2024 events allow *ex ante* preparedness to be analyzed. This analysis considered aspects such as the existence of situational diagnostics on disaster risk, guidelines for producing, using, and analyzing disaster risk data, and interinstitutional articulation for qualifying information. We investigate the extent to which elements related to informational policy capacities are present in Municipal Contingency Plans in ways capable of supporting planners and practitioners in better preparing for the formulation and execution of urban resilience actions. Building on this measurement, we take a further step toward testing variables with the potential to explain the variations in informational policy capacities evidenced in the contingency plans.

Among the main findings of this study, it is possible to mention that it bridges the state capacity and policy capacity traditions through the notion of operational informational capacity, stating that, in low-institutionalization contexts, planning instruments may constitute more than mere records of available capacity resources. Methodologically, the study proposes a replicable index (IndCap) that combines the Sendai Framework, the Urban Resilience Framework, and Wu et al.'s (2015) matrix. Empirically, it shows the potential dependence on external induction for the demonstration of informational policy capacities in municipal contingency plans, and indicates that structural characteristics of municipalities (such as population size and urban hierarchy) exert greater influence on informational capacities than Weberian bureaucracy and the historical record of climate disasters already experienced by municipalities, with both of the latter presenting only marginal influence on the variation of informational capacities demonstrated in the Plans.

Beyond this introduction, the paper is organized as follows: the second section reviews the literature on policy capacities, including informational policy capacities, followed by the literature on data-driven urban resilience. The third section presents the methodology and materials used to operationalize the research. The fourth and fifth sections present, respectively, the findings and a discussion of results in light of the literature on informational policy capacities of local governments for urban resilience. The sixth section presents our final considerations and directions for possible future developments of this research.

Policy Capacities for Urban Resilience

State Capacity and Policy Capacity

This investigation draws on two related but distinct traditions, the state capacity and policy capacity approaches. The state capacity literature, rooted in comparative politics and historical sociology, refers to the fundamental power of the state in terms of sovereignty, taxation, order keeping, bureaucratic quality, and infrastructural aspects, which allow the state to exist and project its authority over the territory and society (Cingolani, 2013; Munoz-del-Campo, 2026). The policy capacity literature, rooted in public policy studies, shifts the unit of analysis to specific policy functions: it concerns the skills and resources that governments possess and mobilize to formulate, implement, analyze, and evaluate policies effectively (Wu et al., 2015; Brenton et al., 2023; Munoz-del-Campo, 2026). Both approaches differ in their unit of analysis (the state as a whole versus a policy domain), in level (predominantly national versus any level of government, including municipalities), and in temporal nature (structural endowments versus capacities that can be built, mobilized, or lost within a policy subsystem).

Wu et al. (2015, p. 166) define policy capacity as "the set of skills and resources (or competences and capabilities) necessary to perform policy functions." In presenting this concept, the authors incorporate three analytical dimensions related to skills and competencies: the analytical, the operational, and the political. Analytical capacities are characterized as the ability to access and apply technical and scientific knowledge and analytical techniques in ways that enable the effective and cost-effective design and implementation of policies. Operational capacity is presented as the ability to perform key activities and functions at strategic, tactical, and operational levels. Regarding political capacities, the authors highlight political knowledge and expertise as key characteristics needed to develop and maintain relationships with governance partners and the public during policy implementation. These dimensions are positioned in relation to three levels of resources and capabilities: the individual, the organizational, and the systemic (the latter referring to the environment in which organizations and individuals involved in a given public policy interact, with particular focus on those interactions), enabling a comprehensive and multidimensional analysis of policy implementation capacities. Table 1 presents an analytical framework illustrating how levels and dimensions are related, indicating possible examples of variables that may be considered for each of the nine possible combinations.

Table 1

Policy Capacities: Levels and Competencies (Dimensions)

Resource levels and capacities	Competencies (dimensions)		
	Analytic	**Operational**	**Political**
Individual	Statistical literacy and data interpretation; Proficiency in digital analytical tools; Capacity for synthesis and technical report writing; Knowledge of policy evaluation methods.	Planning and monitoring skills; Capacity for managing multidisciplinary teams; Competency in budget allocation and control; Adaptability in execution when facing unforeseen circumstances.	Capacity for reading the political environment; Negotiation and consensus-building skills; Strategic stakeholder management; Capacity for public communication and agenda framing.
Organizational	Existence of internal units for data production and analysis; Institutionalized systems for data collection and management; Guidelines and protocols for data collection and use; Evidence-oriented organizational culture; Capacity to recruit technical profiles or contract specialized services.	Performance monitoring and evaluation systems; Clear internal accountability flows; IT infrastructure to support implementation; Structured career paths and staff capacity-building plans; Standardized information and knowledge management processes.	Systematic conduct of public consultations and hearings; Institutionalized channels for dialogue with civil society; Capacity for transparent communication of decisions; Relationship management with the legislative and executive branches.
Systemic	Quality and comprehensiveness of national statistical systems; Availability of public policy training in universities; Presence of think tanks and independent research institutes; Culture of open access to government data.	Legal frameworks for intergovernmental coordination; Stable financing mechanisms across levels of government; Shared digital platforms among public agencies; Clear rules for agreements with non-governmental actors.	General level of societal trust in public institutions; Strength of the rule of law and respect for institutional rules; Legitimacy and stability of the political system; Quality of democratic accountability mechanisms.

Note. Adapted from Wu et al. (2015).

Cingolani (2023) addresses a relevant dimension of policy capacities through the concept of infrastructural capacity. The author defines infrastructural policy capacities as the state's capacity to be fully present in the territories it governs and implement its policies as expected—which, according to the author, involves committing specific endowments in the form of disposable financial resources, as well as a professional, impersonal, and stable bureaucracy. In this context, Cingolani makes an important contribution to the literature by incorporating into her analysis the role of new digital technologies in policy implementation. The author argues that digital technologies introduce at least three relevant elements to the traditional understanding of infrastructural capacities. The first concerns the possibility of bypassing the need to establish physical organizations to be present in citizens' everyday lives (where physical infrastructure would otherwise be required), allowing states to achieve uniform reach across the diversity of territories they govern. The second relates to the ability to identify citizens' needs, characteristics, and past behavior with unprecedented accuracy, such as mapping populations in high-risk areas exposed to extreme climate events in a given city. The third refers to the potential of certain technologies to achieve both of the foregoing at a lower cost than traditional bureaucratic physical presence.

Gomide and Marenco (2024, p. 5) define policy capacities as a state's skills, competencies, and bureaucratic-institutional resources to implement public policies and effectively perform its functions. The authors highlight that among the main challenges on the policy capacities research agenda are conceptual stretching, tautological explanations, endogeneity between means and ends (capacities and outcomes), and the still modest advances in the development of instruments for identifying and measuring policy capacities in ways that enable comparisons and the explanation of observed variations.

Informational Policy Capacities

Within the multifaceted strands of the policy capacities literature reviewed thus far, as well as among other sources (Migone & Howlett, 2023; Peters, 2018; Brenton et al., 2023), the capacity of governments to collect and use data from their citizens and territory is broadly recognized as an essential component for policy formulation and implementation. A particularly useful conceptual anchor for the present study is Whitehead's (1995) proposition of informational state capacity as the planned and sustained organization to collect, process, analyze, and deliver the types of information and insights about society needed for a modern state to plan, implement, monitor, and interpret the impact of its measures. In this sense, informational capacity may be understood as a strategic asset for the formulation and implementation of a given policy and its instruments (Newman et al., 2022).

