

Municipal Profiles in Sinter Integration: a factor and spatial analysis

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Perfis Municipais na Integração ao Sinter: uma análise fatorial e espacial

RESUMO

Objetivo - identificar e mapear os perfis de posicionamento municipal em face do Sistema Nacional de Gestão de Informações Territoriais (Sinter).

Metodologia – aplicação de questionário para diagnóstico, em âmbito nacional, das percepções dos municípios brasileiros em face do Sinter utilizando uma amostragem de conveniência não-probabilística. Foram analisadas as respostas dos itens em escala Likert do questionário aplicado e as análises seguiram as seguintes etapas: medidas de tendência central e dispersão (média, desvio-padrão, mediana e intervalo interquartil); validação do questionário por abordagem psicométrica em múltiplas etapas; análise fatorial exploratória (AFE) e confirmatória (AFC) utilizadas para investigar a estrutura latente dos construtos; extração dos fatores pelo método dos mínimos resíduos com rotação oblíqua; avaliação da consistência interna das dimensões identificadas por alfa de Cronbach e pelo ômega de McDonald; por fim, análise de *clusters* pelo método hierárquico de Ward (Ward.D2) para identificação dos perfis municipais.

Originalidade/relevância – a literatura acerca do Sinter tem avançado na descrição de seu funcionamento, potencial e desafios normativos; contudo, permanecem inexploradas três dimensões analíticas complementares: a mensuração psicométrica das percepções municipais sobre o sistema; a segmentação empírica dos municípios em perfis institucionais de posicionamento; e a representação cartográfica desses perfis no território nacional. O presente estudo preenche simultaneamente essas três lacunas, produzindo — de forma inédita na literatura — um mapa coroplético da distribuição espacial dos perfis municipais de adesão ao Sinter, ancorado em estrutura fatorial validada por análise confirmatória. A relevância acadêmica é demonstrada em quatro dimensões: i) relevância metodológica – o estudo demonstra a viabilidade de aplicar métodos psicométricos ao campo da gestão territorial; ii) relevância substantiva – o achado de que os determinantes da adesão ao Sinter são predominantemente institucionais e não regionais; iii) relevância para a política pública - o diagnóstico produzido pelo estudo pode instrumentalizar os órgãos competentes na priorização de municípios e na alocação diferenciada de recursos de apoio técnico; e iv) relevância para a agenda de pesquisa – o instrumento validado e a tipologia de cinco perfis constituem uma base empírica replicável para estudos longitudinais que monitorem a evolução da adesão municipal ao Sinter ao longo do tempo.

Resultados – oitenta e dois municípios, de todas as cinco regiões do país, participaram da pesquisa. Foram identificados dois fatores latentes: Benefícios percebidos do Sinter ($F1; \alpha = 0,847$) e Desafios para integração e uso ($F2; \alpha = 0,866$), ambos com consistência interna adequada. A análise de *cluster* hierárquica (Ward.D2) segmentou os municípios em cinco perfis distintos, cujos escores fatoriais revelaram combinações específicas entre percepção de valor e percepção de barreiras. A distribuição espacial desses perfis, representada por mapa coroplético, demonstrou ausência de padrão geográfico sistemático, sugerindo que os determinantes da adesão ao Sinter não são regionais, mas predominantemente de natureza institucional, técnica e financeira.

Contribuições teóricas/metodológicas – identificação de dois fatores latentes: Benefícios percebidos do Sinter e Desafios para integração, indicando uma dupla racionalidade na adesão. Classificação dos municípios em cinco perfis (*clusters*) mostrando a heterogeneidade institucional e a necessidade de ações diferenciadas. Constatação de que a distribuição espacial dos perfis não segue padrão regional ou geográfico, sugerindo que determinantes são institucionais, técnicos e financeiros. Validação de construtos, *clusters* hierárquicos e mapa coroplético para leitura espacial dos perfis utilizando método robusto: AFE e AFC.

Contribuições sociais e ambientais – os resultados têm potencial para subsidiar o planejamento de estratégias diferenciadas de apoio técnico, capacitação e comunicação institucional orientadas ao perfil de cada grupo visando a integração dos municípios ao Sinter o que resultará em benefícios para o adequado planejamento urbano em virtude da troca de informações territoriais.

PALAVRAS-CHAVE: Cadastro Territorial. Sinter. Gestão de Informações Territoriais.

Municipal Profiles in Sinter Integration: a factor and spatial analysis

ABSTRACT

Objective – to identify and map municipal positioning profiles regarding the National System for Territorial Information Management (Sinter).

Methodology – national-diagnostic survey of Brazilian municipalities' perceptions toward Sinter, using a non-probabilistic convenience sample. To achieve the study's objective, responses to Likert-scale items from the applied questionnaire were analyzed. Analyses followed these steps: measures of central tendency and dispersion (mean, standard deviation, median, and interquartile range); validation of the questionnaires through a multi-stage psychometric approach; Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to investigate the latent structure of the constructs; factor extraction by the least squares method with oblique rotation; assessment of internal consistency of the identified dimensions via Cronbach's alpha and McDonald's omega; finally, cluster analysis using Ward's hierarchical method (Ward.D2) to identify municipal profiles.

Originality/Relevance – Although the literature on Sinter has advanced in describing its functioning, potential, and regulatory challenges, three complementary analytical dimensions remain unexplored: psychometric measurement of municipal perceptions of the system, empirical segmentation of municipalities into institutional positioning profiles, and cartographic representation of these profiles across the national territory. This study simultaneously fills these three gaps, producing—unprecedented in the literature—a choropleth map of the spatial distribution of municipal profiles of Sinter adoption, anchored in a factor structure validated by CFA. Academic relevance is demonstrated in four dimensions: i) methodological relevance – the study shows the feasibility of applying psychometric methods to the field of territorial governance; ii) substantive relevance – the determinants of Sinter adoption are predominantly institutional rather than regional; iii) policy relevance – the diagnostic can inform authorities in prioritizing municipalities and allocating differentiated technical-support resources; and iv) research agenda relevance – the validated instrument and the five-profile typology provide a replicable empirical basis for longitudinal studies monitoring how municipal adherence to Sinter evolves over time.

Results – effectively 82 municipalities participated, distributed across all five regions of the country. Two latent factors were identified—Perceived Benefits of Sinter ($F1; \alpha = 0.847$) and Challenges for integration and use ($F2; \alpha = 0.866$)—both with adequate internal consistency. Hierarchical cluster analysis (Ward.D2) segmented municipalities into five distinct profiles, whose factor scores reveal specific combinations of value perception and perceived barriers. The spatial distribution of these profiles, represented by a choropleth map, showed no systematic geographical pattern, suggesting that determinants of Sinter adoption are predominantly institutional, technical, and financial rather than regional.

Theoretical/ Methodological Contributions – Identification of two latent factors: Perceived Benefits of Sinter and Challenges for integration, indicating a dual rationality in adoption. Classification of municipalities into five profiles (clusters) shows institutional heterogeneity and the need for differentiated actions. The spatial distribution of profiles does not follow a regional pattern, suggesting determinants are institutional, technical, and financial, not geographical. Use of a robust method: EFA and CFA for construct validation, hierarchical clustering, and choropleth mapping for spatial reading of profiles.

Social and Environmental Contributions – The results support the planning of differentiated strategies for technical assistance, capacity-building, and institutional communication tailored to each group's profile, with the objective of municipalities integrating into Sinter, benefiting from the exchange of territorial information that underpins appropriate Urban Planning.

KEYWORDS: Land Cadastre. Sinter. Territorial Information Management.

Perfiles Municipales en la Integración al Sinter: un análisis factorial y espacial

RESUMEN

Objetivo – identificar y mapear los perfiles de posicionamiento municipal frente al Sistema Nacional de Gestión de Información Territorial (Sinter).

Metodología – aplicación de un cuestionario para diagnóstico a nivel nacional de las percepciones de los municipios brasileños respecto al Sinter, utilizando una muestra por conveniencia no probabilística. Para alcanzar el objetivo de este estudio, se analizaron las respuestas de los ítems en escala Likert del cuestionario aplicado. Los análisis siguieron las siguientes etapas: medidas de tendencia central y dispersión (media, desviación típica, mediana e intervalo intercuartílico); validación de los cuestionarios mediante un enfoque psicométrico en múltiples etapas; Análisis Factorial Exploratorio (AFE) y Análisis Factorial Confirmatorio (AFC) para investigar la estructura latente de los constructos; extracción de factores por el método de mínimos cuadrados con rotación oblicua; evaluación de la consistencia interna de las dimensiones identificadas mediante alfa de Cronbach y omega de McDonald; por último, análisis de clústeres por el método jerárquico de Ward (Ward.D2) para identificar los perfiles municipales.

