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From Infrastructure to Governance: The Diffusion and Normative Maturation of “Smart Cities” in Brazil (2013–2025)

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Abstract

The accelerated diffusion of the smart cities concept across public agendas in the Global South raises a central analytical question: to what extent does normative expansion reflect substantive institutional transformation, or does it constitute legislative smartwashing, in which the "smart" label operates as political legitimation dissociated from implementation capacity? This article presents the first nationwide systematic mapping of the Brazilian normative framework on smart cities, analyzing a corpus of 319 municipal and state laws enacted between 2013 and 2025 through a mixed-methods approach combining systematic content analysis, lexical mining, and protocol-oriented qualitative coding. The findings reveal a measurable shift from a hard paradigm centered on infrastructure and connectivity to a soft paradigm focused on governance, participation, and sustainability. This maturation, however, remains predominantly rhetorical: mimetic isomorphism structures normative diffusion, producing legislation with nominal capacity that lacks substantive information governance, intersectoral coordination mechanisms, and verifiable prescriptive density. The concentration of 86.2% of normative production in the South and Southeast regions demonstrates that, absent a structuring federal policy, the digital agenda reproduces and deepens pre-existing territorial asymmetries, generating islands of institutionalization surrounded by normative rhetoric. The article proposes an analytical model comprising three interdependent axes (information governance, institutional capacity, and normative density) and recommends that smart city policies be linked to City Statute instruments, particularly the Master Plan and Multi-Year Plan, as a condition for overcoming the capacity gap and translating urban innovation into territorially equitable governance.

1. Introduction

The identification of 319 normative instruments related to smart cities in Brazil over more than a decade suggests an expansion of the agenda within the public sphere. However, this evolution does not necessarily indicate institutional consolidation. To a large extent, it reflects the diffusion of a normative discourse that is poorly supported by effective implementation instruments. When municipalities with radically different administrative capacities, socioeconomic contexts, and regulatory traditions converge toward legislation with nearly identical content (listing the same principles, mobilizing the same vocabulary, and articulating the same objectives) what is observed is not the diffusion of a public policy, but rather the operation of a mechanism of mimetic isomorphism: the adoption of institutional forms to signal modernity and territorial competitiveness, regardless of the capacity to implement them (DiMaggio & Powell, 1983). In this context, the "smart city" label operates less as a description of an emerging reality and more as a strategy of political legitimation, a phenomenon that this article conceptualizes as legislative *smartwashing*, whose scale and patterns in Brazil remain empirically underexplored.

The international literature has established that urban intelligence is not a technological attribute, but an institutional capacity (Nam & Pardo, 2011; Almulhim & Yigitcanlar, 2025; Koelmel et al., 2026). A city's intelligence lies in the state's ability to use information strategically, ethically, and collaboratively to

support evidence-based decision-making (Nam & Pardo, 2011), a definition that positions data not as infrastructure but as a governance asset. The most significant risks associated with smart cities are not technical, but political: the transfer of custody of strategic data to private actors without public mandate, the production of informational asymmetries, and the weakening of mechanisms of social control over digital public action (Kitchin & Moore-Cherry, 2021).

The concept of “digital plumbing” refers precisely to what is often missing in these policies: not strategic vision, but the set of data systems, interoperability standards, custody protocols, and accountability mechanisms that transform raw data into actionable knowledge (Koelmel et al., 2026). The gap between normative discourse and this underlying infrastructure constitutes what the literature defines as a capacity gap, and it is within this gap that the present study is analytically situated.

In Brazil, this debate acquires specific contours that make it an emblematic case of the Global South. The federal framework for science, technology, and innovation has not established information governance mechanisms applicable to urban management. The Brazilian Charter for Smart Cities (2021), although relevant as a conceptual inflection point, lacks standardized metrics, clearly defined institutional responsibilities, and stable sources of funding, conditions without which a guiding framework becomes a catalyst for isomorphism, providing the vocabulary of innovation without the institutional conditions required for its operationalization.

This regulatory vacuum is further exacerbated by federal heterogeneity: in a country where municipal administrative capacity varies drastically across regions, the absence of a redistributive, structuring federal framework means that the smart cities agenda tends to selectively benefit territories that already possess greater institutional capacity, thereby deepening the socio-spatial asymmetries that Global North models systematically overlook (Yigitcanlar et al., 2020). The proliferation of disconnected local arrangements, in which the “smart” label often serves as a strategy of political visibility without corresponding concrete instruments, represents the local expression of a global tension between the rhetoric of urban innovation and the reality of the institutional capacities available to sustain it.

This article addresses this gap. Its objective is to analyze how Brazilian smart city laws structure the strategic use of information, organize state capacities, and establish normative instruments with operational effectiveness, to assess the degree of institutionalization of these policies between 2013 and 2025. To this end, the research examines a corpus of 319 ordinary and complementary laws at the municipal and state levels, collected from the LeisMunicipais.com platform, using systematic content analysis, textual mining, and protocol-assisted qualitative coding.

The central contribution of the article is theoretical and analytical: it proposes a legislative evaluation model structured around three interdependent axes (information governance, institutional capacity, and normative density), each operationalized through empirical markers and critical analytical distinctions that allow differentiation between institutions that effectively transform urban management and those that merely incorporate the vocabulary of innovation. Information governance assesses whether norms build an institutional architecture for data as a strategic asset (defining custody, interoperability, and

accountability) or operate within an informational rhetoric that invokes data use without creating verifiable obligations (Ruangwicha & Tuamsuk, 2026).

Institutional capacity distinguishes arrangements endowed with decision-making authority, intersectoral coordination, and budgetary linkage (effective capacity) from the formal creation of structures lacking operational conditions for implementation (nominal capacity), as defined by Koelmel et al. (2026). Normative density classifies legislative statements into declaratory, programmatic, and prescriptive categories, assessing whether policy operates at a symbolic level or advances toward concrete, funded, and auditable obligations (DiMaggio & Powell, 1983; Almulhim & Yigitcanlar, 2025).

This model advances beyond the predominantly descriptive approaches in the literature by shifting the focus from the mere presence of the term “smart city” to its institutional translation, responding to the demand for more precise analytical instruments for evaluating digital urban policies in complex and asymmetric federal contexts (Koelmel et al., 2026; Almulhim & Yigitcanlar, 2025). From an empirical standpoint, the study provides the first nationwide systematic mapping of Brazilian normative production on the subject, revealing territorial patterns, temporal trajectories, and differentiated degrees of institutionalization that aggregated legislative analysis alone is unable to capture.

2. The Triangle Of Digital Governance: Data, Capacity, And Regulation

2.1 Information Governance

Information governance constitutes the analytical core of the smart cities paradigm, shifting data from an operational input to a strategic asset of state action (Nam & Pardo, 2011; Kitchin, 2021). From this perspective, urban intelligence does not reside in technological density, but in the institutional capacity to structure information flows, ensure their quality, and convert them into evidence-based public decisions (Hu, Zhang & Sheng, 2024). Data, as a factor of production, only generates value when integrated into institutional structures that guarantee its custody, interoperability, and accessibility (Ruangwicha & Tuamsuk, 2026).

Interoperability emerges as a condition for information governance by enabling integration across heterogeneous systems and the circulation of data among public organizations. Its absence produces fragmented data environments that undermine horizontal coordination and the real-time monitoring of policies (Janssen, Charalabidis & Zuiderwijk, 2012; Ruijer et al., 2020). Transparency and informational accountability, in turn, constitute core dimensions of governance, as they establish parameters for data ownership, access control, and the traceability of decisions (Koelmel et al., 2026). The absence of these parameters amplifies informational asymmetries and weakens mechanisms of social oversight over digital public action.

The literature indicates that information governance faces specific risks in contexts of dependence on private vendors, where the custody of strategic data shifts to actors without a public mandate, thereby compromising the state's informational sovereignty (Kitchin & Moore-Cherry, 2021; Ismagilova et al.,

2019). Adaptive regulation, oriented toward protecting rights and holding private actors accountable, thus emerges as an institutional requirement rather than a discretionary choice (Bibri & Krogstie, 2017).