It is possible to infer, therefore, that informational capacities can function as drivers of public policies (both within and across institutions) insofar as the information produced and shared may enable the identification of vulnerabilities in populations or territories that require targeted policy responses. Peeters et al. (2023) argue that information capacity opens up possibilities for policy design while simultaneously signaling specific and effective ways to implement policies. The authors highlight that informational affordances (understood as the aspects of a technology that, under certain conditions, prompt certain behaviors) provide a kind of script for action, thereby simultaneously enabling and constraining human action and policymaking. Recognizing that informational capacities can take multiple forms and nuances, Peeters et al. (2023) propose three ideal-typical models of information system design (understood not as specific software, but as procedural systems for recording, processing, and using information) to support an understanding of how governments manage the use of information for the planning and implementation of public policies in their respective areas of activity. The three typologies are the infrastructural model, the system-by-system model, and the ad hoc model.

The infrastructural model is characterized by the "once-only" principle, whereby data is recorded a single time and subsequently made available for use across a wide range of processes and organizations, combining high data quality with high intra- and interinstitutional integration. The system-by-system model, in turn, is characterized by informational islands: data collected by specific organizations primarily for their use, yielding high-quality but variable integration depending on how individual systems are configured. In the ad hoc model, data collection is carried out by patching together information sources for primary processes and organizations, resulting in low data quality and limited integration capacity. In the case of the ad hoc model, the literature recognizes that limitations in data literacy and financial resources frequently act as constraints on efforts to qualify and upgrade informational capacities (Brambor et al., 2020; Herbst, 2000).

Building on the framework proposed by Peeters et al. (2023), a key question concerns which factors are capable of inducing (or inhibiting) the constitution of informational policy capacities in local governments. In this regard, Wang and Feeney (2016) are particularly relevant: they found that Weberian bureaucratic structures may inhibit the incorporation of information technologies. Similarly, Marenco and Abulatif (2025) found that the constitution of informational policy capacities in local governments showed little relationship with the presence of Weberian bureaucracy in its most tangible form, that is, career civil servants with univer-

sity-level education. Lui et al. (2025) further corroborate this finding, showing that economic capacity and human resources, while important, are insufficient conditions for the constitution of informational policy capacities. It is therefore pertinent to investigate what factors are (or are not) capable of inducing the constitution of informational capacities in the urban resilience planning of local governments.

Operationalizing informational policy capacities through documentary analysis (particularly planning instruments) requires conceptual justification for the type of capacity under examination. In this regard, the organizational capabilities literature (Penrose, 1959; Teece et al., 1997) draws a distinction between latent capacity (the means and resources internal to a given organization that are not mobilized) and operational capacity, resources that are mobilized institutionally and in a coordinated manner, as occurs, for instance, in crisis. This distinction contributes to the analysis of informational capacities in urban resilience contexts, insofar as the capacity to mobilize resources (especially at the organizational and systemic levels) for disaster prevention and response can be enabled or enhanced through an organizational instrument such as the Contingency Plan. This claim is corroborated by Weick (1995), who argues that organizational action under conditions of ambiguity and turbulence is driven not by the prior knowledge individuals happen to possess, but by instruments previously constructed and structured to enable and direct collective institutional action.

This dynamic is further crystallized in the case of street-level bureaucrats, who, in low-institutionalization contexts, tend to confine their actions to pre-established protocols and routines rather than drawing on tacit organizational knowledge that was never formalized or learned (Lipsky, 1980). This argument is reinforced in the context of local governments characterized by ad hoc informational capacity regimes. In such contexts, formalizing guidelines and protocols for informational resources within a contingency plan does not merely signal pre-existing capacity; it makes a given informational capacity operationally available for collective action (Wu et al., 2015). Conversely, the absence of informational capacity indicators in a contingency plan, under ad hoc conditions, should not be interpreted as the absence of a given capacity, but rather as evidence that such capacity (even if present at the individual level) is not operationally available for mobilization at the organizational and systemic levels by all the potential actors who should be able to activate such resources when a disaster threatens or occurs.

The IndCap index developed in the present study therefore proposes to measure operational informational policy capacity (understood as the institutionalized and coordinated di-

mension of informational capacity that is effectively available for mobilization in the context of urban resilience governance in local governments) rather than the stock of latent resources that may or may not be mobilized by local governments.

Translating the concept of information capacities to municipal governments requires recognizing that, in decentralized federations such as Brazil, municipalities are on the front lines of disaster risk governance. Under federal legislation, municipalities map and monitor risk areas, develop risk contingency plans, and provide the initial response to disasters (Brasil, 2023), while much of the data cities rely on is produced by federal and state agencies. In this sense, it is possible to infer that while supermunicipal governments develop and apply their informational capacities, this does not translate into improved or developed municipal informational policy capacities. Municipal informational capacity is therefore less about producing data from scratch than about accessing, integrating, qualifying, and acting upon data produced at other levels.

Determinants of Informational Policy Capacities

The literature identifies five groups of potential determinants, which can suggest the selection of explanatory variables (EV). Scale and urban complexity (EV 1): larger, more central municipalities face more complex informational demands and benefit from economies of scale in data infrastructure (Schabbach et al., 2024), suggesting a positive association with population and urban hierarchy. Weberian bureaucracy (EV 2): the state capacity tradition associates professional and stable bureaucracies with higher implementation capacity (Cingolani, 2013; Marenco, 2017). Politicization (EV 3): political appointments constitute a distinct dimension of bureaucratic quality in Brazil and are associated with worse governance outcomes (Bersch et al., 2017). Disaster experience (EV 4): recurrent disasters may open windows for policy learning, although evidence from municipal governments indicates that such learning is neither automatic nor homogeneous (Crow et al., 2018). Economic resources (EV 5): wealth is expected to enable investments in data literacy and infrastructure, though it is not sufficient for informational capacities (Lui et al., 2025). A positive but weak association is expected for GDP per capita, with territorial area included as a control for monitoring costs. Finally, because contingency plans are legally maintained and often drafted from standardized templates, external induction through coercive and mimetic isomorphism (DiMaggio & Powell, 1983) is an alternative explanation that may reduce the variation attributable to local attributes.

Data-Driven Urban Resilience

Increasingly resilient cities have greater capacity to prevent and rapidly recover from extreme climate disasters. The concept of urban resilience has become increasingly prominent in the literature on cities—not only as a framework for better preparing for extreme climate events, but also for addressing the everyday challenges of urban spaces that are growing ever more stressed, noisy, and conflictual, particularly in the Brazilian context. Büyükozkan et al. (2022) highlight, in this regard, how the COVID-19 pandemic led cities to reassess the importance of developing in more resilient ways. Lowe et al. (2024, p. 892) define urban resilience as "the capacity of individuals, communities, institutions, businesses and systems within a city to adapt, survive, and thrive no matter what kind of chronic stresses and acute shocks they experience, and to positively transform as a result," and identify four key characteristics for its development at the local level: recovery, persistence, adaptive capacity, and transformative capacity.

In the planning of more resilient cities, the creation of information systems (incorporating georeferenced data and monitoring technologies) is gaining increasing relevance as a means of supporting public action not only to adapt cities to extreme climate events, but also to inform public policies across the three phases of risk management: prevention, response, and recovery. These information systems are related to the informational capacities of the state. Drawing on Marenco et al.'s (2025) conceptualization, informational capacities are assessed along the following dimensions: (i) implementation of situational diagnostics on disaster risk, (ii) adoption of technologies for data collection and analysis, (iii) intersectoral articulation for the production and qualification of information, and (iv) projects for the use of produced information.

For the specific analysis of these variables in the informational capacities of Rio Grande do Sul municipalities affected by the 2024 floods, two guiding frameworks for the development of more resilient cities were used as references: the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015) and the City Resilience Framework (CRF) presented by the Resilient Cities Network (ARUP, 2024). The former is an international agreement established by the United Nations in 2015 that is directly aligned with the 2030 Agenda and the Sustainable Development Goals, the Paris Agreement on Climate Change, the Addis Ababa Action Agenda on Financing for Development, and the New Urban Agenda.