Originalidad/relevancia – Aunque la literatura sobre el Sinter ha avanzado en describir su funcionamiento, su potencial y los desafíos normativos, siguen inexploradas tres dimensiones analíticas complementarias: la medición psicométrica de las percepciones municipales sobre el sistema, la segmentación empírica de los municipios en perfiles institucionales de posicionamiento y la representación cartográfica de estos perfiles en el territorio nacional. Este estudio cubre simultáneamente las tres lagunas, produciendo —de forma inédita en la literatura— un mapa coroplético de la distribución espacial de los perfiles municipales de adhesión al Sinter, anclado en una estructura factorial validada por un análisis confirmatorio. La relevancia académica se demuestra en cuatro dimensiones: i) relevancia metodológica –el estudio demuestra la viabilidad de aplicar métodos psicométricos al campo de la gestión territorial; ii) relevancia sustantiva – el hallazgo de que los determinantes de la adhesión al Sinter son predominantemente institucionales y no regionales; iii) relevancia para la política pública – el diagnóstico producido por el estudio puede instrumentalizar a las autoridades competentes en la priorización de municipios y en la asignación diferenciado de recursos de apoyo técnico; y iv) relevancia para la agenda de investigación – el instrumento validado y la tipología de cinco perfiles constituyen una base empírica replicable para estudios longitudinales que monitorear la evolución de la adhesión municipal al Sinter a lo largo del tiempo.

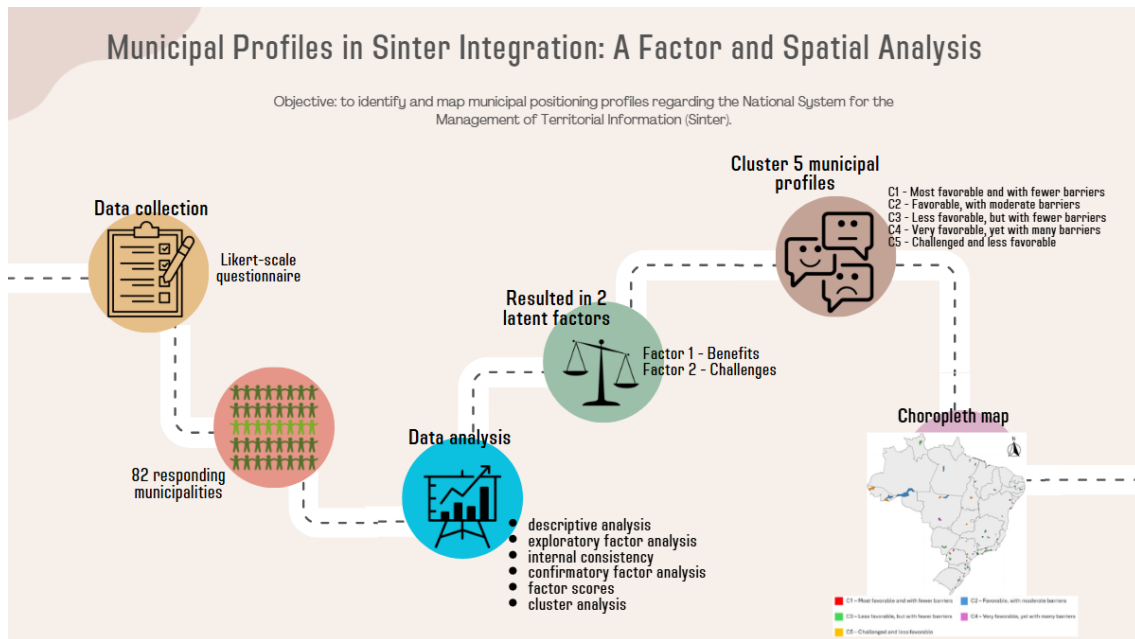
Resultados – participaron efectivamente de la encuesta 82 municipios, distribuidos en las cinco regiones del país. Se identificaron dos factores latentes - Beneficios Percebidos del Sinter ($F1; \alpha = 0,847$) y Desafíos para la Integración y Uso ($F2; \alpha = 0,866$) -, ambos con consistencia interna adecuada. El análisis de clúster jerárquico (Ward.D2) segmentó los municipios en cinco perfiles distintos, cuyos puntajes factoriales revelan combinaciones específicas entre la percepción de valor y la percepción de barreras. La distribución espacial de estos perfiles, representada por un mapa coroplético, mostró ausencia de un patrón geográfico sistemático, sugiriendo que los determinantes de la adhesión al Sinter son predominantemente institucionales, técnicos y financieros – y no regionales.

Contribuciones teóricas/metodológicas – Identificación de dos factores latentes: Beneficios Percebidos del Sinter y Desafíos para la integración, indicando una doble racionalidad en la adhesión. La clasificación de los municipios en cinco perfiles (clústeres) muestra heterogeneidad institucional y necesidad de acciones diferenciadas. La distribución espacial de los perfiles no sigue un patrón regional, sugiriendo que los determinantes son institucionales, técnicos y financieros, no geográficos. Uso de método robusto: AFE y AFC para la validación de constructos, clúster jerárquico y mapa coroplético para la lectura espacial de los perfiles.

Contribuciones sociales y ambientales – Los resultados respaldan la planificación de estrategias diferenciadas de apoyo técnico, capacitación y comunicación institucional orientadas al perfil de cada grupo con el objetivo de que los municipios se integren al Sinter, beneficiándose del intercambio de información territorial que fundamenta una adecuada Planificación Urbana.

PALABRAS CLAVE: Catastro Territorial. Sinter. Gestión de Información Territorial.

GRAPHICAL ABSTRACT



1 INTRODUCTION

Specialized literature indicates that several countries have adopted centralized models of territorial cadastral management. European nations such as Austria, Belgium, Spain (with the exception of 5% of its territory), France, the Netherlands, and Luxembourg, as well as Latin American countries such as Chile, Costa Rica, and Uruguay, centralize the management of their land cadastres under a single national administration, encompassing both urban and rural properties (Amorim *et al.*, 2018; España, 2021; Loch & Erba, 2007).

Brazil, in turn, adopts a significantly different model. Brazilian territorial cadastral administration is characterized by a fragmented structure, with segregation between rural and urban land cadastres. The urban land cadastre is dispersed among the various municipalities, lacking standardization and systemic integration at the national level; the administration of urban land cadastres is the responsibility of each municipality within its respective territory. Meanwhile, authority over the rural land cadastre lies with the federal government, under the responsibility of the National Institute for Colonization and Agrarian Reform (INCRA).

The complexity of Brazilian cadastral management is amplified by the country's continental dimension and the large number of municipalities 5,570 (IBGE, 2023), which causes boundary conflicts and overlapping property areas, hindering the correlation between title records and cartographic documents (Erba, 2005).

Brazilian urban land cadastres exhibit considerable variation in their levels of technological and structural development. At one extreme are basic systems composed of nothing more than elementary spreadsheets; at the other, sophisticated land cadastres that have achieved international recognition for their technical excellence. This heterogeneity reflects differences in technical staff capacity and in levels of investment in the cadastral field. Built upon this uneven foundation, problems of a distinct nature accumulate: the lack of standardization in data collection and storage compromises the information consistency; excessive focus on fiscal aspects and frequent outdatedness neglect the current territorial reality and hinder integrated territorial management, further aggravated by the absence of adequate georeferencing; and the dispersion of information among different municipal departments creates administrative silos that reduce management efficiency. Together, these weaknesses—technological, methodological, and organizational—shape a scenario of structural fragmentation that compromises municipalities' ability to fully exercise their cadastral function. This situation is particularly evident in small municipalities; Stephan and Souza Maria (2015) identify the fragility of the municipal land cadastre as one of the main bottlenecks to urban planning in small Brazilian cities.

Concomitant with the evolution of this fragmented land cadastre, demands for information generated by the Land Cadastre have intensified, both in the public and private spheres. Cadastral information is primarily essential for its managing bodies, such as municipalities, which, under the City Statute, Law No. 10,257 (2001), are required to implement the Master Plan, thus demanding a high-quality land cadastre. Likewise, municipalities need to know their territory to exercise their tax authority over property. At the federal level, the cadastral registration of rural properties constitutes an essential element for land regularization policy and territorial planning.

Beyond direct managers, various other agencies have an interest in the information generated by land cadastres. In the absence of direct access to this information, such entities resort to their own means of obtaining it, processes that frequently prove costly, slow, inefficient, untimely, and duplicative.

Farias and Carneiro (2015) point out that, in the past, information was seen as belonging exclusively to a single institution, being generated and maintained internally. With administrative and technological evolution, however, entities began to take advantage of the benefits of data integration among different institutions, enabling cost reduction, greater speed in information production, and advances in territorial management. Queiroz (2018) states that we live in a society in which information has become a strategic asset, and that data obtained from a multipurpose land cadastre are essential in the process of transforming a municipality into a Smart City. Silva *et al.* (2021) argue that only a nationally comprehensive territorial administration system can enable a nation's sustainable development. In this sense, to minimize the obstacles related to the Land Cadastre, the Brazilian federal government implemented an important initiative in 2016 to unify property cadastral information across the entire national territory. Established by Decree No. 8,764 (2016), the National System for Territorial Information Management (Sinter) aims to integrate urban and rural property data from across the country into a single platform, providing access to information - subject to legal limitations - for public administration bodies and entities at all levels of government, for registry and notarial services, as well as for other agencies, entities, and concessionaires or licensees of public services that manage data related to real estate, and for natural and legal persons under public or private law (Brazil, 2022).

In his analysis of Sinter's compliance with national legislation, and its insertion within the context of land governance, Cardoso (2018) highlights that Sinter represents an initiative aimed at addressing a historical deficiency in Brazilian land governance: the absence of a unified land cadaster encompassing both public and private lands. Sinter thus represents a Brazilian institutional response to the challenge of reconciling the autonomy of federative entities and the diversity of cadastral systems with the growing need for integration of territorial information to support public policies, ensure legal certainty, and promote the country's sustainable development.