The operationalization of information governance requires that analysis move beyond merely identifying the existence of normative provisions related to data. What matters is the institutional architecture these provisions construct: whether they establish who holds custody of information and under what conditions it can be shared; whether they define technical standards of interoperability across public systems; whether they create transparency mechanisms that enable the auditability of data-driven decisions; and whether they establish clear responsibilities in cases of security breaches or misuse of information (Nam & Pardo, 2011; Koelmel et al., 2026).

The key analytical distinction lies between legislation that regulates data as a strategic state asset, defining its lifecycle, custodians, and uses, and legislation that merely states which data will be used to improve management, without translating this statement into verifiable institutional obligations. The former pattern constitutes substantive information governance, while the latter reflects informational rhetoric (Ruangwicha & Tuamsuk, 2026). The analysis will identify which of these patterns the data-related provisions in the examined normative instruments most closely resemble.

2.2 Institutional Capacity

Institutional capacity refers to the state's ability to formulate, coordinate, and implement public policies in the context of digital transformation. The literature moves away from interpretations that center solely on technological resources and emphasizes the articulation among organizational structures, administrative competencies, and coordination mechanisms (Neirotti et al., 2014; Almulhim & Yigitcanlar, 2025). In the context of smart cities, this capacity manifests, first, through intersectoral coordination. The integration of areas such as mobility, urban planning, technology, and environment constitutes a necessary condition to avoid policy fragmentation and duplication of efforts (Saito et al., 2021; Filipe & Duarte, 2026). The absence of such coordination tends to constrain information flows and compromise the effectiveness of public interventions.

Second, the creation of specific institutional structures, such as agencies, programs, and administrative units dedicated to managing digital transformation, stands out. Evidence indicates that formalizing these structures expands implementation capacity and reduces discontinuities associated with administrative changes (Ruangwicha & Tuamsuk, 2026; Nukpezah et al., 2025). Third, integration with planning instruments, such as master plans and multi-year plans, constitutes a relevant indicator of institutionalization. This integration provides coherence to public policies and ensures alignment between digital strategies and territorial objectives (Baptista & Rezende, 2011). In the absence of such linkage, policies tend to assume an episodic character, with limited capacity for continuity and evaluation.

The literature identifies a “capacity gap” in which strategic formulation exceeds implementation capacity, particularly in municipal contexts (Koelmel et al., 2026). This imbalance highlights that policy

effectiveness depends on the consolidation of organizational and cognitive capacities within the state. The operationalization of institutional capacity begins with the recognition that the mere creation of formal structures does not equate to the production of real implementation capacity. The literature distinguishes between nominal capacity, which depends on the existence of agencies, committees, and formal mandates, and effective capacity, which depends on equipping these arrangements with specialized human resources, decision-making authority, and intersectoral coordination instruments (Koelmel et al., 2026; Nukpezah et al., 2025).

What is examined in normative texts is whether governance structures have been created, whether these structures possess clear attributions, whether they are articulated with other sectoral bodies through formal coordination mechanisms, and whether their operation is linked to planning instruments that ensure continuity and budgetary predictability (Baptista & Rezende, 2011). The absence of any of these conditions constitutes what the literature defines as a “capacity gap”, a situation in which strategic formulation advances over an institutional base unable to sustain it operationally (Koelmel et al., 2026). The analysis will classify normative instruments according to the extent to which they overcome this gap, distinguishing between legislation that builds effective capacity and that which presupposes it without creating it.

2.3 Normative Density

Normative density refers to the degree of concreteness of public policies, that is, the extent to which normative instruments translate general guidelines into measurable, fundable, and controllable obligations (Neirotti et al., 2014). Its analytical relevance stems from a recurrent limitation in the literature: the tendency toward mimetic isomorphism, in which municipalities adopt the “smart city” rhetoric as a signal of modernity and competitiveness without possessing normative frameworks to sustain implementation (DiMaggio & Powell, 1983; Souza, 2006). When the “smart” label operates as a symbolic legitimizer dissociated from verifiable targets, normativity assumes a declaratory character, sustained by episodic programs and permanent pilot projects lacking institutional learning capacity (Baptista & Rezende, 2011).

The presence of targets, indicators, and deadlines constitutes the first marker of normative density, as it establishes parameters for accountability and for evaluating results. The absence of these dimensions prevents policy monitoring and favors the rhetorical capture of the concept (Almulhim & Yigitcanlar, 2025; Nukpezah et al., 2025). Linked funding represents the second marker: without stable, identifiable sources of funding, digital strategies remain at the discursive level, vulnerable to administrative discontinuity and fiscal constraints (Koelmel et al., 2026). The third marker concerns the degree of normative obligation and the distinction between provisions that prescribe mandatory actions and those that merely recommend or provide guidelines. Only the former produce legal obligations capable of sustaining implementation and effective social control (Ruangwicha & Tuamsuk, 2026).

The literature indicates that excessive normative rigidity may compromise the adaptability of digital policies, which require periodic revision and continuous evaluation to prevent indicators from becoming

obsolete in the face of rapid technological change (Rodrigues et al., 2021). Optimal normative density, therefore, combines operational concreteness with regulatory flexibility, enabling cycles of institutional learning. The operationalization of normative density requires a criterion to distinguish three types of normative statements, each with distinct institutional implications. The first corresponds to declaratory statements, in which the law establishes objectives or values without imposing obligations, deadlines, or responsible actors; its function is essentially symbolic and does not impose constraints on public action (DiMaggio & Powell, 1983; Souza, 2006). The second corresponds to programmatic statements, which define guidelines and orientations for future policy formulation without specifying measurable targets, funding sources, or monitoring mechanisms, producing a certain degree of political linkage but remaining difficult to audit (Baptista & Rezende, 2011).

The third corresponds to prescriptive statements, which establish concrete obligations, accompanied by indicators, deadlines, assignment of responsibilities, and funding sources, and are the only ones capable of sustaining verifiable implementation and effective social control (Almulhim & Yigitcanlar, 2025; Ruangwicha & Tuamsuk, 2026). The normative density of each instrument will be assessed based on the proportion and relative weight of these three types of statements, identifying whether the policy operates predominantly at a declaratory level or advances toward a prescriptive one.

The three analytical axes developed in this section (information governance, institutional capacity, and normative density) constitute interdependent dimensions of the institutionalization of smart city policies. Their articulation enables moving beyond readings centered on the presence of technological infrastructure and toward evaluating the extent to which normative instruments structure the strategic use of information, consolidate state capacities, and produce obligations with operational effectiveness.

3 Methodological Procedures

3.1 Research design, data source, and selection protocol

The study adopted a mixed-methods, exploratory, and descriptive approach, based on a systematic documentary survey and content analysis of the legislative corpus on smart cities in Brazil. The unit of analysis consisted of municipal and state normative acts that contained, in their full text, a direct reference to the concept of “smart city” or its variants in English.

Document collection was conducted on October 27, 2025, through the LeisMunicipais.com platform, using the National Search mode and the advanced full-text search field. The choice of this database was based on its nationwide coverage, standardized access, and the possibility of comparison across federative entities within a single environment, an essential condition for longitudinal and territorial analyses. According to the platform itself, the database includes more than 11 million normative acts. It serves municipal and state governments across all federative units, making it suitable for studies on normative diffusion at a national scale.

The search strategy employed the following descriptors in the full-text field of the norms: “Cidades Inteligentes”, “Cidade Inteligente”, “Smart City”, and “Smart Cities”. The initial search retrieved 735 acts. After preliminary filtering by document type, retaining only ordinary and complementary laws, the dataset was reduced to 733 records. In the subsequent stage, titles and abstracts were examined, and when necessary, internal text searches were performed within each norm to confirm the substantive use of the term.

A total of 15 acts without full text available in the database were excluded, along with 429 records lacking direct thematic adherence, as they mentioned the terms in a peripheral, generic, or disconnected manner from urban policy, public management, territorial innovation, or municipal planning. Figure 1 synthesizes the methodological architecture of the study, organized into five integrated stages.

Stage 1 presents the data collection and filtering process, from the search in the LeisMunicipais.com database to the definition of the final corpus of 319 laws. Stage 2 illustrates the analytical processing, combining lexical exploration, statistical analysis, and AI-assisted tools. Stage 3 highlights the validation procedures, emphasizing human supervision and methodological transparency. Stage 4 introduces the tri-axial analytical model, structured around the dimensions of information governance, institutional capacity, and normative density. Finally, Stage 5 presents the functional categorization of the norms into three groups: symbolic, instrumental, and structuring, consolidating the interpretation of the analyzed corpus.