The Sendai Framework has proven a valuable reference tool for recent empirical research. Abulatif et al. (2025) drew on the Framework to develop a methodology for assessing

the institutional learning capacity of municipalities affected by the 2024 floods, examining the extent to which the disaster experience qualified and enhanced the implementation of prevention and mitigation instruments for hydrometeorological disasters, thereby contributing to increased urban resilience at the local level.

The City Resilience Framework (CRF) is a complementary analytical tool developed specifically for urban resilience; its first edition was launched in 2013 and updated in 2024. It drew on urban resilience research across a diverse set of cities, which showed that resilient systems are defined by reflectiveness, resourcefulness, robustness, redundancy, flexibility, inclusivity, and integration (Rodríguez-Izquierdo et al., 2022; Lowe et al., 2024). These qualities are directly relevant to the present study, as each, to varying degrees, addresses the design of public policies that can anticipate, prevent, and prepare for disaster occurrence. Robustness refers to the importance of designing and managing projects well so that failure becomes more predictable and therefore more manageable. Redundancy (the reserve capacity created to withstand extreme pressures, demand peaks, or external shocks) involves multiple ways to meet a given need (ARUP, 2024).

Flexibility among decision-makers broadens the range of alternative response strategies available in crisis situations and requires continuously updated technologies and knowledge, including recognition of traditional practices. The qualities of inclusivity and integration are associated with effective governance and leadership, ensuring that investments and actions are directed toward meeting the needs of the most vulnerable populations, that is, building a resilient city for all. These processes underscore the importance of shared governance in creating a sense of public purpose and the need to collectively build urban resilience. Finally, the Framework emphasizes the need for integrated processes that bring together systems and institutions, with shared resources and empowered social actors working collaboratively toward collective goals (ARUP, 2024).

The Framework thus offers a broad range of analytical possibilities for understanding the complexity of cities and the factors that contribute to their resilience, enabling the identification of critical areas of fragility and the definition of targeted actions and programs to strengthen it. It proposes four main axes for the development of urban resilience: (i) local governance and planning, (ii) health and well-being, (iii) infrastructure and environment, and (iv) economy and society (ARUP, 2024, p. 9). We argue that combining the axes of the CRF with the priorities of the Sendai Framework offers an innovative analytical toolkit for municipalities (and in the case of this study, for the municipalities of Rio Grande do Sul) to more effectively

prevent, mitigate, respond to, and recover from climate disasters. In this regard, while the Sendai Framework and the City Resilience Framework share important conceptual convergences, they also reflect distinct emphases on aspects that are relevant to the construction of urban resilience.

This convergence becomes evident when considering that one of the Sendai Framework's core priorities is the strengthening of disaster risk governance. In the City Resilience Framework, this concern is addressed by emphasizing appropriate governmental decision-making. While the Sendai Framework emphasizes the role of local coordination and cooperation forums, disaster risk reduction plans with clear targets, and the capacity-building of authorities for community coordination (a key element in climate disaster management), the CRF focuses on effective coordination across different governmental bodies, proactive collaboration with multiple stakeholders, and the development of mechanisms for meaningful community engagement with government. Table 2 presents the convergences between the two frameworks that informed the analysis of informational capacities across the 70 Rio Grande do Sul municipalities examined in this study. To this end, Priorities 1 and 2 of the Sendai Framework were considered, and the possible convergences with the CRF were mapped alongside their correspondence to the study's information capacity dimensions.

Table 2

Convergences Between the Sendai Framework and the City Resilience Framework in Relation to Informational Capacity Dimensions

Sendai Framework Priorities	City Resilience Framework	Informational Capacity Dimensions
Priority 1: Understand Disaster Risk	**07.1 Comprehensive hazard and exposure mapping**	(1) implementation of situational diagnostics on disaster risk.
- Data collection, analysis, and dissemination.	10.4 Comprehensive hazard monitoring and risk assessment.	(2) adoption of technologies for data collection and analysis.
-Periodic assessment of risks and vulnerabilities.	**12.1 Comprehensive city data monitoring and management**	(4) projects for the use of produced information.
- Use of maps and geospatial technology.		(2) adoption of technologies for data collection and analysis.
- Strengthening the dialogue between science and public policy.	**10.3 Proactive collaboration with multiple stakeholders**	(2) adoption of technologies for data collection and analysis.

Sendai Framework Priorities	City Resilience Framework	Informational Capacity Dimensions
- Integration of risk assessments into land use planning.		(4) projects for the use of produced information.
Priority 2: Strengthen Disaster Risk Governance	**10.1 Appropriate governmental decision-making**	(3) intersectoral articulation for the production and qualification of information.
- Integration of disaster risk reduction policies.	**10.2 Effective coordination with other governmental bodies**	(3) intersectoral articulation for the production and qualification of information.

Note. Prepared by the authors.

The convergences presented in Table 2 highlight the intersectoral and participatory dimension as fundamental to the effective use of information, grounded in the connection between smart technologies (real-time and georeferenced data), intersectoral articulation, and governance approaches that engage communities in disaster prevention and management. Budimir et al. (2025) underscore the institutional and informational challenges facing community-directed early warning systems, particularly in Global South countries, a perspective that is essential for contextualizing the Brazilian case. Regarding the event that motivates this paper, two studies are particularly relevant. Alvalá et al. (2024) analyze the hydrological disaster of September 2023 in Rio Grande do Sul, examining vulnerabilities in risk management capacities among smaller municipalities in the state. CEMADEN/INPE (2025) assesses the performance of federal early warning systems and their interface with the municipalities affected by the May 2024 floods. These studies, among others, consolidate the argument that the construction of resilient cities is inseparable from the capacity to produce, integrate, and mobilize qualified information grounded in robust, comprehensive, and reliable data.

Methodology

To address the research questions regarding the characterization of informational policy capacities in local governments and which variables might explain the extent to which such capacities are evidenced in the Plans, an exploratory and inferential study was conducted, analyzing data obtained from the Contingency Plans for disaster prevention and response of 70 municipalities in the Brazilian state of Rio Grande do Sul. These 70 municipalities are among the 95 that declared a state of public calamity following the hydrometeorological disasters of May 2024. The municipalities were selected because they had a contingency plan

publicly available and developed before the May 2024 hydrometeorological disasters. This selection criterion was established to assess municipalities' level of preparedness (in terms of planning) for disaster prevention, response, and recovery, which broadly corresponds to the urban resilience approach. The remaining 25 municipalities were excluded when no plan was publicly available, or the available plan was drafted after May 2024.

Within the scope of this study, the analysis of policy capacities was delimited to the specific dimension of informational policy capacities, measured by the IndCap Index (as the dependent variable), with emphasis on the organizational and systemic levels and on the analytical and operational dimensions, as proposed by Wu et al. (2015). Regarding the informational aspects of the urban resilience literature, analytical attention was directed to the Understanding Disaster Risk (UDR) pillar of the Sendai Framework and the Local Governance & Planning (LGP) dimension of the City Resilience Framework. To obtain objective information on the informational aspects of the contingency plans, a set of questions was formulated to be answered through documentary analysis (see Table 3). Each question was scored using the following criteria: No—the plan does not address or indicate anything related to the topic (score = 0); Partial—the plan addresses the topic only in general terms and does not objectively meet the question's requirements (score = 1); Yes_1—the plan addresses at least one criterion in the question (score = 2); Yes_2—the plan addresses at least two criteria in the question (score = 3).