For Sinter to effectively fulfill the purpose for which it was created, the active participation of municipalities as providers of data and information generated in their territorial registries constitutes a *sine qua non* condition. Initially, municipal participation in Sinter was based on voluntary accession, formalized by means of an agreement between the municipality and the federal body responsible for managing the system, the Brazilian Federal Revenue Service (RFB), as established by Decree No. 11,208 (2022).

In contrast, the recent tax reform, consolidated by Complementary Law No. 214 (2025), simplifies consumption taxation and establishes new principles to guide the Brazilian tax system: simplicity, transparency, tax fairness, cooperation, and environmental protection. In the context of the reform, Sinter takes on a central role, since the legislation makes it mandatory for all urban properties to obtain the CIB code (Cadastro Imobiliário Brasileiro) and determines that the reference value of real estate properties be disclosed and made available by the system itself. In other words, the tax reform decisively drives the integration of municipal territorial

registries into Sinter, giving it a character that is no longer merely voluntary, but structural to the new national tax model.

However, it was found that in the period between the system's entry into operation in December 2022 (Lançamento [...], 2022) and February 2025, only 65 (sixty-five) municipal governments had formalized their accession to the program. Even more concerning, of this total, only 7 (seven) municipalities had completed the integration by sending their first data shipment.

Given the situations outlined above, it is considered that the well-established relevance of the land cadastre for the formulation and implementation of efficient public policies positions Sinter as a strategic solution to historical challenges in territorial administration in Brazil. However, despite its transformative potential for Brazilian territorial management, the system faces a critical obstacle: low municipal accession. This scenario significantly undermines the system's integrative purpose, since active municipal participation constitutes a fundamental condition for the initiative's success.

From this perspective, this article aims to present the results of a nationwide diagnostic assessment of Brazilian municipalities' integration into Sinter, with an emphasis on identifying and spatially mapping municipal profiles derived from factor and cluster analysis. Specifically, it seeks to: validate the factorial structure of the applied instrument; segment municipalities into distinct profiles regarding their perception of the benefits and challenges associated with Sinter; and represent the geographic distribution of these profiles through a choropleth map, verifying whether systematic regional patterns exist.

2 METHOD

8

2.1 Participants

The study included the participation of 82 Brazilian municipalities. The participating municipalities span all five regions of the country, with a predominance of the Southeast (32.93%) and South (28.05%) regions, followed by the Northeast (20.73%), North (12.20%), and Central-West (6.10%). In terms of population size, the sample encompasses municipalities of all categories, from Small-Sized I to Metropolises, according to the classification adopted by the National Council for Social Assistance (Conselho Nacional de Assistência Social, CNAS) based on the IBGE's 2022 Demographic Census.

2.2 Instruments

The instrument applied to the municipalities was a structured questionnaire composed of dichotomous questions and five-point Likert-scale items (1 = Strongly disagree; 5 = Strongly agree), organized into three domains: Benefits of Sinter (Q7–Q11), Challenges to integration (Q12–Q19), and Evolution and opportunities for improvement (Q21–Q25). For the factor analysis, items Q7 through Q19 were used—a set of 13 items answered by all 88 participants, with no missing data.

2.3 Procedures

To obtain responses, a non-probabilistic convenience sampling approach was adopted, with three lines of contact with municipalities to provide access to the survey to as many municipalities as possible. The survey link was disseminated by the National Confederation of Municipalities (Confederação Nacional de Municípios, CNM) and by the Brazilian Association of Capital Cities' Finance Departments (Associação Brasileira das Secretarias de Finanças das Capitais, ABRASF), and was sent by e-mail to 2,580 municipalities directly to the sectors related to the municipality's territorial registry, such as the Real Estate Registry, Property Tax Department, Urban Planning, Urbanism, Cartography and Registry, among others. The response collection period was from July to September 2025.

2.4 Data Analysis

The statistical analysis of this study was designed with the aim of characterizing the profile of the participating municipalities, validating the data collection instrument, synthesizing perceptions of Sinter through scores, and investigating patterns, associations, and groupings among respondents.

In the initial stage, a descriptive analysis of all study variables was performed. Categorical variables were expressed as absolute and relative frequencies (n and %), while quantitative and ordinal variables were described using measures of central tendency and dispersion: mean, standard deviation, median, and interquartile range, considering the ordinal nature of the Likert scales used.

Validation of the questionnaires followed a multi-step psychometric approach. Initially, an Exploratory Factor Analysis (EFA) was conducted with the aim of investigating the latent structure of the constructs, identifying the grouping of items into factors and reducing data dimensionality, as well as verifying the adequacy of the items to the proposed theoretical dimensions.

Given the ordinal nature of the variables, a polychoric correlation matrix was employed, whose adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity. Factor extraction was performed using the minimum residual method with oblique rotation (oblimin), allowing for correlation among factors. The determination of the number of factors jointly considered statistical and interpretive criteria, including parallel analysis and inspection of the scree plot, with selection of the model showing the best fit, greatest stability, and preservation of sample size. In interpreting the factorial solution, factor loadings with a magnitude ≥ 0.40 were adopted as the retention criterion; in cases of cross-loadings, items were allocated to the factor with the highest absolute loading value, respecting conceptual coherence.

The internal consistency of the identified dimensions was estimated using Cronbach's alpha and McDonald's omega, with values equal to or greater than 0.70 considered adequate, complemented by an analysis of corrected item-total correlations. Items with high uniqueness (≥ 0.70) were analyzed individually, as they represented a substantial proportion of variance not explained by the factors.

Confirmatory Factor Analysis (CFA) was conducted to test the adequacy of the model obtained in the EFA. The WLSMV estimator, recommended for ordinal variables, was used, and model fit was assessed using the following indices: chi-square (χ^2) and degrees of freedom, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) with a 90% confidence interval, and Standardized Root Mean Square Residual (SRMR). CFI and TLI values equal to or greater than 0.90 (acceptable fit) or 0.95 (good fit), and RMSEA equal to or less than 0.08 (acceptable) or 0.06 (good fit), were adopted as reference thresholds. An alternative model excluding items with lower factorial adherence was also tested for comparative purposes. After model confirmation, factor scores were calculated for each dimension, subsequently standardized as z-scores to ensure comparability across dimensions.

Finally, with the aim of identifying municipal profiles, a cluster analysis was performed based on the standardized factor scores. Ward's hierarchical method (Ward.D2) with squared Euclidean distance was initially applied, with the number of clusters determined by the elbow criterion and the average silhouette index, together with the interpretability of the groupings. The k-means method was employed as a complementary analysis to assess the robustness of the solution obtained. Results were presented through descriptive tables, scatter plots on the factorial plane, and a choropleth map. All analyses were conducted using R software (RStudio), adopting a significance level of 5% ($\alpha = 0.05$) at all inferential stages.

2.5 Results

2.5.1 Characterization of the Respondent Municipalities

The study included the participation of 82 Brazilian municipalities, from which 88 responses to the questionnaire were obtained, given that 6 municipalities each submitted two responses, from different professionals. It was decided to retain all 88 responses to preserve the statistical power of the analysis. Excluding the responses from the 6 municipalities that had already responded would reduce the sample and compromise the robustness of the results, in addition to eliminating the individual perception of the municipal respondent.

The participating municipalities span all five regions of the country, with a predominance of the Southeast (32.93%) and South (28.05%) regions, followed by the Northeast (20.73%), North (12.20%), and Central-West (6.10%). Regarding the federative unit, a higher concentration of respondents was observed from the states of São Paulo, Santa Catarina, and Minas Gerais, followed by Paraná and Rio Grande do Sul.

The classification of the respondent municipalities by population size is presented in Table 1.

Table 1 – Classification of municipalities by size that responded to the survey

Municipality size	Number of inhabitants	Number of municipalities
Small I	up to 20,000	18
Small II	20,001 to 50,000	23
Medium	50,001 to 100,000	9
Large	100,001 to 900,000	23
Metropolises	More than 900,000	9
Total		82

Source: prepared by the authors based on the CNAS classification, data from the IBGE 2022 Demographic Census, and survey data (2026).

Initially, through the descriptive analysis of the variables, the results shown in Table 2 were obtained, characterizing the participating municipalities in terms of their knowledge of Sinter, whether they have a georeferenced land cadastre and an alphanumeric land cadastre, the municipality's status of integration with Sinter, and their perception regarding the system's benefits, challenges, evolution, and improvements.

Table 2 – Institutional Characterization and Perceptions of the Municipalities Participating in the Study (n = 88)

Variable	Category	n (%)
Do you know Sinter?	Yes	67 (76.1)
	No	21 (23.9)
Has a Georeferenced Land Cadastre?	Yes	52 (59.1)
	No	36 (40.9)
Has an Alphanumeric Land Cadastre?	Yes	52 (59.1)
	No	36 (40.9)
Integration status	Not integrated	60 (68.2)
	In implementation phase	19 (21.6)
	Integrated	9 (10.2)
Perceptions (scale Likert)		
Dimension	Scale	Mean ± SD
Benefits of the Sinter	1-5	4.03 ± 0.81
Challenges to integration	1-5	3.86 ± 0.674
Evolution and improvements	1-5	3.91 ± 0.71
		Median (IQR)
Benefits of the Sinter		4.20 (3.35 – 4.8)
Challenges to integration		3.94 (3.38 – 4.28)
Evolution and improvements		3.80 (3.40 – 4.50)

Notes: SD: standard deviation; IQR: interquartile range

Source: prepared by the authors with survey data (2026).