3.2 Analytical coding, text mining, and validation of results

The analytical stage combined text mining, descriptive statistics, and qualitative coding, supported by a structured protocol. Lexical exploration of the corpus was conducted using Voyant Tools, version 2.6, a tool employed to identify term frequency, co-occurrences, lexical clouds, and semantic networks. This procedure enabled mapping the 20 most frequent terms and observing temporal variation between terms associated with *hard* dimensions, such as infrastructure, technology, and connectivity, and *soft* dimensions, such as governance, participation, inclusion, and environmental sustainability.

Statistical data processing was performed in RStudio (version 4.3.1) using descriptive statistics, proportions, annual growth rates, and temporal and relational visualizations. Time series were organized using line and area charts to examine the evolution of the corpus and the semantic transition between technocentric and institutional approaches. Additional visualization techniques were applied to identify lexical clustering and territorial patterns based on the consolidated matrix. Given the volume of the dataset, approximately 4.3 million words, NotebookLM was used as an auxiliary tool for the preliminary extraction of entities, the initial identification of recurring themes, and the provisional organization of analytical categories.

The use of this tool did not replace human reading nor independently support any classification decision. To ensure methodological transparency and reduce the risk of interpretive error, four safeguards were adopted. First, the prompts were descriptive and exploratory, aimed at identifying recurring themes,

references to planning instruments, indicators, funding sources, and mentions of the Brazilian Smart Cities Charter. Second, the outputs generated were treated as preliminary inputs, without automatic category assignment. Third, each document underwent full manual reading to confirm, correct, or reject the suggestions extracted by the tool. Fourth, ambiguous or hybrid cases were reviewed separately according to a previously defined coding protocol. This strategy preserved human analytical control throughout the classification process and mitigated the risk of improper inferences from artificial intelligence.

The classification of norms followed three central axes. The first corresponded to the normative type, distinguishing between ordinary laws, complementary laws, and state-level norms. The second corresponded to normative function, with three operational categories: symbolic, referring to norms that acknowledge the theme without creating instruments, competencies, targets, or implementation mechanisms; instrumental, referring to norms that establish programs, rules, or execution and sectoral regulation mechanisms related to the theme; and structuring, referring to norms that incorporate the concept in a transversal manner into public management, linking it to planning instruments, budgeting, governance, monitoring, or institutional coordination. The third axis corresponded to institutional content, through the identification of indicators, funding sources, references to the Brazilian Smart Cities Charter, and links to the Master Plan, the Multi-Year Plan, and Agenda 2030.

In cases where a single norm exhibited characteristics of more than one functional category, the criterion of substantive predominance was adopted. Final classification was assigned based on the dominant function within the normative design, while secondary overlaps were recorded in an auxiliary dataset for analytical control. This procedure avoided classificatory duplication and preserved comparative consistency across cases. Validation of the analysis was conducted through two complementary approaches. First, a full manual review of all norms in the corpus was conducted, with textual verification of the coded variables. Second, borderline cases were subjected to a focused re-reading, particularly when ambiguity existed between symbolic, instrumental, and structuring functions. The final analysis resulted from the triangulation of a systematic search, text mining, and supervised human coding, producing a structured, auditable analytical matrix capable of supporting the statistical and interpretative analyses presented in the following sections.

3.3 Analytical Model: operationalization of theoretical dimensions

The reading of the legislative corpus is guided by an analytical model constructed from the three theoretical axes developed in Section 2. Each axis operates as an evaluative dimension applied to normative instruments, enabling the examination not of the nominal presence of the term “smart city”, but of the degree of substantive institutionalization of the associated policies. This shift is methodologically relevant, since the mere mention of the concept does not constitute evidence of institutional transformation; what matters is the normative architecture that instruments effectively construct (Koelmel et al., 2026; Ruangwicha & Tuamsuk, 2026).

Information governance is operationalized by identifying provisions that regulate custody, interoperability, transparency, and accountability related to public data. The analysis distinguishes between legislation that structures data as a strategic state asset, that is, defining lifecycle, custodians, and conditions of use, and legislation that merely states the use of data without creating verifiable institutional obligations. The former pattern constitutes information governance in a substantive sense, while the latter corresponds to what the literature defines as informational rhetoric (Nam & Pardo, 2011; Ruangwicha & Tuamsuk, 2026).

Institutional capacity is operationalized by the presence in normative texts of formal structures endowed with explicit mandates, intersectoral coordination mechanisms, and links to planning and budgeting instruments. The central distinction contrasts effective capacity, arrangements with authority, resources, and intersectoral articulation capable of overcoming the “capacity gap” identified in the literature, with nominal capacity, characterized by the formal creation of bodies without operational conditions for implementation (Koelmel et al., 2026; Nukpezah et al., 2025).

Normative density is operationalized through the classification of normative statements into three types: declaratory, which state objectives or values without creating obligations; programmatic, which define guidelines without specifying targets, resources, or responsible actors; and prescriptive, which establish concrete obligations accompanied by indicators, deadlines, and funding sources. The analysis evaluates the proportion and relative weight of these types within each instrument, identifying whether the policy operates predominantly at a symbolic level or advances toward an operational one (DiMaggio & Powell, 1983; Almulhim & Yigitcanlar, 2025; Baptista & Rezende, 2011).

The three dimensions are applied in an integrated manner and correspond directly to the functional categories used in the coding of norms, symbolic, instrumental, and structuring, establishing the bridge between the theoretical framework and the analytical procedure. Norms classified as symbolic tend to concentrate declaratory statements, lack implementation structures, and present low regulation of data; instrumental norms exhibit partial operational capacity, with some degree of normative density but limited coordination; structuring norms approximate the pattern of substantive governance, with effective institutional capacity and prescriptive density. Table 1 summarizes the empirical markers and analytical distinctions that guide this interpretation and will be revisited in the analysis of results.

Table 1
Analytical dimensions, empirical markers, and critical distinctions

Dimension	Central concept	Empirical markers in legislation	Critical analytical distinction
Information governance	Data as a strategic asset (Nam & Pardo, 2011; Kitchin, 2021; Hu et al., 2024)	Institutional structuring of the data lifecycle (production, custody, use, disposal), definition of data custody, interoperability standards, transparency and auditability mechanisms, and accountability for misuse	Substantive governance (regulates data as an asset, defines custody, uses, and responsibilities) vs. informational rhetoric (states data use without creating verifiable obligations)
Institutional capacity	Implementation capacity (Koelmel et al., 2026; Nukpezah et al., 2025; Baptista & Rezende, 2011)	Formal structures with authority, resources, and intersectoral coordination mechanisms, explicit mandates, linkage to planning instruments, and provision of specialized human resources	Effective capacity (structures with authority, coordination, and budget that overcome the "capacity gap") vs. nominal capacity (formal creation of bodies without authority, resources, or coordination)
Normative density	Policy concreteness (DiMaggio & Powell, 1983; Almulhim & Yigitcanlar, 2025; Souza, 2006)	Type of statement (declaratory, programmatic, prescriptive), presence of targets and performance indicators, linked funding sources, defined deadlines, and responsibilities	Prescriptive statements (concrete obligations with indicators, deadlines, responsible actors, and funding, subject to audit and social control) vs. declaratory statements (expression of objectives or values without constraints on action, symbolic function)

Source: elaborated by the author based on Nam & Pardo (2011), Koelmel et al. (2026), Almulhim & Yigitcanlar (2025), DiMaggio & Powell (1983), Baptista & Rezende (2011), Ruangwicha & Tuamsuk (2026).

The three axes presented (information governance, institutional capacity, and normative density) constitute integrated analytical dimensions that guide the reading of the legislative corpus. These axes serve as interpretative filters, allowing the evaluation of both the presence of the term "smart city" and the degree of institutionalization of the associated public policies. The analysis thus shifts from a descriptive to an analytical perspective, in which legislation is examined for its capacity to structure the strategic use of information, consolidate state capacities, and produce norms with operational effectiveness.