It is important to acknowledge a conceptual boundary in this study's measurement strategy. Contingency plans are not treated here as proxies of latent informational policy capacities, but as the instruments through which informational capacities are institutionalized and made available to collective action at the organizational and systemic levels. The IndCap measures documented operational informational capacity (the extent to which municipal governments have formally incorporated informational instruments into disaster risk planning). At the same time, we recognize that a municipality may possess informational capacities that are not formalized in its contingency plan and, conversely, may produce a well-structured plan based on external templates without having internalized the underlying capacities. This limitation is discussed in the concluding section. The analytical focus, therefore, is on the institutionalized and documented dimension of informational policy capacities, which is itself a theoretically relevant object of study insofar as formalization signals organizational commitment and shapes implementation behavior (Wu et al., 2015).

The analysis treats contingency plans as instruments through which informational policy capacities are constituted and institutionalized to be made accessible for action at the organizational and systemic levels. In this way, as addressed in the literature review (Penrose, 1959; Teece et al., 1997), the analytical focus remains on operational capacity, the institutionalized and coordinated dimensions of capacity that are collectively mobilizable.

Table 3

Analytical Framework

Question (IndCap variables)	Level	Capacity	Sendai	CRF	Informational Capacity Dimension
Does the CP include guidelines or proposals for the collection of disaster risk data?	Organizational	Operational	UDR		2
Does the CP indicate guidelines or proposals for the use and analysis of disaster risk information?	Organizational	Analytical	UDR	LGP - Data Management	4
Does the CP include a Situational Diagnostic section produced from municipal data?	Organizational	Analytical	UDR		1
Does the CP indicate actions for the acquisition of instruments or contracting of services for the production of risk information?	Organizational	Operational	UDR		2
Does the CP indicate actions for interinstitutional articulation for the sharing and qualification of information relevant to disaster prevention and mitigation?	Systemic	Analytical and Operational	UDR	LGP - Data Management	3
Does the CP indicate actions for the dissemination of disaster risk information to the municipal population?	Organizational	Operational	UDR		4
Does the Plan explicitly indicate actions directed at data security in disaster situations?	Organizational	Operational		LGP - Data Management	2

Note. Prepared by the authors.

Based on the scoring system described above, the scores for each question were summed by municipality, and an index of informational policy capacities for local governments (IndCap) was constructed. This index has a theoretical range of 0 to 21, derived from the sum

of the individual variable scores, with each variable carrying a maximum score of three points and all variables weighted equally in the index. Equal weights reflect that neither the literature nor the Sendai Framework nor the Urban Resilience Framework establishes a hierarchy among the informational dimensions considered; all are treated as complementary components of risk understanding.

The IndCap should be understood as an index of documented policy design capacity, that is, the extent to which municipalities have formally incorporated informational instruments into their disaster risk planning. This is distinct from, though related to, implementation capacity, which would require longitudinal or observational data on actual organizational behavior (Wu et al., 2015). The distinction matters: a municipality may score high on IndCap by articulating strong informational guidelines in its plan, yet face significant implementation gaps in practice. Conversely, low IndCap scores may underestimate actual informational practices that were not formalized in the plan. We argue that documented policy design capacity is itself a theoretically meaningful dimension of informational policy capacities, as the absence of formalized informational guidelines signals structural gaps in the organizational and systemic levels of policy capacity (Wu et al., 2015), and is associated with weaker preparedness outcomes in the disaster risk literature (UNDRR, 2022).

We collected data through a systematic process combining human action and artificial intelligence. A large language model (Claude 4.6, Anthropic) was deployed using a structured coding protocol and applied to the automated analysis of contingency plans. To support transparency and quality control, the model was instructed to assign a confidence score to each coding decision, ranging from 1 (classification not possible; mandatory human review) to 5 (two or more criteria objectively and substantively met in accordance with the coding guide, yielding high interpretive confidence). No score of 1 was recorded across the full coding process, indicating that the model was able to produce a classifiable response for all plan-variable combinations.

The coding process involved three validation phases: (1) a pilot round in which a subsample of plans was independently coded by human researchers and by the model, with discrepancies discussed and used to refine both the coding instructions and the prompt strategy; (2) full automated coding of all 70 plans; and (3) systematic human review concentrated on responses assigned lower confidence scores (2 and 3), ensuring that borderline classifications received direct human judgment. All phases were subject to continuous human oversight to ensure standardization and consistency of results across the full dataset.

For each analyzed plan, we created a table containing the analytical questions (variables), the coded response (No, Partial, Yes_1, Yes_2), the justification for the response, the verbatim excerpt from the plan supporting the classification, and the AI model's confidence score. The tables from all 70 plans were consolidated into a single variable table identifying each municipality and its scores across all analyzed variables. This dataset was processed using KNIME Analytics Platform (version 5.11), through which the following contextual variables were added: municipal population (based on the 2022 Census), total and per capita gross domestic product, urban hierarchy, distance from the state capital, population size interval, territorial area, characterization of municipal public servants by employment status and educational level, and the historical record of hydrometeorological disaster occurrences in the ten years preceding the May 2024 disaster.

To classify municipalities' exposure to hydrometeorological risk, a binary variable (hist_hidro) was operationalized as the occurrence of four or more extreme hydrometeorological events in the ten years preceding May 2024, based on data from the Integrated Disaster Information System (S2ID). The threshold of four events was established through exploratory frequency analysis of the distribution of disaster occurrences in the sample, identifying municipalities with recurrent (rather than episodic) exposure to hydrometeorological risk as a theoretically meaningful analytical category.

With the dataset structured, the next step was an exploratory descriptive analysis of the data. This was followed by inferential analyses using multivariate linear regression and principal component analysis (PCA). The inferential tests were performed considering the IndCap (or its constituent variables) as the dependent variable, and the remaining variables described above as potential explanatory variables for the induction of informational policy capacity constitution in the municipalities under study.

The sample size of n = 70, combined with up to eight predictors in the complete OLS model (M1), implies an observation-to-predictor ratio at the lower bound of what is conventionally recommended for stable multiple regression estimates. To address potential multicollinearity, variance inflation factors (VIF) were calculated for all predictors in M1. The highest value was observed for log(Pop) (VIF = 4.19), followed by % of university-educated staff (VIF = 3.52), urban hierarchy (VIF = 2.76), % of tenured civil servants (VIF = 2.56), and % of appointed positions (VIF = 2.04). All values remained well below the conventional threshold of 10 (and below the more conservative threshold of 5), suggesting that multicollinearity does not substantially distort the estimates. Additionally, principal component analysis serves as

a complementary analytical strategy that reduces the predictor space to orthogonal components, mitigating collinearity concerns while preserving interpretive content. The convergence of results across both approaches is taken as evidence of robustness.

Due to the article length limits established by the journal, verbatim excerpts from the contingency plans were not included in the text. The complete dataset, including the scores assigned to each indicator and the plan excerpts that supported each classification, is available to readers upon request.

Results

The analysis of the contingency plans was organized into two complementary stages. The first, descriptive in nature, mapped the presence of the seven informational dimensions—six corresponding to the Understanding Disaster Risk (UDR) pillar and one to the Local Governance & Planning (LGP) dimension—across the plans, and constructed IndCap_soma as a composite index. The second, inferential in nature, tested (through OLS linear regression and principal component analysis (PCA)) which structural and administrative variables explain the variation in IndCap across municipalities. Following methodological exclusions (plans outside the temporal scope or those that do not strictly constitute contingency plans), the study analyzes n = 70 municipalities out of the 95 that declared a state of public calamity in May 2024.