It was observed that most respondents had already heard of Sinter (76.1%), while the minority (23.9%) reported having no prior knowledge of the system. Regarding integration status with Sinter, it was found that 68.2% were not yet integrated, 21.6% were in the implementation phase, and only 10.2% reported already being integrated into the system. As for cadastral infrastructure, most municipalities reported having a Georeferenced Land Cadastre as well as an Alphanumeric Land Cadastre, although important gaps persist, especially among those that had not yet begun the integration process with Sinter. Regarding the perceptions assessed on the Likert scale, the mean scores indicated high agreement regarding the potential benefits of Sinter (mean = 4.03; SD = 0.81) and moderate agreement regarding the challenges faced by municipalities in the integration process (mean = 3.86; SD = 0.674).

2.5.2 Factorial structure and internal consistency

Before proceeding with the exploratory factor analysis, the adequacy of the correlation matrix for items Q7–Q19 was assessed, resulting in a KMO = 0.761 and a significant Bartlett's test ($p < 0.001$), indicating satisfactory conditions for the EFA, as shown in Table 3.

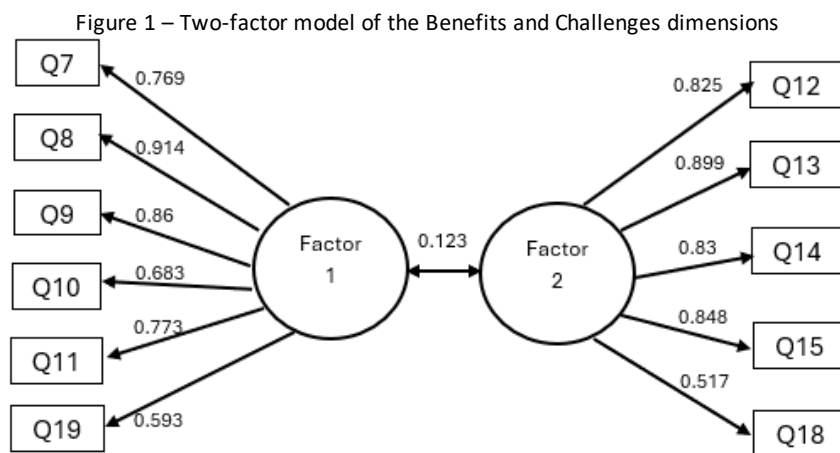
Table 3 – Adequacy measures of the correlation matrix for EFA

Measure	Complete items Q7-Q19
Overall KMO	0.761
Bartlett's Chi-square	750.65
df	78
p-value	<0.001
Total n of the analysis	88
n of complete cases	88

Source: prepared by the authors based on research data (2026).

Parallel analysis and the scree plot consistently indicated the retention of two factors, which jointly explain 57.0% of the total variance.

Figure 1 presents the two-factor model obtained through the EFA, with its respective standardized factor loadings and the interfactorial correlation ($\phi = 0.123$), reinforcing the interpretation that the two identified dimensions represent distinct factors, with relative independence between the perception of Sinter's benefits and the perception of challenges to its integration and use.



Source: prepared by the authors based on research data (2026).

Factor 1 — Perceived benefits of Sinter comprised items Q7, Q8, Q9, Q10, Q11, and Q19, with factor loadings ranging from 0.593 to 0.914. Item Q8 (contribution to tax collection) showed the highest loading (0.914) and the lowest uniqueness (0.128), indicating strong adherence to the dimension.

Factor 2 — Challenges to integration and use grouped items Q12, Q13, Q14, Q15, and Q18, with loadings ranging from 0.517 to 0.899. Items Q16 and Q17 did not show relevant factor loadings on either factor and were kept out of the multi-item structure.

The CFA confirmed the two-dimensional structure with good incremental fit (CFI = 0.986; TLI = 0.982) and partially adequate absolute fit (RMSEA = 0.111; SRMR = 0.122). The

interfactorial correlation was low and non-significant ($\phi = 0.175$; $p = 0.118$), reinforcing the relative independence between the two dimensions.

Both dimensions showed adequate levels of internal consistency, as shown in Table 4. Internal consistency is a measure of coherence among the items that make up the same factor of the questionnaire. It indicates the extent to which the questions grouped within a factor are indeed measuring the same aspect in a cohesive and reliable manner, that is, whether a respondent who agrees with one question tends to agree with the others in the same group.

Table 4 - Internal consistency and descriptive statistics of the validated dimensions (n = 88)

Dimensions	Items	Cronbach's alfa (α)	McDonald's omega (ω)	Mean $\pm$ SD	Median (IQR)	CI 95%
Factor 1 – Perceived benefits of Sinter	Q7, Q8, Q9, Q10, Q11, Q19	0.847	0.904	4.00 $\pm$ 0.78	4.17 (3.33–4.67)	3.83–4.16
Factor 2 – Challenges to integration and use	Q12, Q13, Q14, Q15, Q18	0.866	0.89	3.68 $\pm$ 1.09	3.80 (3.00–4.65)	3.44–3.91

Notes: reference values: $\alpha \geq 0.70$ and $\omega \geq 0.70$ indicate adequate internal consistency. SD: standard deviation; IQR: interquartile range.

Source: prepared by the authors based on research data (2026).

Factor 1 — Perceived benefits of Sinter — obtained a Cronbach's alpha of 0.847 (95% CI: 0.797–0.898) and a McDonald's omega of 0.904, while Factor 2 — Challenges to integration and use — showed an alpha of 0.866 (95% CI: 0.823–0.908) and an omega of 0.890, both above the minimum criterion of 0.70 adopted in the study, attesting to the reliability of the proposed dimensions.

2.5.3 Municipal Profiles: Cluster Analysis

The hierarchical cluster analysis segmented the 88 municipal respondents into five distinct profiles based on the standardized factor scores of F1 and F2. The five-cluster solution presented the highest average silhouette index (0.397) and a balanced distribution among groups and was therefore adopted as the final partition. The identified profiles are described in Table 5.

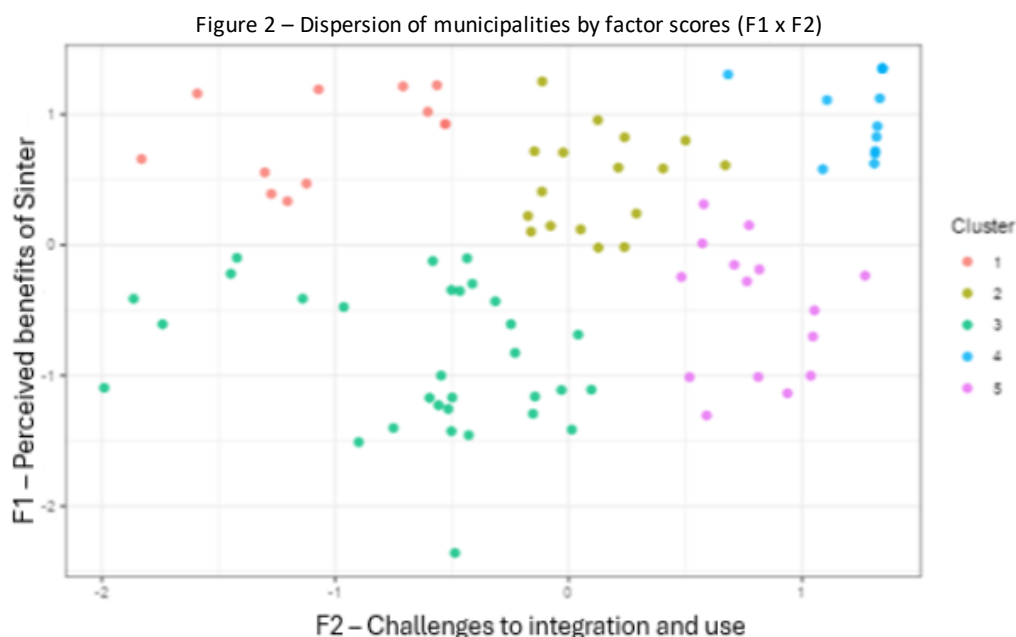
Table 5 – Municipal profiles identified by the cluster analysis (k = 5; n = 88)

Profile	n (%)	F1 Benefits (mean ± SD)	F2 Challenges (mean ± SD)	Description
C1 – Most favorable and with fewer barriers	12 (13.6%)	0.84 ± 0.34	-1.03 ± 0.34	High perception of benefits; low perception of challenges. Greater readiness for integration.
C2 – Favorable, with moderate barriers	17 (19.3%)	0.48 ± 0.37	0.12 ± 0.37	Positive perception of benefits; average level of challenges. Requires technical operational support.
C3 – Less favorable, but with fewer barriers	31 (35.2%)	-0.88 ± 0.54	-0.64 ± 0.54	Below-average perception of both benefits and challenges. Lower level of conviction, but without major obstacles.
C4 – Very favorable, yet with many barriers	13 (14.8%)	1.02 ± 0.31	1.24 ± 0.31	Strongly convinced of the benefits, but heavily constrained by structural barriers.
C5 – Challenged and less favorable	15 (17.0%)	-0.49 ± 0.51	0.80 ± 0.51	Lowest perception of benefits and highest perception of difficulties. Requires broad awareness-building efforts.