4 Results

4.1 Normative Landscape: Temporal, Territorial, And Institutional Distribution Of Brazilian Smart City Laws (2013–2025)

Between 2013 and 2025, a total of 319 municipal and state laws with substantive reference to the concept of smart cities were identified, distributed across 27 federative units and approximately 180 municipalities. Of this total, 253 norms (79.3%) had a confirmed year of enactment and compose the analyzed time series. In contrast, the remaining 66 (20.7%) did not present a verified sanction date in the original documents (due to file fragmentation, absence of headers in technical annexes, or recent insertion into the system without formal closure of the text). These were included in spatial and typological analyses but excluded from temporal distribution.

The corpus is predominantly composed of ordinary laws (n = 259; 81.2%), a typical instrument for programmatic execution and budget management, and complementary laws (n = 60; 18.8%), whose higher normative hierarchy makes them a preferred vehicle for structural reforms (such as revisions of master plans and administrative reorganization). This distribution is not trivial, as it indicates that the smart city concept has been incorporated into the Brazilian legal system primarily through operational instruments, with direct implications for normative density and the effective institutional capacity of the resulting policies.

The historical series of the 253 dated laws reveals three distinct phases of normative evolution. The initial phase (2013–2018) includes 12 laws (4.7%), concentrated mainly in municipalities in the state of São Paulo, such as Santos, Botucatu, and Sorocaba. The expansion phase (2019–2021) comprises 52 laws (20.6%), representing a 333% increase over the previous phase, and marks the entry of new states (including Ceará, Rio Grande do Sul, Rio de Janeiro, Goiás, and Paraná). The consolidation phase (2022–2025) concentrates 189 laws (74.7% of the dated corpus), with a peak of 54 norms in 2025, and is characterized by increasing alignment with the Brazilian Smart Cities Charter (Brazil, 2021). The 66 undated norms are distributed across regional and typological analyses, preserving the integrity of the full corpus of 319 laws.

Normative production increases by 333.3% relative to the previous phase, but remains predominantly at a declaratory level, without structuring instruments for information governance, interoperability, or results evaluation (Bibri & Krogstie, 2017). The consolidation phase (2022–2025) accounts for 74.7% of total legislative production, marked by the growing influence of the Brazilian Smart Cities Charter (Brazil, 2021), which served as a normative catalyst. Law No. 12,900/2023 of Sorocaba, for example, explicitly refers to the Charter as “an important supporting and reference document for legislative initiatives across Brazil”, indicating a non-binding framework capable of inducing discursive convergence without ensuring institutional standardization. It is in this phase that the first structuring norms emerge (linked to master plans, multi-year plans, and data governance mechanisms), though they still represent a minority within the overall set.

Regional distribution confirms a pattern of concentration associated in the literature with typical Global South asymmetries (Yigitcanlar et al., 2020). The Southeast (46.8%; n = 149) and South (39.4%; n = 126) regions account for 86.2% of total normative production, while the Northeast (8.3%; n = 26), Center-West (3.7%; n = 12), and North (1.8%; n = 6) remain marginal. This concentration is not merely quantitative, as it reflects differentiated institutional capacities. Municipalities such as Sorocaba (SP), Gravatal (SC), Curitiba (PR), and Maringá (PR) produce norms with higher normative density and institutional capacity, integrating the concept into territorial planning instruments and public budgeting. In contrast, norms from peripheral regions tend to concentrate in symbolic laws (such as commemorative weeks, idea banks, and state-level guideline legislation without implementation mechanisms), reproducing the structural deficit of information governance identified by Koelmel et al. (2026) as a key obstacle to translating digital policies into measurable public value.

Cross-analysis of the three analytical dimensions (information governance, institutional capacity, and normative density) enables the classification of the corpus into three functional patterns. Structuring norms (n = 164; 51.4%) constitute the core of public policy, integrating smart cities into master plans, innovation funds, budgetary targets, and intersectoral coordination mechanisms, as illustrated by cases such as Gravatal (SC), Natal (RN), Sorocaba (SP), and Fortaleza (CE). Instrumental norms (n = 120; 37.6%) operate as protocols of intention, defining principles and priorities (often through standardized templates), but lacking administrative structure or budgetary allocation within the norm itself; that is, their institutional capacity is nominal, and their information governance remains at a declaratory level. Symbolic norms (n = 35; 11.0%) perform an essentially discursive and commemorative function, without creating obligations, structures, or implementation instruments; their normative density is declaratory (DiMaggio & Powell, 1983). Table 2 synthesizes this landscape, articulating analytical dimensions with temporal phases, territorial distribution, and the functional patterns identified in the corpus.

Table 2
– Normative landscape of smart cities in Brazil (2013–2025)

Phase / Period	Laws (n)	Predominant territory	Functional pattern	Information governance
Historical series (n = 253; 79.3%)				
Initial phase (2013–2018)	12 (4.7%)	Southeast (SP), Santos, Botucatu, Sorocaba (technocentric pioneering)	Symbolic/incipient instrumental (sensor authorization without coordination)	Informational rhetoric (data use stated without institutional architecture)
Expansion phase (2019–2021)	52 (20.6%, + 333%)	Southeast, South, Northeast, entry of GO, PR, CE, RJ, RS	Predominantly instrumental (guidelines, initial budget linkage)	Enunciative (participation and sustainability without data regulation)
Consolidation phase (2022–2025)	189 (74.7%, peak: 54 in 2025)	Southeast, South (SC and SP lead)	Structuring (emergent), linkage to plans, funds, sandboxes	Substantive (selective), regulated data lifecycle in leading municipalities
Undated laws (n = 66; 20.7%)	66	All federative units	Included in spatial and typological analysis	Excluded from time series (data fragmentation, missing headers, recent insertion)
Regional distribution (N = 319)	—	Southeast 46.8%, South 39.4%, Northeast 8.3%, Center-West 3.7%, North 1.8%	South + Southeast = 86.2% (territorial concentration)	Substantive governance is concentrated in the South-Southeast
Functional distribution (N = 319)	—	—	Structuring 51.4%, Instrumental 37.6%, Symbolic 11.0%	Substantive governance in structuring norms, rhetoric in symbolic, and part of instrumental governance

Source

elaborated by the author based on the analysis of the legislative corpus (LeisMunicipais.com, 2025), Nam & Pardo (2011), Koelmel et al. (2026), DiMaggio & Powell (1983), Almulhim & Yigitcanlar (2025), Yigitcanlar et al. (2020).

Note

temporal phases refer to the 253 norms with confirmed year of enactment. The remaining 66 laws, without identified dates, were included only in regional and typological analyses. Functional

classification and the information governance dimension result from protocol-assisted qualitative coding.

The integrated reading of Table 2 indicates that the quantitative growth of normative production does not translate into linear advancement across the three analytical dimensions. Substantive information governance (that which regulates the data lifecycle, defines custody, and establishes accountability mechanisms) remains exceptional, concentrated in municipalities with an established tradition of territorial planning and above-average administrative capacity. Effective institutional capacity is likewise restricted to a fraction of the corpus. The formal creation of agencies and programs is frequent. However, the provision of these arrangements with decision-making authority, intersectoral coordination, and budgetary linkage (conditions that distinguish effective capacity from nominal capacity) remains limited (Koelmel et al., 2026; Nukpezah et al., 2025).

Normative density follows this same pattern. Most laws operate at a programmatic or declaratory level, stating objectives and values without defining measurable indicators, deadlines, or linked funding sources, a condition that, according to Baptista and Rezende (2011), undermines social control and favors the rhetorical capture of the concept. The resulting scenario is that of a public agenda in transition, numerically expressive and discursively convergent around the Brazilian Smart Cities Charter, yet institutionally fragmented and territorially asymmetric. Brazilian urban intelligence, as the data suggest, remains more declared than measured, and its effective institutionalization depends less on the production of new norms than on the quality of the institutional architecture these norms construct.

4.1 From Infrastructure To Governance: The Normative Maturation Of Smart Cities

4.2.1 Lexical analysis and the hard/soft transition

The lexical exploration of the normative corpus, conducted with Voyant Tools, reveals a measurable paradigmatic shift in Brazilian legal vocabulary on smart cities: from a technocentric matrix (centered on physical infrastructure and connectivity) to an institutional and sociopolitical approach oriented toward governance, participation, and sustainability. This semantic inflection not only confirms the periodization proposed in the international literature (Bibri & Krogstie, 2017; Yigitcanlar et al., 2018), but also documents it empirically through frequencies, co-occurrences, and lexical trends observable within the legal framework itself, as summarized in Fig. 2.