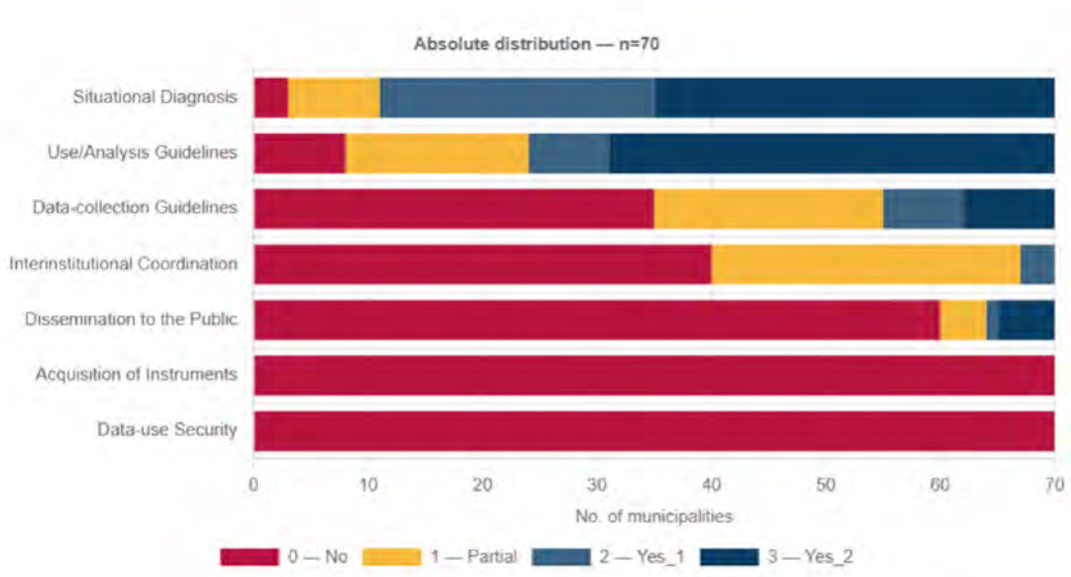
Descriptive Exploratory Analysis of Informational Policy Capacities

The analysis of the frequency distributions of the seven informational policy capacity variables across the contingency plans revealed a systematic internal hierarchy among dimensions. As shown in Figure 1, the variables concerning situational diagnostics (mean = 2.30; 84% of plans reaching Yes_1 or Yes_2) and data use and analysis guidelines (mean = 2.10) are the most consistently covered; interinstitutional articulation, information dissemination to the population, instrument acquisition, and data security are the weakest. Notably, regarding intersectoral articulation, the predominant classification is “Partial”, a result of what was characterized as “unilateral articulation,” in which the municipality receives data from other institutions but neither shares its data nor provides feedback on the data received. The dimensions “Instrument Acquisition” and “Data Security” receive a score of zero in 100% of the plans, suggesting, respectively, that there is no evidence of commitment to qualifying information production processes to support disaster prevention, response, and recovery, and

that information security is entirely disregarded as a component of urban resilience strategy, contrary to what is proposed by the City Resilience Framework under the principle of secure and effective data management.

Figure 1

Absolute Distribution of the Seven Informational Dimensions (n = 70)



Note. Prepared by the authors.

Based on the initial measurement of the informational policy capacity variables, a composite index (IndCap) was constructed for the joint analysis of all seven variables. It is important to note that, given the complete absence of scores on the "Instrument Acquisition" and "Data Security" dimensions across all plans, the effective ceiling of the IndCap is 15. The distribution of IndCap results enabled the construction of a value-range categorization (Low: 0–4; Medium: 5–8; High: 9–15), as presented in Table 4.

The observed distribution yielded a mean IndCap of 6.00 (median = 6; maximum observed = 14; standard deviation = 3.03), corresponding to only 28.6% of the theoretical ceiling. Only 14.3% of municipalities reached the "High" category (IndCap ≥ 9), while 35.7% fell into the "Low" category (IndCap ≤ 4).

Table 4

IndCap Distribution

Category	IndCap Range	n	% of total
Low	0 – 4	25	35.7%
Medium	5 – 8	35	50.0%
High	9 – 14	10	14.3%

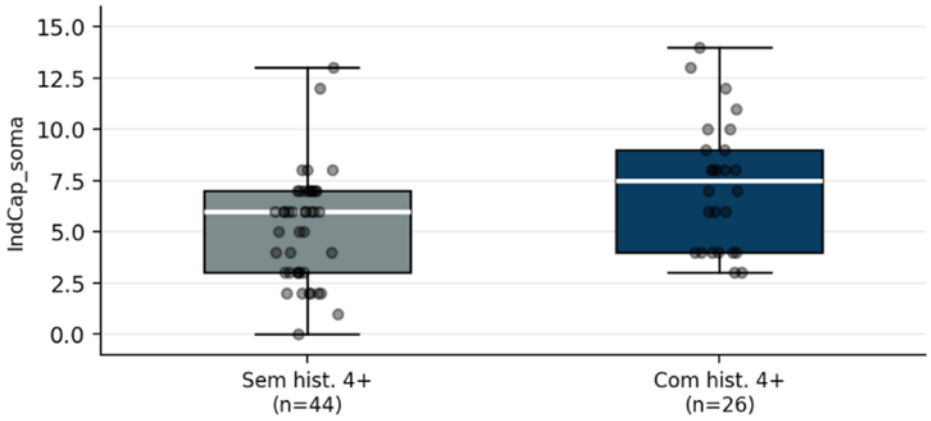
Note. Prepared by the authors.

The structural absence of scores on the "Instrument Acquisition" and "Data Security" dimensions across all 70 municipalities warrants a conceptual observation. While the original seven-dimension structure of the IndCap is retained for theoretical completeness (as the absence of these dimensions is itself a substantively meaningful finding), the effective measurement range of the index is 0–15. For comparative and inferential purposes, results are interpreted against this effective ceiling. The universal zero-scoring on these two dimensions should not be read as a measurement artifact but as evidence of a systematic gap in municipalities' informational policy capacities: the absence of any documented effort to qualify information production processes or to incorporate data security into disaster resilience strategies.

The bivariate comparison of IndCap between municipalities with four or more extreme hydrometeorological disasters in 2014–2023 (n = 26) and the remaining municipalities (n = 44) was conducted using three tests: descriptive mean comparison, the Mann-Whitney test (non-parametric, one-tailed, g1 > g0), and Spearman correlation between the binary variable hist_hidro and IndCap_soma. This analysis showed that municipalities with a history of four or more hydrometeorological disasters had a median IndCap_soma of 7.5, compared with 6.0 for the remaining group. As shown in Figure 2, this difference is statistically robust under both the non-parametric test (Mann-Whitney U = 801.5, p = .002) and the Spearman correlation (ρ = +.339, p = .004). It should be noted, however, that a significant portion of this effect operates indirectly through correlated structural variables (log(Pop) and urban hierarchy), suggesting that rather than reflecting genuine institutional learning from prior disaster experience, municipalities may have merely incorporated data produced on an ad hoc basis.