Notes: interpretation relative to the sample meaning.

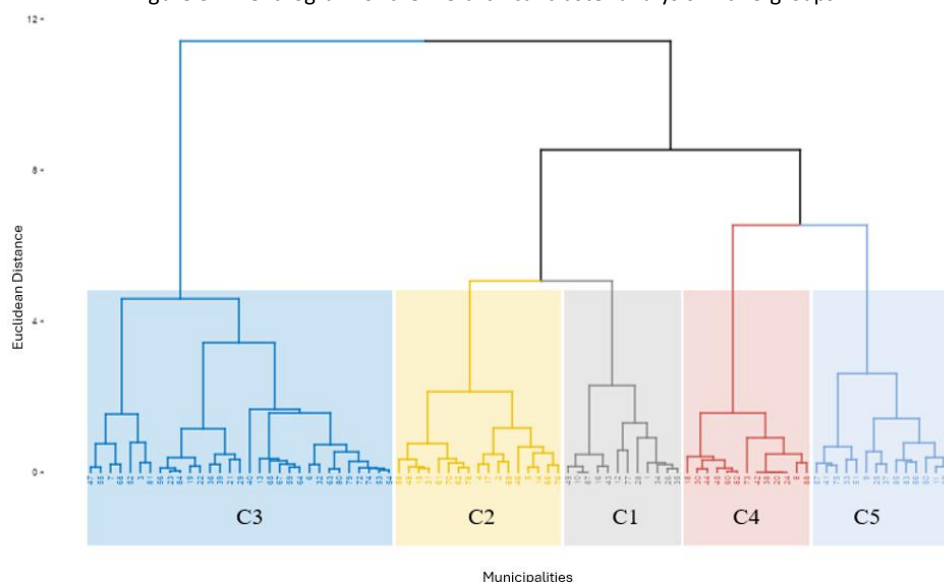
Source: prepared by the authors based on research data (2026).

The dispersion of municipalities by factor scores is illustrated in the cluster plot in Figure 2, showing that Cluster 3 ("Less favorable, but with fewer barriers") concentrates the largest share of municipalities (35.2%), followed by Cluster 2 (19.3%) and Cluster 5 (17.0%).



These findings are supported by the dendrogram (Ward.D2 method) in Figure 3, which represents the hierarchical similarity structure among municipalities and the final formation of the five groups.

Figure 3 – Dendrogram of the hierarchical cluster analysis with 5 groups



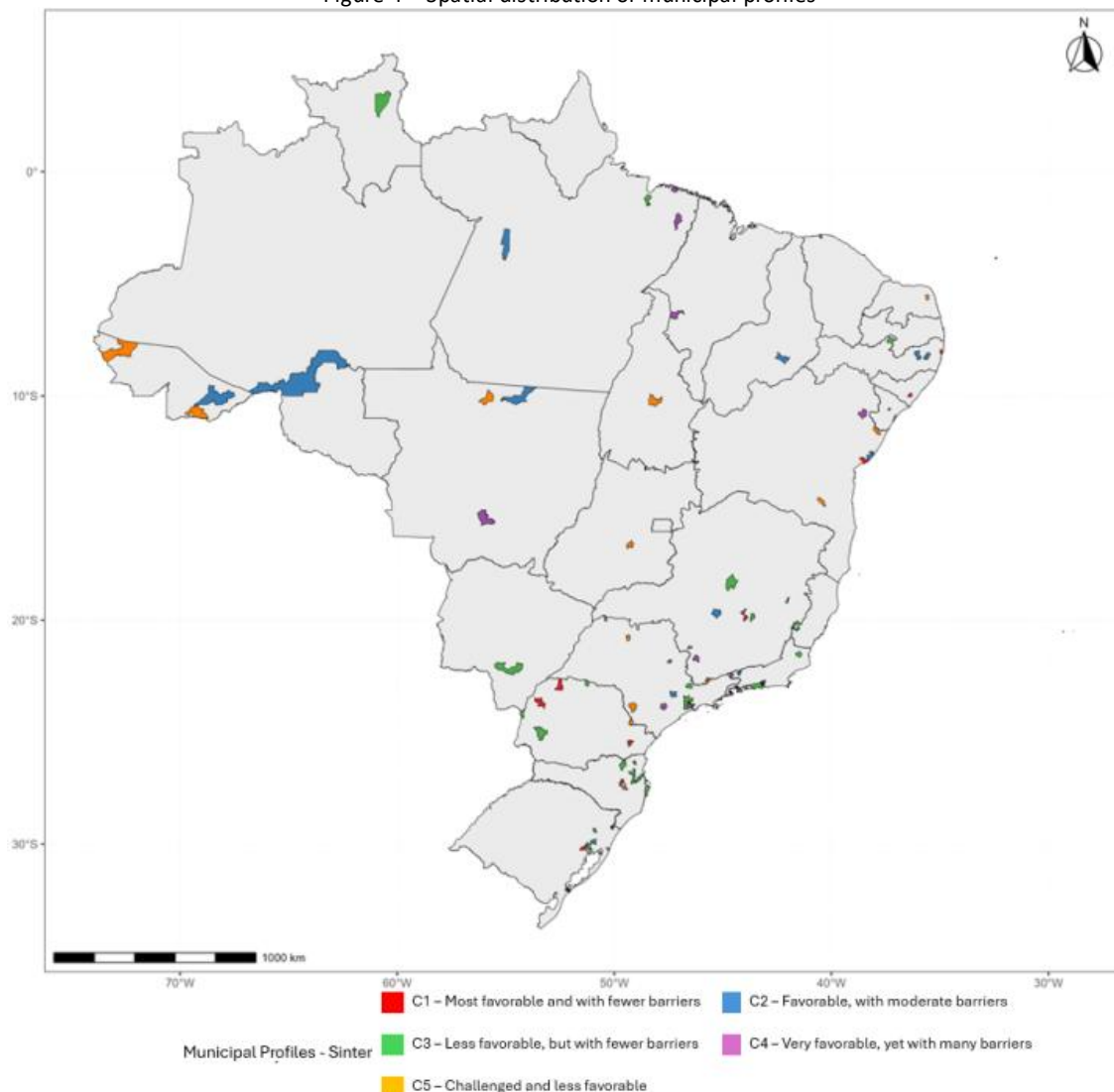
It is noted that the colored branches reflect the progressive separation of the identified profiles, allowing visualization of the relative proximity among municipalities within each cluster and the distance between clusters. Some groups can be observed to form more cohesively, with mergers occurring at lower distance levels, while others show greater internal heterogeneity, consistent with the differences observed in the means and dispersions of the factors.

2.5.4 Spatial distribution of municipal profiles: choropleth map

Figure 4 presents the spatial distribution of the 82 participating municipalities according to the profiles identified in the cluster analysis, allowing for an examination of whether the resulting segmentation exhibits any pattern of regional concentration or whether the profiles are heterogeneously distributed across the national territory.

The spatial distribution analysis reveals that municipal profiles are geographically dispersed across the Brazilian territory, without forming clear regional clusters or systematic spatial patterns. Municipalities belonging to distinct profiles appear side by side across various regions, indicating that municipalities' positioning toward Sinter — both in terms of perceived benefits and challenges to integration — is not determinantly associated with geographic location or administrative region of belonging.

Figure 4 – Spatial distribution of municipal profiles



Source: prepared by the authors based on research data (2026).

It is observed, however, that participating municipalities are predominantly concentrated in the South and Southeast regions, with a sparser presence in the North, Northeast, and Center-West regions, reflecting the survey's own response pattern. In these regions with a higher density of respondents, it is possible to identify the coexistence of multiple profiles in neighboring states or even within the same state — for example, in Santa Catarina, Minas Gerais, and São Paulo — reinforcing the internal heterogeneity of these regions regarding the stage of relationship with the system.

The absence of a clear territorial pattern suggests that the determining factors of municipal profiles are institutional, technical, and financial in nature — such as management capacity, technological infrastructure, and availability of specialized staff — rather than geographic. This finding reinforces the relevance of differentiated support strategies by profile, regardless of regional scope.

3 DISCUSSIONS

The results of this study reveal a scenario marked by the simultaneous recognition of Sinter's strategic value and the persistence of concrete challenges to its implementation. The validated factorial structure — composed of the Perceived Benefits and Challenges to Integration factors — proved consistent with the literature on the adoption of territorial information systems (Amorim *et al.*, 2018; Farias & Carneiro, 2015; Silva *et al.*, 2025), indicating that the integration decision is not unidimensional and involves the simultaneous weighing of perceived gains and institutional barriers.

The existence of five distinct profiles demonstrates that municipal heterogeneity cannot be underestimated in the planning Sinter implementation policies. Profile C1 ("Most favorable and with fewer barriers"), composed mainly of municipalities in the South of the country with greater institutional capacity, represents the segment best prepared for accelerated integration and could serve as a benchmark of good practices. In contrast, profiles C4 ("Very favorable, yet with many barriers") and C5 ("Challenged and less favorable") indicate situations that call for distinct interventions: the former primarily requires technical and financial support to overcome structural barriers, while the latter additionally requires communication and awareness-raising actions regarding the system's value.