In the initial period of the series (2013–2018), the lexical structure is concentrated around terms such as “infrastructure”, “technology”, “fiber optics”, “Wi-Fi”, and “digitalization”, indicating a conception of urban intelligence as an attribute derived from installed technological density. The legislation of Santos (2013) and São Caetano do Sul (2016) exemplifies this pattern: the focus lies on the availability of technical networks and the digitalization of services as ends in themselves, without articulation with governance instruments, information regulation, or social participation. This corresponds to phase 1.0, in which

urban intelligence is operationalized as infrastructure expansion rather than institutional capacity (Bibri & Krogstie, 2017).

From 2019 onward, a progressive inflection can be observed. Terms such as “planning”, “participation”, “inclusion”, “sustainable”, and “governance” gain relative centrality, while technical vocabulary loses proportional dominance. This semantic shift accompanies the expansion of the normative repertoire beyond São Paulo, with the inclusion of states such as Ceará, Rio Grande do Sul, Goiás, and Paraná, and coincides with the increasing incorporation of the SDGs as a legislative reference.

Note

Figure 2A shows the annual variation in the 20 most frequent terms in smart city legislation (2013–2025), revealing oscillations and shifts in focus. Until 2018, *hard* terms prevailed, while from 2020 onward, *soft* terms gained prominence. Figure 2B synthesizes this transition, highlighting the shift from a technical discourse to an institutional approach oriented toward inclusion and the Sustainable Development Goals.

Co-occurrence analysis reinforces this reconfiguration. “Development” operates as an aggregating core connecting economic, social, and environmental dimensions; “innovation” functions as a bridge between technology and public strategy; and “participation” and “governance” emerge as elements of the *soft* core, although still peripheral within the overall lexical structure. The interpretation of Table 3 requires a key analytical qualification: the *hard/soft* transition in Brazil does not represent a paradigmatic substitution, but rather an incomplete overlap. “Development” (100%) and “innovation” (87%) retain absolute dominance, while “governance” appears in only 23% of the norms and “digitalization” in 15%.

Table 3
– Frequency and semantic trends of key terms in legislation

Term	Total frequency	Presence (%)	Semantic trend
Development	8412	100%	Umbrella term structuring economic, social, and environmental growth agendas
Innovation	7346	87%	Core of technological discourse and municipal modernization policies
Technology	3087	61%	Technical support for service digitalization and administrative efficiency
Education	2887	59%	Associated with capacity-building and social inclusion, especially in innovation contexts
Planning	2520	55%	Central instrument of urban and territorial management
Infrastructure	2197	51%	Refers to physical works, connectivity, and urban networks
Participation	1498	44%	Linked to democratic governance and collaborative policymaking
Sustainable	1092	41%	Emphasis on environmental integration with Agenda 2030
Environment	1061	40%	Ecological foundation of municipal sustainability policies
Economy	894	38%	Focus on local development, entrepreneurship, and productive innovation
Mobility	698	32%	Increasing term in post-2020 legislation, related to urban accessibility
Inclusion	681	31%	Associated with equity, accessibility, and social policies
Sustainability	440	27%	Consolidated long-term institutional discourse
Quality of life	419	26%	Synthetic indicator of urban and social policies
Governance	290	23%	Expresses integrated management and accountability logic
SDGs	186	21%	Direct linkage to the Sustainable Development Goals
Public participation	106	17%	Emphasis on hearings, consultations, and municipal councils
Digitalization	75	15%	Reinforces the transition toward e-government and smart cities

Source

elaborated by the author based on lexical analysis of the normative corpus (Voyant Tools, v. 2.6).

4.2.2 Analytical dimensions and empirical markers

The functional classification of the corpus into three categories (symbolic, instrumental, and structuring) enables moving beyond a purely quantitative analysis and assessing the extent of institutionalization of smart city policies. Each category expresses a distinct pattern of relationship between normative vocabulary and the institutional architecture that sustains it, and its distribution within the corpus (11.0%, 37.6%, and 51.4%, respectively) reveals both the advances and the limitations of the Brazilian institutionalization process.

Structuring norms (n = 164; 51.4%) constitute the densest layer of the corpus and approximate the pattern of substantive governance described by Nam and Pardo (2011). They integrate the smart city concept into territorial planning instruments, public budgeting, and intersectoral coordination mechanisms. The Master Plan of Itaguara (Complementary Law No. 68/2024) exemplifies this category by translating the theoretical triad of Almulhim and Yigitcanlar (2025) into territorialized guidelines aligned with local targets, Agenda 2030, and the New Urban Agenda.

The Multi-Year Plan 2022–2025 of Jaguapitã (Law No. 52/2021) structures governmental action around transparency, measurable indicators, and public efficiency, demonstrating that urban intelligence lies not in technological devices, but in evidence-based management. In more advanced cases, such as Sorocaba (Law No. 12,900/2023) and Fortaleza (Law No. 11,373/2023), norms establish observatories, innovation funds, regulatory sandbox mechanisms, and institutional architectures that enable policy formulation, testing, evaluation, and iterative correction. The inclusion of the “Right to Smart Cities” as a principle of territorial regulation in the master plans of Cabo Frio (RJ), Maringá (PR), and Sorocaba (SP) represents an additional step toward institutionalization, transforming the concept from a sectoral program into a structuring guideline for land use.

Instrumental norms (n = 120; 37.6%) operate as protocols of intention. They define principles, list priorities, and establish guidelines, but lack administrative structure, budgetary allocation, or formally established coordination mechanisms within the norm itself. Municipalities such as Cabo Frio, Franca, Parnamirim, and Contagem have adopted, within this category, legislation with nearly identical content, a phenomenon the literature describes as mimetic isomorphism (DiMaggio & Powell, 1983). These norms define a smart city as one that possesses “collective intelligence” and enumerate priorities such as “generating data for efficient planning” without specifying who produces the data, how it is governed, or under what criteria it is used. From 2023 onward, the proliferation of instrumental norms for technical cooperation through networks such as ANCITI and CONACIN suggests a potentially relevant movement of intergovernmental collaboration. However, one still lacks concrete mechanisms for interoperability and shared data governance.

Symbolic norms (n = 35; 11.0%) perform an essentially discursive and commemorative function, without creating obligations, structures, or implementation instruments. Law No. 16,534/2025 of Curitiba, which establishes the “Smart Cities Day” in the municipal calendar, Law No. 6,315/2023 of Amazonas, which creates the “Week of Debates on Creative Economy and Smart Cities”, and Law No. 3,395/2021 of Tambaú, which establishes a “Bank of Innovative Ideas and Practices” without budgetary guarantees, exemplify this pattern. Although they represent a minority of the corpus, these norms are analytically relevant because they document the clearest expression of the phenomenon described in the literature as smartwashing, that is, the use of the “smart” label as a strategy of political legitimation without any verifiable institutional commitment (Angelidou, 2014; Souza, 2006).

From a regional perspective, structuring norms are concentrated in the South-Southeast axis, where municipalities with an established tradition in territorial planning exhibit greater capacity to translate the concept into operational instruments. The Southeast prioritizes master plans and land-use regulation instruments, the South combines budget execution with emphasis on public security and urban services, and the Center-West links the concept to the science, technology, and innovation agenda. In peripheral regions, instrumental and symbolic norms predominate, confirming the territorial asymmetry identified in the literature on the Global South (Yigitcanlar et al., 2020). The institutional capacity to translate normative discourse into operational public policy is unevenly distributed across the national territory.

4.2.3 Critical distinctions: effective governance versus informational rhetoric

The analysis of the corpus reveals a central analytical distinction that the functional categorization only partially captures: the difference between norms that construct information governance in a substantive sense and those that operate within the domain of informational rhetoric. This distinction, which is fundamental for assessing the institutional maturity of smart city policies, cuts across the three functional categories and does not necessarily coincide with them. There are instrumental norms with isolated data governance provisions and formally structured norms that regulate territorial planning without addressing custody, interoperability, or the protection of the data generated by their own policies.