Figure 2

Distribution of IndCap_soma by Hydrometeorological History Group

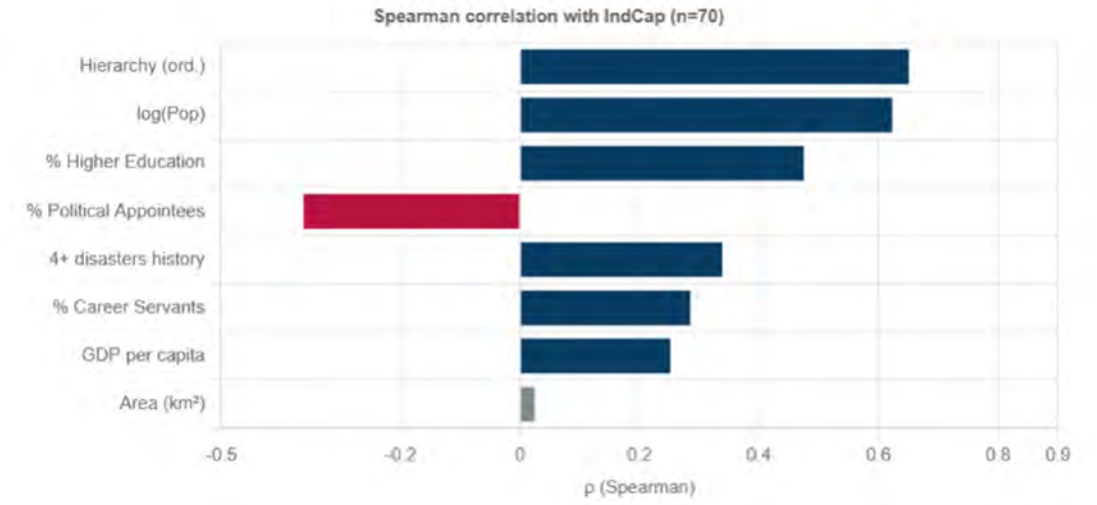


Note. Prepared by the authors.

The next step was to conduct Spearman correlation analyses between IndCap_soma and eight potential structural and administrative predictors. Seven of the eight predictors correlate significantly with IndCap ($p < .05$). Figure 3 presents the predictors in descending order of association strength: ordinal urban hierarchy ($\rho = +.65$), log(Pop) ($\rho = +.62$), percentage of university-educated staff ($\rho = +.48$), percentage of appointed positions ($\rho = -.36$, the only significant negative association), hist_hidro ($\rho = +.34$, history of four or more extreme hydro-meteorological disasters in 2014–2023), percentage of tenured civil servants ($\rho = +.28$), and GDP per capita ($\rho = +.25$). Only the territorial area ($\rho = +.02$) did not correlate significantly. Two findings merit particular attention: (i) the strongest positive correlation (urban hierarchy) suggests that greater structural complexity in public functions and socioeconomic dynamics may act as inducing factors for the formal institutionalization of informational policy capacities in climate disaster prevention and response planning; and (ii) the negative correlation with the percentage of appointed positions constitutes evidence that the politicization of bureaucracy is associated with lower informational capacity, a finding further reinforced by the PCA results.

Figure 3

Spearman Correlations of Predictors With IndCap_sum



Note. Prepared by the authors.

Inferential Analysis: What Induces Informational Policy Capacities for Urban Resilience?

Five OLS linear regression models were tested with IndCap_soma as the dependent variable and progressively larger sets of predictors. The five models were composed as follows: M1 - Complete [log(Pop), GDP per capita, AREA_KM2, urban hierarchy, hist_hidro, and the three bureaucratic composition variables: % tenured civil servants, % appointed positions, and % university-educated staff]; M2 - Structural [log(Pop), GDP per capita, and urban hierarchy]; M3 - Structural + Staff [M2 + % tenured civil servants, % appointed positions, and % university-educated staff]; M4 - Structural + Staff + Hydrometeorological History [M3 + hist_hidro]; M2+ - Structural + Hydrometeorological History [M2 + hist_hidro].

As shown in Table 5, Model M2 presents the best AIC. The addition of hist_hidro to M2 (Model M2+) yielded only marginal gains: the adjusted R^2 increases slightly from 0.379 to 0.381, with a modest reduction in AIC (323.6). These results indicate that structural variables outside the local bureaucracy explain the induction of informational policy capacity constitution better, while the history of extreme hydrometeorological events shows limited evidence of driving institutional learning.

Table 5

Comparison of the Five OLS Models (n = 70)

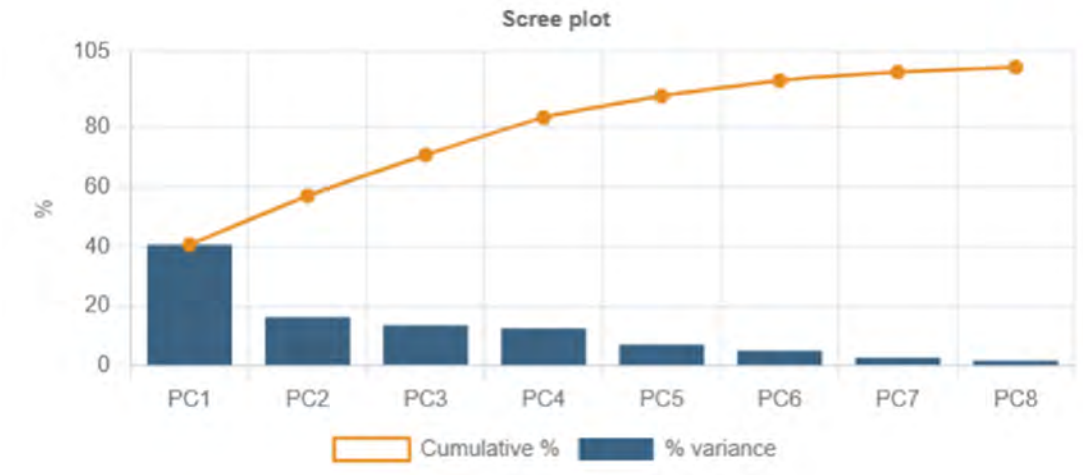
Model	R^2	Adjusted R^2	F	p (F)	AIC
M1 — Complete	0.421	0.345	5.54	<0.001	331.1
M2 — Structural	0.406	0.379	15.03	<0.001	322.9
M3 — Structural + Servants	0.408	0.351	7.23	<0.001	328.7
M4 — Struc. + Serv. + hist_hidro	0.420	0.355	6.42	<0.001	329.2
M2+ — Struc + hist_hidro	0.417	0.381	11.63	<0.001	323.6

Note. Prepared by the authors.

A PCA was applied to the eight standardized predictors with the aim of identifying latent factors that organize the correlation structure among them and testing whether these reduced dimensions (see Table 6) explain the variation in IndCap. Three principal components were found to jointly explain 70.6% of the variance in the predictors (see Figures 4 and 5). The first component (PC1) alone accounts for 40.6% and has a clear substantive interpretation: it combines, with positive loadings, population scale (log(Pop)), urban hierarchy, and bureaucratic professionalization (% university-educated staff and % tenured civil servants), and with a negative loading, politicization (% appointed positions). It is reasonable to interpret PC1 as a dimension of "Weberian bureaucratic complexity." The second component (PC2, 16.3%) combines prior exposure history (hist_hidro, loading +0.53) with territorial area (+0.61), a dimension that may be read as "Exposure + Territory," identifying municipalities that are both physically large and historically more exposed to disasters.

Figure 4

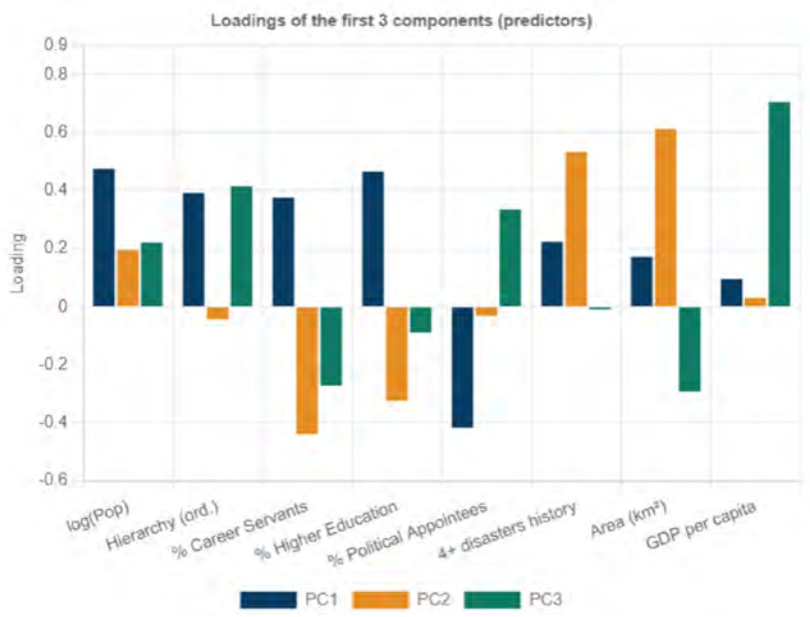
Variance Explained by Each Component



Note. Prepared by the authors.