The fact that Cluster 3 — municipalities classified as "Less favorable, but with fewer barriers" — accounts for 35.2% of the sample is particularly relevant. Although these municipalities do not face major operational barriers, they report relatively less favorable perceptions of Sinter's potential benefits. This pattern suggests a gap in institutional communication: municipalities that could advance their integration but lack sufficient information about the system's concrete advantages for their territorial and fiscal management routines.

From a methodological standpoint, the combination of EFA, CFA, and cluster analysis with cartographic representation constitutes an integrative approach that advances beyond purely descriptive diagnostics. The psychometric validation of the dimensions ensures that the differences between profiles reflect real latent constructs rather than mere spurious variations

in responses. The spatial representation of profiles through a choropleth map adds an analytical layer that facilitates the identification of priority territories for institutional action.

The study presents limitations that should be considered. The convenience sampling and the relative concentration of respondents in the South and Southeast regions may introduce regional biases and limit the generalizability of the findings. The exclusive use of a structured questionnaire, although appropriate for the proposed objectives, did not allow for an in-depth exploration of the qualitative aspects underlying the identified perceptions.

For future studies, it is recommended to incorporate qualitative approaches, longitudinal studies that monitor the trajectory of municipal integration over time, and comparative investigations between integrated and non-integrated municipalities, controlling for variables such as population size, fiscal capacity, and regional location — elements that may contribute to the identification of predictive factors for successful Sinter implementation.

4 CONCLUSIONS

This study demonstrated that Brazilian municipalities are distributed into five distinct profiles regarding the perceived benefits and challenges associated with Sinter, revealing a scenario of marked institutional heterogeneity. The psychometric validation of the dimensions — with Cronbach's alpha values above 0.84 and a CFA with CFI = 0.986 — ensures the quality of the measures used in the segmentation. The choropleth map of the spatial distribution of profiles confirmed the absence of a systematic geographic pattern, reinforcing that the determinants of adherence are predominantly institutional.

The practical implications are direct: agencies responsible for implementing Sinter should abandon uniform approaches and adopt differentiated strategies by profile. For municipalities in Clusters 1 and 2, technical support for integration should be accelerated. For Clusters 3 and 5, communication actions and value demonstration are priorities. For Cluster 4, the focus should be on strengthening technical and financial capacity. The operationalization of the Tax Reform — which makes the CIB mandatory for properties affected by the Tax on Goods and Services (IBS) and the Social Contribution on Goods and Services (CBS) — lends urgency to these actions, given that only 10.2% of the surveyed municipalities were integrated with Sinter during the study period.

In this context, it is worth reflecting on the developments that the Tax Reform is expected to produce in the dynamics of municipal adherence to Sinter. Until the enactment of Complementary Law No. 214 (2025), integration into Sinter, regulated by Decree No. 11,208 (2022), was configured as an essentially voluntary initiative, whose adoption depended on the political will and technical capacity of each municipal entity, weighing the costs of cadastral structuring against benefits that, for most administrators, remained largely intangible in the short term. Adherence to Sinter, which previously constituted a discretionary prerogative of local administrators, is thus transformed into a structural condition for the municipality's inclusion in the new national tax architecture — a change that should accelerate, albeit unevenly among federative entities, the cadastral modernization movement evidenced by the different profiles identified in this study.

Given this scenario, it is possible to anticipate at least three impacts arising from this new mandatory condition, associated with the risk of revenue loss for municipalities that remain outside the system. The first concerns its role as a driver of cadastral modernization: as highlighted by Roveri (2024), the dissemination of Multipurpose Territorial Cadastre (CTM) technology constitutes an essential condition for the municipal territory to be effectively known and explored to its full potential, such that the regulatory requirement tends to convert into an administrative imperative what previously depended solely on the local administrator's initiative. The second expected impact is an exponential growth in adherence to Sinter, since remaining outside the system will no longer be a viable option for municipalities, given the link established between CIB integration and the assessment of reference property values for IBS and CBS purposes. The third impact, in turn, falls upon Sinter itself: as municipalities with widely varying degrees of cadastral maturity — as revealed by the five profiles identified here — begin to join the system on a mandatory basis, its technical architecture and support mechanisms will need to adapt to accommodate this heterogeneity, under penalty of formal integration failing to translate into effective quality of the incorporated territorial data.

It can therefore be concluded that the transition from a voluntary adherence regime to a compulsory integration regime not only lends urgency to the differentiated support strategies proposed in this study, but also requires Sinter to develop sufficient flexibility to progressively accommodate municipalities at widely varying stages of cadastral development while ensuring technical robustness throughout the integration process.

5 REFERENCES

19

AMORIM, Amilton; PELEGRINA, Marcos Aurélio; JULIÃO, Rui Pedro. **Cadastro e gestão territorial**: uma visão luso-brasileira para a implementação de sistemas de informação cadastral nos municípios. São Paulo: Editora Unesp Digital, 2018. 131 p. *E-book*. Disponível em: <https://doi.org/10.7476/9788595462823>. Acesso em: 07 nov. 2025.

BRASIL. Ministério da Fazenda. **Administração Pública**: Prêmio de Criatividade e Inovação Auditor-Fiscal da Receita Federal do Brasil José Antônio Schöntag. Secretaria da Receita Federal do Brasil Coletânea de Monografias Premiadas. Brasília, DF: Ministério da Fazenda, 2010. 234 p. *E-book*. Disponível em: <https://repositorio.enap.gov.br/bitstream/1/4579/1/Livro%20-%207%C2%BA%20Premio%20RFB.pdf>. Acesso em: 22 fev. 2025.

BRASIL. **Lei nº 10.406, de 10 de janeiro de 2002**. Institui o Código Civil. Brasília: Casa Civil. Disponível em: https://www.planalto.gov.br/ccivil_03/leis/2002/l10406compilada.htm#art2044. Acesso em: 12 fev. 2025.

BRASIL. **Lei nº 5.868, de 12 de dezembro de 1972**. Cria o Sistema Nacional de Cadastro Rural, e dá outras providências. Brasília: Casa Civil. Disponível em: https://www.planalto.gov.br/ccivil_03/leis/l5868.htm. Acesso em: 17 fev. 2025.

BRASIL. **Decreto nº 8.764, de 10 de maio de 2016**. Institui o Sistema Nacional de Gestão de Informações Territoriais e regulamenta o disposto no art. 41 da Lei nº 11.977, de 7 de julho de 2009. Brasília: Secretaria-Geral. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2016/Decreto/D8764.htm. Acesso em: 28 nov. 2024.

BRASIL. **Decreto nº 11.208, de 26 de setembro de 2022**. Dispõe sobre o Sistema Nacional de Gestão de Informações Territoriais e sobre o Cadastro Imobiliário Brasileiro e regula o compartilhamento de dados relativos a bens imóveis. Brasília: Secretaria-Geral. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2019-2022/2022/decreto/d11208.htm. Acesso em: 27 nov. 2024.

BRASIL. **Lei nº 13.709, de 14 de agosto de 2018.** Lei Geral de Proteção de Dados Pessoais (LGPD). Brasília: Secretaria-Geral. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/lei/l13709.htm. Acesso em: 12 jan. 2025.

BRASIL. **Lei nº 10.257, de 10 de julho de 2001.** Regulamenta os arts. 182 e 183 da Constituição Federal, estabelece diretrizes gerais da política urbana e dá outras providências. Brasília: Casa Civil. Disponível em: https://www.planalto.gov.br/ccivil_03/leis/leis_2001/l10257.htm. Acesso em: 26 nov. 2024.

BRASIL. **Lei nº 10.267, de 28 de agosto de 2001.** Altera dispositivos das Leis nºs 4.947, de 6 de abril de 1966, 5.868, de 12 de dezembro de 1972, 6.015, de 31 de dezembro de 1973, 6.739, de 5 de dezembro de 1979, 9.393, de 19 de dezembro de 1996, e dá outras providências. Brasília: Casa Civil. Disponível em: https://www.planalto.gov.br/ccivil_03/leis/leis_2001/l10267.htm. Acesso em: 28 nov. 2024.

BRASIL. **Lei Complementar nº 214, de 16 de janeiro de 2025.** Institui o Imposto sobre Bens e Serviços (IBS), a Contribuição Social sobre Bens e Serviços (CBS) e o Imposto Seletivo (IS); cria o Comitê Gestor do IBS e altera a legislação tributária. Brasília: Casa Civil. Disponível em: https://www.planalto.gov.br/ccivil_03/leis/lcp/lcp214.htm. Acesso em: 02 fev. 2025.

BRASIL. **Instrução Normativa nº 2030, de 24 de junho de 2021.** Institui o Cadastro Imobiliário Brasileiro (CIB). Brasília: Secretaria Especial da Receita Federal do Brasil. Disponível em: <https://normasinternet2.receita.fazenda.gov.br/#/consulta/externa/118641>. Acesso em: 24 nov. 2024.

BRASIL. **Portaria nº 3.242, de 9 de novembro de 2022.** Aprova as diretrizes para a criação, a instituição e a atualização do Cadastro Territorial Multifinalitário - CTM, nos municípios brasileiros. Brasília: Ministério do Desenvolvimento Regional. Disponível em: <https://www.in.gov.br/en/web/dou/-/portaria-n-3.242-de-9-de-novembro-de-2022-443240087>. Acesso em: 17 nov. 2024.