Informational rhetoric predominates in the corpus. Laws such as those of Sete Lagoas (2025) and São Sebastião do Paraíso (2021) refer to “data security” and “information protection” as abstract principles, without establishing technical parameters, institutional responsibilities, or references to the General Data Protection Law (LGPD, Federal Law No. 13,709/2018). This pattern aligns with the diagnosis of Ruangwicha and Tuamsuk (2026), who argue that public agencies may demonstrate high conceptual awareness of data governance without translating it into actual performance in information management, indicating that the bottleneck is structural rather than cognitive. The absence of comparable metrics, interoperability standards, and accountability instruments compromises social oversight and reproduces the weaknesses in information policy identified by Ismagilova et al. (2019) and Kitchin and Moore-Cherry (2021).

Cases of structured governance are limited, yet analytically revealing of an emerging pattern. Law No. 1,818/2022 of Assaí (PR) establishes “system interoperability” and explicitly references the LGPD as a parameter for personal data protection. The municipal law of Pomerode (2025) requires that video monitoring respect individual rights and establishes guidelines for compliance and IT governance. The most advanced case is the law of São José dos Pinhais (2025), which establishes a “Municipal Policy for Digital Sovereignty and Data Security” and explicitly prohibits the outsourcing of data hosting infrastructure for sensitive information, constituting the first manifestation of informational sovereignty at the municipal level within the analyzed corpus. Complementary Law No. 866/2025 of Chapecó, by incorporating principles of transparency and digital integration into the regulation of public security, represents the first case of sensitive data regulation in an essential service context, indicating an emerging but still limited level of institutional maturity.

The phenomenon of mimetic isomorphism (DiMaggio & Powell, 1983) permeates the entire corpus and is particularly visible in symbolic norms and a significant portion of instrumental norms. Between 2018 and 2021, a period identified by the data as dominated by “territorial marketing”, municipalities adopted the “smart city” label to signal modernity and competitiveness without possessing the governance architecture required to implement the policies described. The standardization of legislative texts (nearly identical laws adopted by municipalities of varying sizes, regions, and administrative capacities) is the most visible expression of this process. It indicates formal convergence without institutional convergence, producing what the literature defines as smartwashing (Angelidou, 2014; Hollands, 2008).

The inflection observed from 2022 onward, with the growth of structuring norms and the emergence of data governance provisions, does not eliminate this pattern but relativizes it. Cases such as Sorocaba, Itaguara, Fortaleza, and Assaí demonstrate that the institutionalization of information governance is possible within the Brazilian context, yet remains exceptional and geographically concentrated. The recurrent reliance on the Brazilian Smart Cities Charter (Brazil, 2021) as the primary normative reference (without binding force and without standardized metrics) limits comparability across experiences. It prevents the establishment of a national system for evaluating digital urban policies. As indicated by Almulhim and Yigitcanlar (2025), the absence of accountability mechanisms and stable funding structures structurally compromises the effectiveness of smart governance agendas, converting the rhetoric of innovation into verifiable planning only in municipalities that already possess prior institutional capacity.

Overall, the results confirm that Brazilian urban intelligence is shifting from the *hard* to the *soft* dimension, progressively incorporating the vocabulary of governance, participation, and sustainability. This advancement is asymmetric, territorially concentrated, and institutionally incomplete. Most laws lack the elements required to translate normative guidelines into auditable policies, such as indicators, funding sources, data standards, and intersectoral coordination mechanisms. Urban “intelligence” thus remains, to a large extent, more declared than measured, characterizing a transitional stage in which normative accumulation has not yet been converted into effective institutional capacity to govern urban information in a strategic, equitable, and democratic manner (Nam & Pardo, 2011; Koelmel et al., 2026).

5. Discussion of Results

5.1 Mimetic isomorphism and the phenomenon of legislative smartwashing

The significant normative volume identified in this study (319 laws distributed across 27 federative units in little more than a decade) could be interpreted as evidence of the consolidation of a robust public agenda for urban digital transformation. A more rigorous analysis, however, reveals the opposite. The quantitative growth of legislative production is largely dissociated from the construction of effective state capacity. The 333% increase between the initial and expansion phases does not correspond to an equivalent rise in normative density, institutional capacity, or information governance. Instead, it reflects a process of rhetorical diffusion in which the “smart city” label has been appropriated by local governments as a strategy of political legitimation, without correspondence in verifiable institutional architectures.

This pattern finds a precise explanation in the concept of mimetic isomorphism, defined by DiMaggio and Powell (1983) as the tendency of organizations under conditions of uncertainty and legitimacy pressure to imitate the structures and vocabularies of entities perceived as successful, regardless of a critical assessment of their suitability to the local context. In the Brazilian case, isomorphic pressure operates at two simultaneous levels. At the horizontal level, municipalities with radically different administrative capacities, sizes, and socioeconomic contexts adopt legislation with nearly identical content, standardized texts that list principles, enumerate priorities, and define “smart city” in convergent language, without adaptation to local implementation conditions.

At the vertical level, the Brazilian Smart Cities Charter (Brazil, 2021) has paradoxically functioned as a catalyst for this isomorphism. By providing a conceptual framework without binding force, standardized metrics, or defined funding sources, the document has encouraged discursive adherence without imposing the institutional conditions necessary for operationalization. The result is formal convergence (in vocabulary and legal structure) coexisting with profound substantive divergence in implementation capacity.

The resulting phenomenon can be described as legislative smartwashing, that is, the production of norms that incorporate the vocabulary of urban innovation without building the institutional conditions required for execution, functioning essentially as a mechanism of territorial marketing and signaling of modernity to voters and investors (Angelidou, 2014; Hollands, 2008; Souza, 2006). Symbolic norms (which represent 11% of the corpus and manifest in the creation of commemorative dates, debate weeks, and idea banks without budgetary obligations) constitute the clearest expression of this phenomenon.

However, smartwashing is not limited to this category. A significant portion of instrumental norms (37.6% of the corpus) also operates within the domain of nominal capacity, creating formal structures

devoid of decision-making authority, specialized human resources, and intersectoral coordination mechanisms. The distinction between these laws and purely symbolic ones is one of degree rather than nature; both articulate a commitment to urban intelligence without producing the instruments required to translate that commitment into auditable public policy.

5.2 The paradox of “intelligence” without data: the vacuum of information governance

The lexical evolution documented in this study (from the *hard* vocabulary of infrastructure to the *soft* vocabulary of governance, participation, and sustainability) could suggest a substantial conceptual maturation of the Brazilian normative corpus. This interpretation reflects an analytical misconception that conflates the incorporation of institutional vocabulary with the construction of institutional architecture. The most revealing finding in Table 3 is not the increasing presence of terms such as “governance” and “participation”, but their relatively low incidence (23% and 44%, respectively), in contrast with the absolute dominance of “development” (100%) and “innovation” (87%). Even more significant is the near absence of operational terms such as “interoperability”, “data custody”, “personal data protection”, and “LGPD”, that is, the vocabulary that distinguishes informational rhetoric from substantive information governance.

Nam and Pardo (2011) established, with enduring precision, that a city's intelligence does not reside in its technological apparatus but in its institutional capacity to use information strategically, ethically, and collaboratively to produce evidence-based decisions. By this criterion, most of the Brazilian legislative corpus does not produce smart cities; it produces cities that legislate about urban intelligence without constructing the informational infrastructure that such intelligence requires. This distinction is not merely semantic; it has direct consequences for the state's capacity to monitor policies, allocate resources dynamically, and hold public and private actors accountable for the use of urban data.

Koelmel et al. (2026) describe this mismatch as a “capacity gap”, a condition in which political strategy and institutional vision evolve more rapidly than the “digital plumbing” required to operationalize them, including data systems, interoperability standards, custody protocols, and accountability mechanisms that transform raw data into actionable knowledge. The Brazilian corpus clearly exhibits this gap. Laws refer to “data for efficient planning”, “evidence-based decisions”, and “real-time monitoring”, but do not define who holds data custody, under what conditions data can be shared, which technical interoperability standards are required, or what responsibilities apply in cases of misuse. The absence of references to the LGPD in the vast majority of norms (despite the federal law being in force since 2020) is symptomatic, revealing that urban digital transformation is largely conceived as administrative modernization rather than a reconfiguration of the relationship between the state, data, and citizens.