Figure 5

Loadings of Predictors on the First Three Components



Note. Prepared by the authors.

As shown in Table 6, scale and bureaucratic professionalization load jointly, suggesting that PC1 can be interpreted as Weberian bureaucratic complexity, which can be labeled as "urban-administrative scale": larger and more central municipalities also have more professionalized and less politicized bureaucracies. PC2 combines disaster history and territorial area. PC3 is dominated by GDP *per capita*, with secondary loadings for urban hierarchy and political appointees and a negative loading for area.

Table 6

Variance Explained and Interpretation of the First Three Principal Components

Component	% variance	Cumulative	Proposed interpretation
PC1	40.6%	40.6%	**Weberian Bureaucratic Complexity (scale + hierarchy + professionalization vs. politicization)**
PC2	16.3%	56.9%	Exposure + Territory (hist_hidro + area in km²)
PC3	13.7%	70.6%	Wealth + Centrality (GDP per capita + hierarchy)

Note. Prepared by the authors.

Pearson correlations were calculated between each principal component and IndCap_soma, followed by the regression IndCap ~ PC1 + PC2 + PC3. PC1 was found to be the

only component that significantly predicts IndCap, while PC2 (Exposure + Territory) and PC3 (Wealth + Centrality) did not yield significant predictions. The regression IndCap ~ PC1 + PC2 + PC3 reaches an adjusted R^2 = .347, with PC1 alone accounting for virtually all the explanatory power (see Table 7 and Figure 6). Even with the inclusion of hist_hidro among the predictors, the latent dimension "Weberian Bureaucratic Complexity" remains the consolidated predictor, constituting an additional indication that the effect of prior disaster exposure observed in the bivariate analysis operates primarily through administrative scale and urban hierarchy.

Table 7

Pearson Correlation of the First Three Principal Components With IndCap_sum

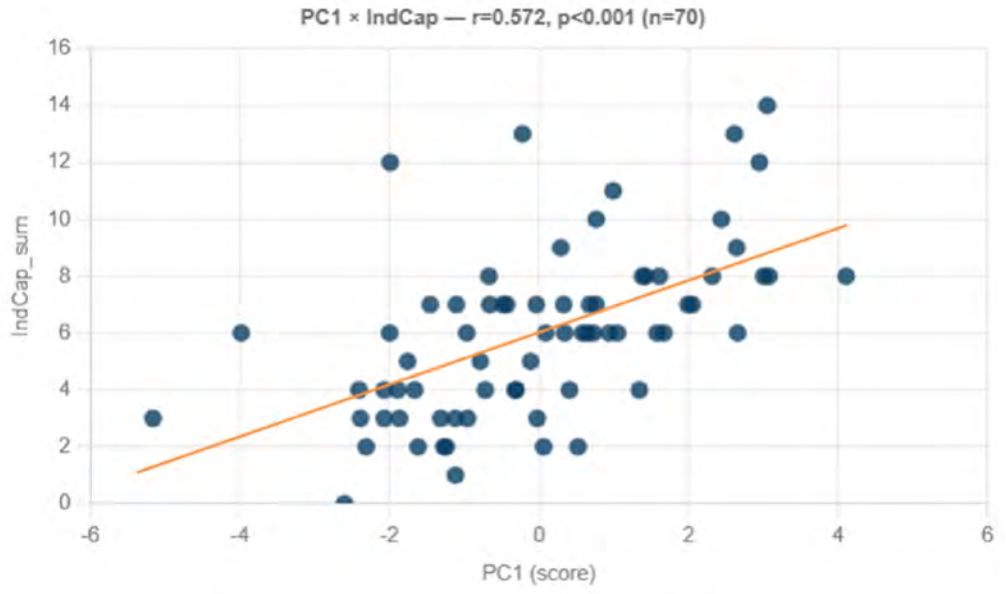
Component	r (Pearson)	p value	Significance
PC1—Bureaucratic Complexity	**+0.572**	<0.001	**Yes (p < .05)**
PC2—Exposure + Territory	+0.121	0.318	No
PC3—Wealth + Centrality	+0.183	0.130	No

Note. Prepared by the authors.

Figure 6 shows a positive, approximately linear association, but also substantial dispersion: some municipalities with below-average PC1 scores reach IndCap values of 12 and 13, indicating that scale and administrative structure are not necessary conditions for high documented informational capacity.

Figure 6

Scatterplot of PC1 (Urban-Administrative Scale) and IndCap_sum



Note. Prepared by the authors.

Discussion

The results presented signal important features of the reality of informational policy capacities for urban resilience among local governments, a reality that warrants attention from researchers, policymakers, and practitioners alike. A first notable finding concerns the fact that, although municipalities formally include situational diagnostics in their Contingency Plans (84%), their planning documents show no indication of any effort to qualify the processes of data collection, management, and analysis through the procurement of instruments or specialized services for that purpose.

This reality is compounded by the low level of intersectoral articulation for data sharing and qualification, and where articulation does exist, it consists essentially of the reception of external data rather than the active production of information within a partnership network. Drawing on the typology of informational policy capacities proposed by Peeters et al. (2023), we suggest that a first key finding of this study is that municipalities operate fundamentally in ad hoc mode in terms of informational capacities, and therefore exhibit low capacity with respect to the Understanding Disaster Risk dimension of the Sendai Framework.

It is therefore possible to infer that the predominance of municipalities operating in this condition tends to undermine both their own response capacity and their ability to benefit from peer-to-peer information sharing (through cooperation networks or inter-municipal consortia), which has the potential to reduce information acquisition costs and, as a rule, provides better conditions for coordinated and integrated action toward regionalized disaster risk reduction and climate disaster management.

The inferential analysis identified several relevant aspects regarding the development of informational policy capacities in the analyzed municipalities. A first aspect concerns the convergent direction indicated by both the linear regression and the PCA: the data support the interpretation that municipal informational capacities depend to a significant degree on external induction through structural factors (particularly population size and urban hierarchy) rather than on internal dimensions such as Weberian state bureaucracy. While it is not possible to directly test the induction mechanisms with the available data, the proposed interpretation finds theoretical grounding in the multilevel governance literature discussed by Arretche et al. (2007) and Gomide and Marenco (2024). Regarding Weberian bureaucracy specifically, the variables associated with it (percentage of tenured civil servants and percentage of university-educated staff) cannot individually predict the constitution of informational capacities, corroborating the findings of Marenco and Abulatif (2025) and Wang and Feeney (2016). It

is further possible to infer that if the use or qualification of informational resources does not emerge in a consolidated form within Contingency Plans, there is a structural weakness in the analytical and operational dimensions at the organizational level of informational policy capacities (as characterized by the typology proposed by Wu et al. (2015)).