BRASIL. **Portaria RFB nº 1.091, de 20 de julho de 2018.** Dispõe sobre a publicação do Manual Operacional do Sistema Nacional de Gestão de Informações Territoriais (Sinter) instituído pelo Decreto nº 8.764, de 10 de maio de 2016. Brasília: Receita Federal do Brasil. Disponível em: <https://normasinternet2.receita.fazenda.gov.br/#/consulta/externa/93499>. Acesso em: 23 nov. 2024.

BRASIL. **Resolução CNAS/MDS nº 176, de 17 de dezembro de 2024.** Dispõe sobre a atualização da classificação do porte dos municípios a partir dos dados do Censo Demográfico IBGE 2022 e dá outras providências. Brasília: Conselho Nacional de Assistência Social. Disponível em: <https://aplicacoes.mds.gov.br/snas/regulacao/visualizar.php?codigo=6858>. Acesso em: 14 abr. 2025.

BOTELHO, Louise Lira Roedel; DE ALMEIDA CUNHA, Cristiano Castro; MACEDO, Marcelo. O método da revisão integrativa nos estudos organizacionais. **Gestão e sociedade**, Belo Horizonte, v. 5, n. 11, p. 121-136, maio/ago. 2011. Disponível em: <https://pdfs.semanticscholar.org/b99b/4f7d8cb581a59f92915a0c64430d43dc65b0.pdf>. Acesso em: 18 dez. 2024.

CARDOSO, Antônio Carlos Apolinário de Souza; REYDON, Bastiaan; TRECCANI, Girolamo; BARBOSA, José de Arimatéia; FISCHER, Luly; ALVES, Luana Nunes Bandeira; SIQUEIRA, Gabriel. **Cadastro Territorial no Brasil: perspectivas e o seu futuro.** Belém: UFPA, 2018. *E-book*. Disponível em: https://www.cidh.ufpa.br/pdf/livros/eBook_CadastroTerritorialBrasil%20_2018.pdf. Acesso em: 05 jan. 2026.

CNJ. **Provimento nº 48, de 16 de março de 2016.** Estabelece diretrizes gerais para o sistema de registro eletrônico de títulos e documentos e civil de pessoas jurídicas. DJe/CNJ, nº 45, p. 32-33. 17 mar. 2016. Disponível em: <https://atos.cnj.jus.br/atos/detalhar/2511#:~:text=Par%C3%A1grafo%20%C3%BAnico.-,Os%20oficiais%20de%20registro%20t%C3%ADtulos%20e%20documentos%20e%20civil,por%20sua%20guarda%20e%20conserva%C3%A7%C3%A3o>. Acesso em: 18 nov. 2024.

CUNHA, Cristiane Martins; DE ALMEIDA NETO, Omar Pereira; STACKFLETH, Renata. Principais métodos de avaliação psicométrica da validade de instrumentos de medida. **Revista de Atenção à Saúde**, São Caetano do Sul, v. 14, n. 47, p. 75-83, jan./mar. 2016. DOI: <https://doi.org/10.13037/ras.vol14n47.3391>. Disponível em: https://www.seer.uscs.edu.br/index.php/revista_ciencias_saude/pt_BR/article/view/3391. Acesso em: 22 jan. 2026.

CUNHA, Eglaisa; OLIVEIRA, Francisco; JULIÃO, Rui; CARNEIRO, Andrea. O cadastro urbano no Brasil: histórico e evolução. **Revista de Geografia e Ordenamento do Território**, Porto, n. 17, p. 55-74, jun. 2019. DOI: <https://doi.org/10.17127/got/2019.17.003>. Disponível em: http://scielo.pt/scielo.php?script=sci_arttext&pid=S2182-12672019000200004&lng=pt&nrm=iso. Acesso em: 15 fev. 2026.

ERBA, Diego Alfonso (org); OLIVEIRA, Fabricio Leal de (org); LIMA JUNIOR, Pedro de Novais (org). **Cadastro multifinalitário como instrumento de política fiscal e urbana**. Rio de Janeiro. 2005. 144p. *E-book*. Disponível em: <http://www.bibliotecapca.org.ar/greenstone/collect/libagr/index/assoc/HASH3fc4.dir/doc.pdf>. Acesso em: 05 nov. 2025.

ESPAÑA. **Gestión de Catastro**: curso online 2021 - Dirección General del Catastro. Disponível em: <https://interconectaaulavirtual.aecid.es>. Acesso em: 13 abr. 2021.

FAO/SEAD. **Governança de terras**: da teoria à realidade brasileira. Brasília, 2017.378 p. *E-book*. Disponível em: <https://openknowledge.fao.org/items/821149a8-64b4-4a2b-b77f-604ffe5c8b6f>. Acesso em: 14 out. 2025.

FARIAS, Edla Siqueira; CARNEIRO, Andréa Flávia Tenório. Análise das necessidades de usuários para o compartilhamento das informações de um cadastro territorial multifinalitário. **Revista Brasileira de Cartografia, [S.l.]**, v. 67, n.2, p. 307-318, mar./abr. 2015. DOI: 10.14393/rbcv67n2-44663. Disponível em: <https://seer.ufu.br/index.php/revistabrasileiracartografia/article/view/44663>. Acesso em: 18 jan. 2025.

FIG. **The FIG statement on the cadastre**. FIG Publication n. 11, 1995. Disponível em: <https://www.fig.net/resources/publications/figpub/pub11/figpub11.asp>. Acesso em: 06 out. 2025.

FIG. **The Bathurst declaration on land administration for sustainable development**. UN-FIG workshop on land tenure and cadastral infrastructure for sustainable development, Bathurst, Australia, 1999. Disponível em: <http://www.fig.net/resources/publications/figpub/pub21/figpub21.asp#APPENDIXIV>. Acesso em: 06 out. 2025.

FREIRE, Victor Augusto Soares. Análise histórica da autonomia conferida (ou não) aos municípios pelas constituições brasileiras. **Conteúdo Jurídico**, Brasília, ago. 2023. Disponível em: <https://conteudojuridico.com.br/consulta/artigos/62768/anlise-historica-da-autonomia-conferida-ou-no-aos-municipios-pelas-constituies-brasileiras>. Acesso em: 01 mar. 2025.

FREITAS, André Luís Policiani; RODRIGUES, Sidilene Gonçalves. A avaliação da confiabilidade de questionários: uma análise utilizando o coeficiente alfa de Cronbach. **XII Simpósio de Engenharia de produção**, Bauru, v. 12, nov. 2005. DOI: 10.13140/2.1.3075.6808. Disponível em: https://www.researchgate.net/publication/236036099_A_avalicao_da_confiabilidade_de_questionarios_uma_analise_utilizando_o_coeficiente_alfa_de_Cronbach. Acesso em: 28 jan. 2026.

GIL, Antonio Carlos. **Métodos e Técnicas de Pesquisa Social**. 7. ed. São Paulo: Atlas, 2019.

GIMENES, Fernanda de Souza Farias; SANTOS, Elizete de Oliveira; NOGUEIRA, Rebecca; LIBERATO, Monelisa da Silva; PAIVA, Ana Carla de Queiroz. Adesão ao sistema nacional de gestão de informações territoriais (Sinter): a experiência do município de Fortaleza/CE. **Anais do COBRAC 2024**, Florianópolis, 11-13 nov. 2024. Disponível em: <https://ocs.cobrac.ufsc.br/index.php/cobrac/cobrac2024/paper/viewFile/995/463>. Acesso em: 28 fev. 2025.

HARMAN, Harry H.; JONES, Wayne H. Factor analysis by minimizing residuals (minres). **Psychometrika**, Cambridge, v. 31, p. 351-368, 1966. DOI: <https://doi.org/10.1007/BF02289468>. Disponível em: <https://www.cambridge.org/core/journals/psychometrika/article/abs/factor-analysis-by-minimizing-residuals-minres/847A52E1D3F89FEDA083440751735FF>. Acesso em: 26 jan. 2026.

HORA, Henrique Rego Monteiro da; MONTEIRO, Gina Torres Rego; ARICA, Jose. Confiabilidade em questionários para qualidade: um estudo com o coeficiente alfa de Cronbach. **Produto & Produção, [S.l.]**, v. 11, n. 2, 2010. DOI: <https://doi.org/10.22456/1983-8026.9321>. Disponível em: <https://seer.ufrgs.br/ProdutoProducao/article/view/9321>. Acesso em 21 dez. 2025.

IBGE. **Pesquisa de Informações Básicas Municipais (MUNIC)**: Perfil dos Municípios Brasileiros 2019. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2020.

IBGE. **Censo Demográfico 2022**. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2023.

LANÇAMENTO Sinter. Gravado por TV Receita Federal. Brasília, 08 dez. 2022. 1 vídeo (129 min.). Publicado pelo canal TV Receita Federal. Disponível em: <https://www.youtube.com/watch?v=7BYrqnSRzSc>. Acesso em: 05 fev. 2025.

LAKATOS, Eva Maria; MARCONI, Marina de Andrade. **Fundamentos de metodologia científica**. 5. ed. São Paulo: Atlas, 2003.

LIKERT, Rensis. A technique for the measurement of attitudes. **Archives of psychology**, New York, v. 22, n. 140, p. 1-55, 1932. Disponível em: <https://archive.org/details/likert-1932/page/4/mode/2up>. Acesso em: 14 fev. 2025.