Exceptional cases such as Assaí (PR), Pomerode (SC), and São José dos Pinhais (PR) are analytically relevant precisely because of their rarity. They demonstrate that substantive information governance is possible within the Brazilian institutional context, but that its emergence depends on specific local conditions of prior administrative capacity, rather than on a national regulatory framework capable of

inducing it systematically. In the absence of such a framework, the vacuum of information governance reproduces itself across the federation, with the custody of strategic data progressively shifting to private vendors without public mandate, a risk identified as a threat to state informational sovereignty (Kitchin & Moore-Cherry, 2021). The Brazilian corpus implicitly documents this risk through the absence of any regulation addressing vendor dependency in the examined smart city policies.

5.3 The “smart city” as a vector of inequality in the Global South

The concentration of 86.2% of normative production on smart cities in the South and Southeast regions is not a peripheral finding; it is the most structurally revealing result of this study. It demonstrates that, in the absence of a structuring federal policy with redistributive capacity, the diffusion of the smart cities agenda in Brazil follows and amplifies the pre-existing map of territorial inequalities. Regions with greater administrative capacity, more developed digital infrastructure, and better access to technical resources develop denser, more institutionalized norms. At the same time, the North, Northeast, and Central-West remain at the margins. Where legislation exists in these regions, it is predominantly symbolic or instrumental, lacking implementation instruments. The result is the formation of “islands of intelligence” within the national territory, municipalities such as Sorocaba, Gravatal, and Fortaleza that move toward substantive governance, surrounded by a broad context of digital institutional informality.

This pattern confirms and deepens the diagnosis of the critical literature on smart cities in the Global South. Yigitcanlar et al. (2020) argue that the uncritical adoption of smart city models developed in Global North contexts, in countries marked by deep socio-spatial asymmetries, tends to selectively benefit already dynamic territories while marginalizing vulnerable populations that would most benefit from the promises of urban innovation. In the Brazilian case, federal mediation is structurally insufficient. The Brazilian Smart Cities Charter is non-binding, does not provide resource transfers, does not establish mandatory minimum capacities, and does not create induction mechanisms for smaller municipalities or peripheral regions.

It treats municipalities with radically different realities as equivalent in their capacity to formulate and implement digital transformation policies, effectively naturalizing and institutionalizing pre-existing inequalities. The Global South literature also documents how smart city technologies may operate as a “social filter”, benefiting connected elites while amplifying the exclusion of already marginalized populations, a phenomenon metaphorically described by Angelidou (2014) and others as the “smarter favela”, a condition in which smart infrastructure advances in formal urban areas while informal settlements remain invisible to data and monitoring systems.

The Brazilian corpus is not immune to this risk. The near-total absence of binding norms on digital inclusion, equitable access to digital public service platforms, and data protection for vulnerable populations indicates that the smart cities agenda has largely been formulated without explicitly considering the groups that most need to be incorporated into (and protected by) the information governance systems these policies promise to build. The occasional inclusion of terms such as

“eradicating poverty” and “reducing inequalities” in some legislative cases (Sorocaba, Fortaleza) remains at a declaratory level when not articulated with budgetary instruments, equity indicators, and territorially disaggregated monitoring mechanisms.

5.4 Implications for urban planning: the post-normative agenda

The results of this study point to a diagnosis that does not support an optimistic interpretation. Brazil has completed an expressive normative cycle on smart cities, yet it has not achieved the substantive institutionalization that this cycle promised. The phase of declaratory expansion, in which the strategic value lay in legislating on the topic, has reached its limits. The continued production of symbolic and instrumental norms, without prescriptive density, does not expand the state’s capacity to govern urban information; it deepens the gap between normative discourse and institutional practice, while consuming political capital and policy-design resources that could instead be directed toward improving existing instruments.

The emerging post-normative agenda requires, first, the mandatory linkage of smart city policies to the Master Plan and the Multi-Year Plan, the two instruments within the Brazilian legal framework that can ensure territorial binding force, administrative continuity, and budgetary predictability for digital governance strategies. The City Statute (Federal Law No. 10,257/2001) provides the legal foundation for this integration. Urban intelligence, understood as the institutional capacity to govern data to deliver equitable services and evidence-based decisions, is fully compatible with the principles of the social function of property, democratic governance, and participatory territorial planning that underpin the statute. Incorporating information governance as a mandatory directive of the Master Plan, rather than as an optional sectoral policy, would mark the transition from a “city that legislates on technology” to a “city that governs through evidence”, enabling the institutional shift that the Brazilian normative corpus signals but does not yet realize.

Second, overcoming the federal vacuum requires the national government to assume an enabling role that the Brazilian Smart Cities Charter has been unable to perform due to its non-binding nature. This implies the creation of a federal legal framework establishing minimum mandatory data governance capacities for municipalities adopting smart city policies, defining national interoperability standards, requiring explicit reference to the LGPD in all norms addressing urban data, and linking access to voluntary transfers and innovation funding to compliance with minimum standards of normative density and institutional capacity. Without such an enabling role, territorial inequality in the distribution of urban intelligence is likely to deepen, not because municipalities in the North and Northeast lack the capacity to innovate, but because they have been structurally deprived of the resources, standards, and incentives necessary for institutional innovation.

Third, the exceptional cases identified in the corpus (Sorocaba, Itaguara, Assaí, São José dos Pinhais) must cease to function as isolated examples and instead become regulatory references. Systematizing these experiences into replicable models, combined with mechanisms for technical transfer across

municipalities and comparative evaluation through standardized indicators, represents the most effective path for expanding institutional capacity in contexts of administrative heterogeneity. As argued by Almulhim and Yigitcanlar (2025), smart governance is not established by decree; it emerges from continuous cycles of institutional learning, in which the ability to monitor, evaluate, and adjust policies is as strategic as the ability to design them. Brazil already possesses sufficient empirical evidence to initiate such a cycle; what remains is the political capacity to transform these experiences into a national standard, rather than leaving them as isolated cases of excellence within a broader landscape of normative rhetoric.

6 Conclusion

The analysis of the Brazilian legislative corpus on smart cities reveals a structural contradiction. The significant normative growth documented does not translate into an equivalent advancement in the institutionalization of policies. The semantic transition from a *hard* vocabulary (centered on infrastructure and connectivity) to a *soft* one, oriented toward governance, participation, and sustainability, is empirically observable, yet remains predominantly discursive. Mimetic isomorphism (DiMaggio & Powell, 1983) explains this mechanism. Municipalities with radically different administrative capacities and socioeconomic contexts have adopted convergent legislation not due to institutional adequacy, but as a strategy of political legitimation.

The result is a corpus largely composed of norms characterized by nominal capacity, which create formal structures, state principles, and mobilize the vocabulary of innovation without constructing the information governance architecture that such vocabulary presupposes. The capacity gap (Koelmel et al., 2026) thus manifests not as a technological deficit, but as an institutional one. This is reflected in the absence of data-custody mechanisms, interoperability standards, linked funding sources, and auditable indicators that turn legislation into effective public policy.

The main practical implication of this finding is direct. The phase of declaratory expansion has reached its limits, and its continuation only deepens the gap between normative production and implementation capacity. Urban intelligence in Brazil will cease to function as territorial marketing once it is mandatorily incorporated into the City Statute's instruments, specifically the Master Plan and the Multi-Year Plan. These instruments are the ones capable of ensuring territorial binding force, budgetary predictability, and administrative continuity beyond electoral cycles.

At the same time, overcoming federal fragmentation requires the national government to assume an effective enabling role. This involves creating a national legal framework establishing minimum data governance capacities, mandatory interoperability standards, and explicit references to the LGPD as a condition for the recognition and financing of municipal smart city policies. Without such linkages, normative production will remain disconnected from the state’s capacity to govern urban information strategically and democratically.

This study focused on the existence and formal architecture of norms, rather than on their budgetary execution or their real impacts on urban quality of life. This constitutes a methodological limitation inherent to the national scale of the analysis and defines the agenda for future research. Comparative implementation studies, centered on municipalities with structuring norms identified in this corpus, may assess the extent to which normative density translates into measurable outcomes and which local institutional conditions explain this conversion.

The regulation of artificial intelligence in public management represents an additional, urgent normative frontier that this study only briefly addresses and that will require further investigation in the coming years. Within the broader context of the Global South, the data clearly signal a warning. When legislation on smart cities is not accompanied by data governance, linked funding, and equity as an evaluation criterion, urban innovation does not overcome pre-existing territorial asymmetries; it reframes them through more sophisticated vocabulary and makes them more difficult to contest.