Another relevant finding is that disaster history matters for the constitution of informational policy capacities, but is not sufficient. Municipalities with a history of four or more hydrometeorological disasters in the decade preceding May 2024 presented a median IndCap 1.5 points higher than those with fewer such events. Given that urban hierarchy proves a stronger predictor of IndCap performance than disaster history in the analyzed cases, it is possible to infer the presence of a pronounced weakness in organizational-level information and knowledge management capacity, one that has prevented local governments from transforming prior disaster experience into institutionalized learning regarding the constitution and qualification of informational policy capacities.

Intersectoral articulation was identified as a strategic bottleneck in the constitution and qualification of informational policy capacities for urban resilience among the analyzed municipalities. The finding that 57% of municipalities presented no indication of intersectoral articulation for data sharing and qualification, and that 38.6% of plans were classified as exhibiting only partial articulation (primarily due to what may be characterized as unilateral articulation, in which the municipality merely receives or accesses disaster risk information without indicating any sharing of its data with partner networks or engagement in regionalized data analysis) reveals a weak operational and political articulation capacity at the organizational level of municipal administrations.

Final Remarks

This study, by analyzing contingency plans elaborated before a severe hydrometeorological disaster, has shed light on the development of operational information policy capacities as a fundamental element of local governments' preparedness for climate disaster prevention and response. As addressed in the reviewed literature, contingency plans are the instruments that enable the mobilization of informational resources at the organizational and political levels toward more effective collective and systemic action for the promotion of urban resilience. The development of the IndCap (derived from a systematic analysis of contingency plans) as a measurement instrument for informational policy capacities offers a relevant contribution to understanding how informational capacities are constituted and which factors influence their performance. The me-

thodology employed in this study, combining systematic documentary analysis and inferential methods such as OLS regression and PCA, supported by the application of generative artificial intelligence, confers methodological robustness to the diagnostic presented.

The main findings, organized according to the study's analytical phases, are as follows: (i) municipalities operating predominantly in ad hoc mode regarding informational policy capacities; (ii) external structural factors (particularly population size and urban hierarchy) are more consistent predictors of the informational capacity index than Weberian bureaucracy; and (iii) the history of disasters matters marginally, but does not translate into consolidated institutional learning capable of inducing the constitution of informational capacities.

A potential contribution of this study to the policy capacities literature in Latin America lies in the application of the distinction between latent capacity and operational capacity in a context that remains underexplored in the regional literature. By advancing the argument that contingency plans constitute (rather than merely record) operational capacity in ad hoc contexts, the study seeks to move conceptually beyond the use of documents as proxies, proposing a constitutive relationship between formalization and capacity availability. A further contribution concerns the corroboration of findings from other bodies of literature demonstrating that Weberian bureaucracy alone is insufficient to predict informational capacities. The study goes a step further by identifying that bureaucratic politicization (measured as the percentage of appointed positions) is negatively associated with the informational capacity index, suggesting the active presence of patrimonialist logics in local public administration.

A third contribution of this study lies in the novel articulation between the Sendai Framework, the City Resilience Framework, and the policy capacities literature. An analytical convergence between two international climate resilience frameworks (with the Sendai Framework adapted to the local level) and the policy capacities literature was proposed and operationalized. This initiative may be understood as a replicable diagnostic toolkit for other local government contexts, with potential contributions both to the academic-scientific community and to policymakers and practitioners across Latin America and other regions.

In terms of concrete implications for policymakers and practitioners, two aspects merit particular attention. The first concerns the problem of municipalities' dependence on external induction: the findings indicate that informational capacities depend primarily on population size and urban hierarchy rather than on local learning. This reality suggests that smaller municipalities or those of lower urban hierarchy tend to be less equipped (in terms of structure and resources) to develop their informational capacities autonomously, and are therefore in greater need of fede-

rative induction mechanisms or regionalized articulation strategies, such as integration into regional inter-municipal consortia. The second aspect concerns intersectoral articulation as a strategic asset for the development of informational capacities for urban resilience. The finding that 57% of municipalities have not formalized intersectoral articulation processes (and that, where it exists, it occurs predominantly unilaterally) shows that strategies such as forming active information-sharing networks and the regionalized, shared use of informational resources remain largely underexplored. This reality suggests that smaller municipalities, which may lack the resources to independently constitute informational capacities, may be forgoing the economies of scale and knowledge dissemination benefits that networked governance arrangements could provide.

Among the limitations of this research, the IndCap (by measuring documented operational capacity) may underrepresent municipalities with non-formalized capacities, or conversely, overrepresent those whose plans do not reflect genuinely internalized capacities. This is an inherent characteristic of the methodological strategy adopted (one that enables the capture of information on informational capacities that would not otherwise be publicly available in the context of the analyzed local governments) and does not undermine the value of the index, but indicates that its application calls for careful and criteria-based interpretation. Two other limitations should be noted. One is that the sample includes only municipalities with publicly available plans drafted before May 2024 (70 of 95), which may affect the average level if municipalities without plans have lower capacity. The other is that this study is cross-sectional, which implies that the associations identified are not necessarily causal effects.

As directions for future research, we identify the opportunity for a longitudinal study comparing the dataset used here (drawn from plans elaborated before May 2024) with a corresponding dataset of plans from the same municipalities produced after May 2024, thereby enabling an analysis of institutional learning and potentially contributing to the organizational learning literature. Additionally, tests incorporating federal and state induction mechanisms could deepen the understanding of municipalities' dependence on external drivers. Another avenue is to replicate the IndCap methodology in other Brazilian states and Latin American contexts (including both federal and unitary systems) to assess the external validity of the findings and contribute to a middle-range theory of subnational informational policy capacities in low-institutionalization contexts.

We close by returning to the motivation of this study: the hydrometeorological disaster of May 2024 in the Brazilian state of Rio Grande do Sul, which exposed the fragility of local governments' informational policy capacities and thereby prompted the present research. In

doing so, it underscored the importance of better understanding the factors that can build local governments' informational capacities for urban resilience, so institutional actions for climate disaster prevention and response can become more effective.

We conclude that the relationship between policy capacities and urban resilience is a field of inquiry with significant potential for theoretical and empirical advancement. This is particularly pressing given that the increasing frequency and intensity of extreme climate events place ever greater demands on local governments to act in the prevention of and response to crisis and turbulence, requiring the constitution and consolidation of their policy capacities and the strategic use of informational resources. It is therefore hoped that the methodology developed and the findings presented in this study may contribute positively (for researchers and practitioners alike) to the production of new research and increasingly effective actions for the promotion of urban climate resilience in Latin America and beyond.

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About the authors

Lisandro Iusry Abulatif

Lisandro Iusry Abulatif is a PhD candidate in Public Policy at the Federal University of Rio Grande do Sul (UFRGS). He holds a master's degree in Architecture and Urbanism and specializes in strategic urban territory management. He has extensive experience planning, monitoring, and evaluating public policies across various levels of Brazilian government. Additionally, he has served as a technical consultant for international organizations like the Red Cross, the Pan American Health Organization (PAHO), and the Brazilian Federal Government.

Ricardo Letizia Garcia

Ricardo Letizia Garcia has been an Adjunct Professor at the State University of Rio Grande do Sul (UERGS) since 2004. He holds a PhD in Economics with a focus on Quantitative Methods, a master's degree from UFRGS, and completed a postdoctoral fellowship in public policy at Universidade Nova de Lisboa. His academic research and teaching focus on public finance, public sector economics, the economics of corruption, and health technology assessment.

Clara Natalia Steigleder

Clara Natalia Steigleder is a professor at the Federal University of Pelotas (UFPel) in the Department of Land Transportation Technology. She holds a PhD in Urban and Regional Planning, a master's degree in Sociology from UFRGS, and a bachelor's degree in Social Sciences. She coordinates the Specialization Course in Management for Sustainability at the Mercosur Integration Center, focusing on public management, traffic education, and urban circulation conflicts.

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