LOCH, Carlos; ERBA, Diego Alfonso. **Cadastro Técnico Multifinalitário: rural e urbano**. Cambridge: Lincoln Institute of Land Policy, 2007. 142 p. *E-book*. Disponível em: <https://www.lincolnst.edu/app/uploads/2024/04/cadastro-tecnico-multifinalitario-rural-e-urbano-full.pdf>. Acesso em: 02 nov. 2025.

MATOS, Daniel Abud Seabra; RODRIGUES, Erica Castilho. **Análise Fatorial**. Brasília: Enap, 2019.

MIRANDA, Benito Bericochea; GARCÍA, Luis Bachiller. Los bienes inmuebles de característica especiales. Revisión de una nueva categoría de inmuebles en el catastro español. **Revista Catastro**, [S.l.], n. 71, p. 7-17, abr. 2011. Disponível em: <https://dialnet.unirioja.es/ejemplar/284889>. Acesso em: 28 fev. 2025.

MORAES, Selene Ferreira de. **Sistemas de coordinación del registro de propiedad y el catastro inmobiliario: un análisis comparativo entre Brasil, España y Perú**. 2021. Dissertação (Mestrado em Fazenda Pública e Administração Financeira e Tributária) – Universidad Nacional de Educación a Distancia, Madri, 2021. Disponível em: https://www.academia.edu/70223285/TFM_Selene_Ferreira_de_Moraes. Acesso em: 13 out. 2024.

MORETTIN, Pedro Alberto; SINGER, Julio da Motta. **Estatística e ciência de dados**. 1. ed. Rio de Janeiro: LTC, 2022.

OBSERVATÓRIO do registro (Brasil). **SREI - ONR - SINTER em discussão**. São Paulo: Sérgio Jacomino, 2020. Disponível em: <https://cartorios.org/2020/05/13/srei-onr-sinter-em-discussao/#more-9266>. Acesso em: 04 mar. 2025.

PRODANOV, Cleber Cristiano; FREITAS, Ernani Cesar de. **Metodologia do trabalho científico: métodos e técnicas da pesquisa e do trabalho acadêmico**. Novo Hamburgo: Feevale, 2013. 276 p. *E-book*. Disponível em: <https://www.feevale.br/Comum/midias/0163c988-1f5d-496f-b118-a6e009a7a2f9/E-book%20Metodologia%20do%20Trabalho%20Cientifico%20.pdf>. Acesso em: 15 jan. 2025.

QUEIROZ, Andrea Oliveira. Cidades inteligentes: o papel do cadastro territorial Multifinalitário como ferramenta de gestão e planejamento. **Revista Nacional de Gerenciamento de Cidades**, [S.l.], v. 6, n. 37, 2019. <https://doi.org/10.17271/2318847263720181767>. Disponível em: https://publicacoes.amigosdanatureza.org.br/index.php/gerenciamento_de_cidades/pt_BR/article/view/1767. Acesso em: 27 jun. 2026.

RECEITA FEDERAL DO BRASIL. **[Visualizador do Sinter]**. Brasília: RFB, 2022. Disponível em: <https://www.sinter.fazenda.gov.br>. Acesso em: 03 mar. 2025.

RECEITA FEDERAL DO BRASIL. **Roteiro técnico de integração ao Sinter versão prd 2023-08-15**. Brasília: RFB, 2023. Disponível em: https://www.enat.receita.economia.gov.br/pt-br/area_nacional/areas_interesse/sinter/roteiro-tecnico-de-integracao-ao-sinter-1. Acesso em: 04 mar. 2025.

RECEITA FEDERAL DO BRASIL. **Manual da declaração sobre operações imobiliárias (DOI)**: fornece instruções ao preenchimento da declaração sobre operações imobiliárias (DOI). Brasília: RFB, 2025. Disponível em: <https://www.gov.br/receitafederal/pt-br/centrais-de-conteudo/publicacoes/manuais/doi>. Acesso em 08 mar. 2025.

REZENDE, L. O. R. Sinter – Um impulso para o futuro do cadastro no Brasil. **Revista de Direito Imobiliário**, São Paulo, ano 39, n. 81, p. 235-252, jul./dez. 2016. Disponível em: <https://academia.irib.org.br/xmlui/handle/123456789/1164>. Acesso em: 28 fev. 2025.

ROGERS, Pablo. Melhores práticas para sua análise fatorial exploratória: tutorial no Factor. **Revista de Administração Contemporânea**, Uberlândia, v. 26, n. 6, e210085, 2022. DOI: <https://doi.org/10.1590/1982-7849rac2022210085>. Disponível em: scielo.br/j/rac/a/RL4bNh4w36J9shFHWsVsFDC/?format=pdf&lang=pt. Acesso em: 13 dez. 2025.

ROVERI, Claudia. O papel do cadastro territorial multifinalitário para a tributação imobiliária no Brasil após a emenda constitucional 132/2023 - Reforma Tributária. **Anais do Cobrac 2024**, Florianópolis, 17º Congresso De Cadastro Multifinalitário E Gestão Territorial. Disponível em: <https://ojs.sites.ufsc.br/index.php/cobrac/article/view/10547>. Acesso em: 04 jul. 2026.

SILVA, Everton (org.). **Cadastro territorial multifinalitário aplicado à gestão municipal**. Florianópolis: UFSC, 2023. 214 p. E-book. Disponível em: <https://repositorio.ufsc.br/handle/123456789/253967>. Acesso em 18 nov. 2024.

SILVA, Suzana Daniela Rocha Santos e; BRANDÃO, Arthur Caldas; CARNEIRO, Andrea Flávia Tenório; ANTUNES, Alzir Felipe Buffara. Por uma estruturação sistêmica e de abrangência nacional para o cadastro territorial brasileiro. **Revista Brasileira de Cartografia**, [S.l.], v. 73, n. 2, p. 685–706, 7 abr. 2021. DOI: <http://dx.doi.org/10.14393/rbcv73n2-57862>. Disponível em: <https://seer.ufu.br/index.php/revistabrasileiracartografia/article/view/57862>. Acesso em: 26 nov. 2024.

SILVA, Suzana Daniela Rocha Santos e; BORGES, Karla A. V.; BRANDÃO, Arthur Caldas; BUENO, Régis F. Um modelo semântico e ontológico para o cadastro territorial brasileiro. **Advances in Knowledge Representation**, [S.l.], v. 5, n. 2, p. 1-24, 2025. Disponível em: <https://periodicos.ufmg.br/index.php/advances-kr/article/view/60298>. Acesso em: 27 nov. 2025.

SOUZA, Deborah Valandro; COSTA, Diogenes Cortijo; OLIVEIRA, Henrique Cândido. O potencial do sistema nacional de gestão de informações territoriais (Sinter) como ferramenta de transparência e integração de cadastros. **Revista Brasileira de Cartografia**, [S.l.], v. 72, n. 3, p. 532–540, jul./set. 2020. DOI: <http://dx.doi.org/10.14393/rbcv72n3-50087>. Disponível em: <https://seer.ufu.br/index.php/revistabrasileiracartografia/article/view/50087/29944>. Acesso em: 20 out. 2024.

STEPHAN, Ítalo Itamar Caixeiro; MARIA, Ana Cristina de Souza. Os desafios do planejamento e gestão urbanos em pequenas cidades de Minas Gerais. **Revista Nacional de Gerenciamento de Cidades**, [S. l.], v. 3, n. 15, 2015. DOI: 10.17271/231884723152015996. Disponível em: https://publicacoes.amigosdanatureza.org.br/index.php/gerenciamento_de_cidades/article/view/996. Acesso em: 27 jun. 2026.

TUKEY, John W. Exploratory Data Analysis. Reading: Addison-Wesley, 1977.

UNECE. **Land administration guidelines with special reference to countries in transition**. United Nations. New York and Geneva, 1996. p.12. Disponível em: <https://unece.org/fileadmin/DAM/hlm/documents/Publications/land.administration.guidelines.e.pdf>. Acesso em: 13 mar. 2025.

STATEMENTS

CONTRIBUTION OF EACH AUTHOR

When describing each author's participation in the manuscript, use the following criteria:

- **Conception and Design of the Study:** Lia Caetano Bastos and Wanderlea Aparecida Zanardi Monteiro.
 - **Data Curation:** Wanderlea Aparecida Zanardi Monteiro.
 - **Formal Analysis:** Wanderlea Aparecida Zanardi Monteiro.
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 - **Investigation:** Wanderlea Aparecida Zanardi Monteiro.
 - **Methodology:** Lia Caetano Bastos and Wanderlea Aparecida Zanardi Monteiro.
 - **Writing - Initial Draft:** Wanderlea Aparecida Zanardi Monteiro.
 - **Writing - Critical Review:** Lia Caetano Bastos.
 - **Revision and Final Editing:** Wanderlea Aparecida Zanardi Monteiro.
 - **Supervision:** Lia Caetano Bastos and Wanderlea Aparecida Zanardi Monteiro.
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DECLARATION OF CONFLICTS OF INTEREST

We, Wanderlea Aparecida Zanardi Monteiro and Lia Caetano Bastos, declare that the manuscript entitled "**Municipal Profiles in Integration with Sinter: A Factorial and Spatial Analysis**":

1. **Financial Links:** No institution or funding entity was involved in the development of this study.
 2. **Professional Relationships:** Has no professional relationships that may impact the analysis, interpretation or presentation of the results.
 3. **Personal Conflicts:** Has no personal conflicts of interest related to the content of the manuscript.
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