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Figures

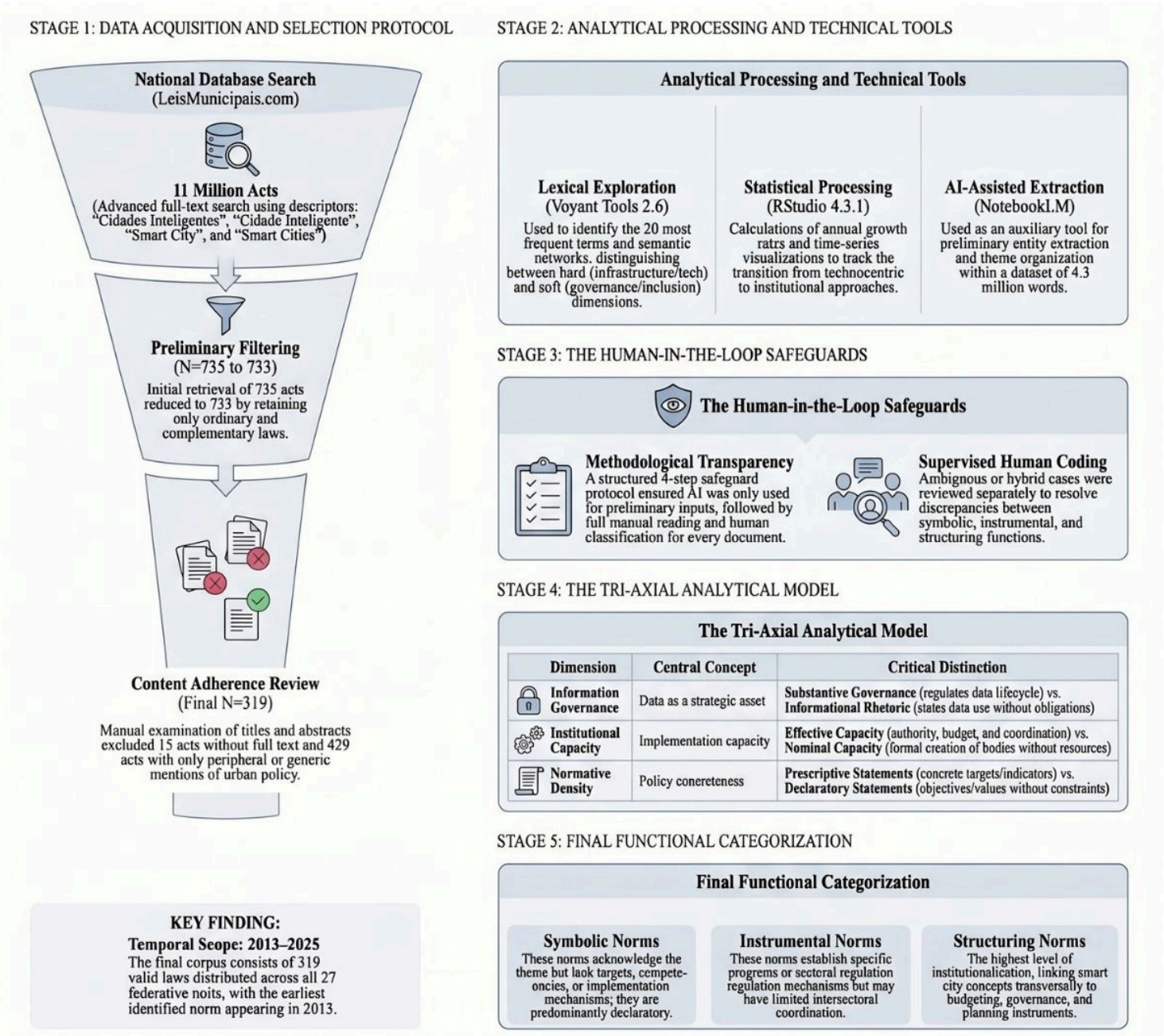


Figure 1

Methodological Architecture of the Study: Data Collection, Analytical Processing, and Validation Framework

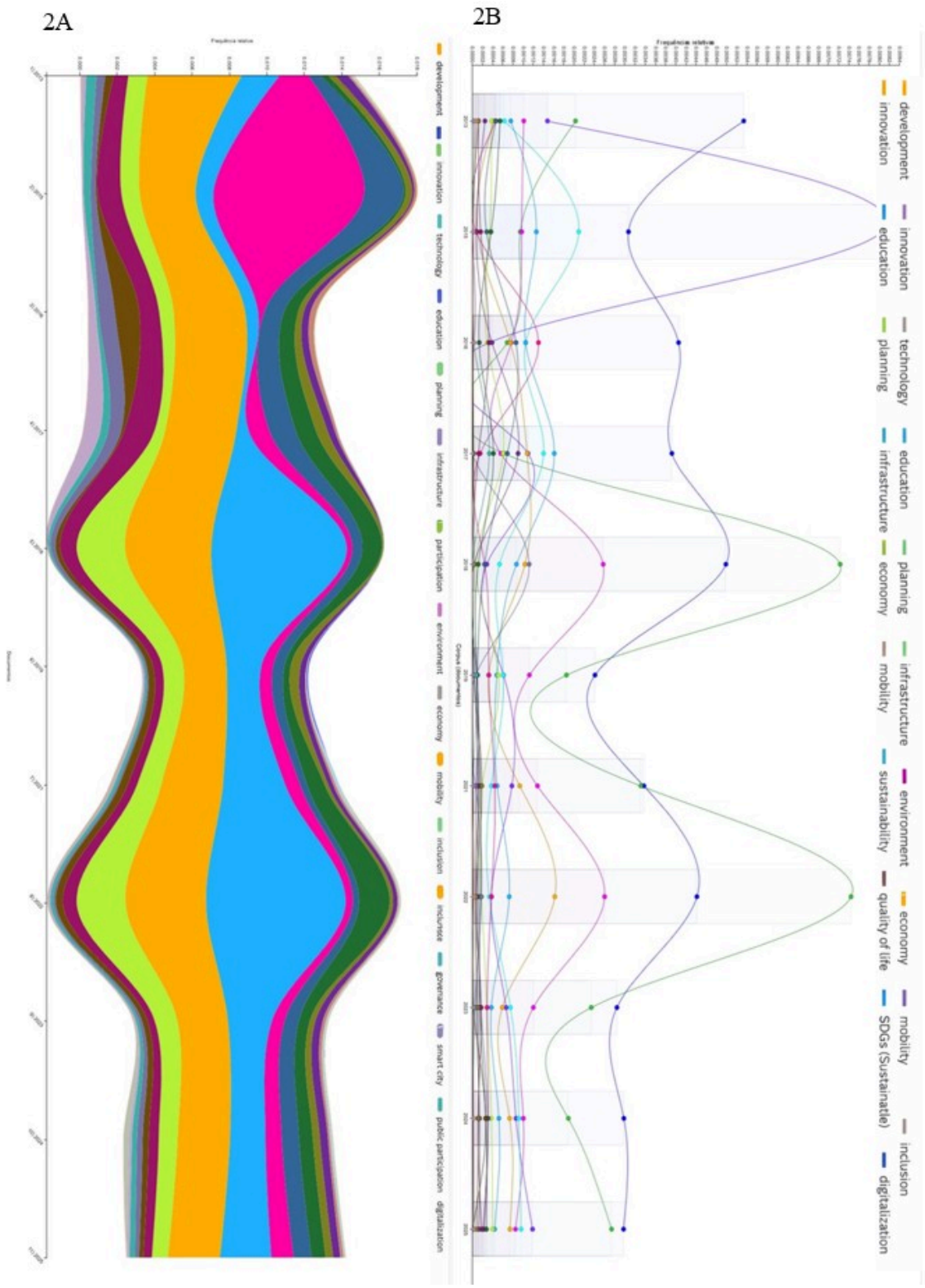


Figure 2

Temporal evolution and semantic distribution of key terms associated with smart cities

Note: Figure 2A shows the annual variation in the 20 most frequent terms in smart city legislation (2013–2025), revealing oscillations and shifts in focus. Until 2018, *hard* terms prevailed, while from 2020 onward, *soft*terms gained prominence. Figure 2B synthesizes this transition, highlighting the shift from a

technical discourse to an institutional approach oriented toward inclusion and the Sustainable Development Goals.