

# The Panorama of Municipal Basic Sanitation Plans in Brazil

*Panorama dos Planos Municipais de Saneamento Básico no Brasil*

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## ABSTRACT

Planning is essential for basic sanitation development. Despite its relevance, planning application is still incipient in Brazil. The Municipal Basic Sanitation Plan (MBSP) is the main public policy instrument at the municipal level. In this context, this study aimed to develop an overview of MBSP elaboration in Brazil and to discuss gaps and potentialities in this process. The panorama was based on a database with information about all Brazilian municipalities. It was structured through active research between 2017 and 2021. Data were treated and analyzed in terms of absolute numbers, spatial cutouts (macroregions), and by the criteria of population size and Human Development Index (HDI). The results showed that plan elaboration still needs to be improved, with 65.7% of Brazilian municipalities indicating MBSP existence but only 40.7% having their documents located. The Southeast region stood out positively, while the Northeast presented the most incipient results. Regarding municipal size, it was observed that plan preparation is proportionally greater in municipalities with a population of over 100,000 inhabitants. Instead, no statistical differences were observed between the small- and medium-sized results. For the HDI, the percentage of plans' existence and location were decreasing according to the classifications of "very high", "high", "medium", and "low". The results point to characteristics that may be involved in the institutionalization of sanitation planning, demonstrating the need to understand the demands for effective public policy development in line with the reality of the municipalities.

**Keywords:** planning; sanitation public policies; city.

## RESUMO

O planejamento é crucial para o avanço do saneamento básico, contudo, sua aplicação no Brasil ainda é incipiente. No âmbito municipal, os Planos Municipais de Saneamento Básico (PMSB) desempenham um papel central nas políticas públicas. Este estudo tem como objetivo analisar a elaboração dos PMSB no Brasil, identificando os desafios e oportunidades envolvidos no processo. Para isso, construímos um banco de dados com informações de todos os municípios brasileiros, coletadas ativamente entre 2017 e 2021. Os dados foram analisados considerando números absolutos, divisões geográficas (macrorregiões) e critérios de tamanho populacional e Índice de Desenvolvimento Humano (IDH). Os resultados indicam que a elaboração dos planos ainda é limitada, com apenas 65,7% dos municípios brasileiros declarando a existência de PMSB e apenas 40,7% tendo seus documentos localizados. A Região Sudeste se destacou positivamente, enquanto o nordeste apresentou resultados mais modestos. Em relação ao tamanho populacional dos municípios, observou-se que a elaboração dos planos é proporcionalmente maior em cidades com mais de 100.000 habitantes, sem diferenças estatisticamente significativas entre municípios de porte médio e pequeno. Quanto ao IDH, a porcentagem de planos declarados e localizados diminui à medida que o IDH é classificado como "muito alto", "alto", "médio" e "baixo". Os resultados destacam características que podem influenciar a institucionalização do planejamento em saneamento, enfatizando a importância de compreender as necessidades para desenvolver políticas públicas eficazes, adaptadas à realidade dos municípios.

**Palavras-chave:** planejamento; políticas públicas de saneamento; municípios.

## INTRODUCTION

Planning is crucial in implementing public policy and gathering universalization on basic sanitation due to its character of ordering actions and supporting decision-making. When properly developed, incorporating the entire sector's complexity, it enhances the management of services. Thus, it

includes corrections in the short term and action projections in the medium and long terms, reducing improvisations and emergency decisions (LISBOA; HELLER; SILVEIRA, 2013).

In Brazil, the enactment of Law 11,445, of 2007, represented a legal and institutional framework for sanitation, recognizing it as a social right by defining

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more inclusive, democratic, and universalistic principles (BRITTO; REZENDE, 2017; MENICUCCI; DALBUQUERQUE, 2018). The legislation text defines basic sanitation as a set of public services, infrastructure, and operational facilities for drinking water supply, sanitary sewage, urban cleaning and solid waste management, and drainage and urban rainwater management. It also highlights the relevance of planning for sanitation, dedicating a specific chapter to the theme – Chapter IV: Planning (BRASIL, 2007).

By this publication, the application of formal planning became a mandatory premise for basic sanitation actions in Brazil. Thus, the municipalities, responsible for the ownership of these services (BRASIL, 1988), must prepare sanitation plans as an access requirement to government funds directed for the sector (BRASIL, 2007). This requirement was regulated by Decree No. 7,217 of 2010, which determined its validity by the year 2014 (BRASIL, 2010). However, the deadlines for preparing the plans were extended five times until the last definition, dated December 31, 2024 (BRASIL, 2023).

Despite the compulsory, in addition to advantages and institutional incentives for planning, many municipalities still have not presented Municipal Basic Sanitation Plans (MBSP). The last panorama, published in Brazil in January 2017, collected information on the preparation of plans from a sample of 3,903 Brazilian cities, corresponding to 70% of the total. The data report that, at the time, 30% of them had a plan, and 38% were in preparation (BRASIL, 2017).

Given this context, the objectives of this study are guided by the general hypothesis that the elaboration phase of MBSP in Brazil has yet to be overcome. So, it deserves emphasis in the search for factors that represent strengths and weaknesses in this process. The analysis of conditions for preparing plans at the local level is relevant for understanding the administrative capacity of cities and assessing the efficiency of implementing national policies in this area (MARINO; CHAVES; SANTOS JUNIOR, 2018).

Based on the premise that small cities have socioeconomic limitations and deficits related to the availability of human and material resources (CASTRO; KOGA, 2019; LISBOA; HELLER; SILVEIRA, 2013), it is understood that the population size indicator is directly related to the ability on preparing a sanitation plan. Lower Human Development Index (HDI) values should also correspond to less favoring the development of plans since higher index rates are correlated with improved sanitation conditions (RIAHI *et al.*, 2018). Furthermore, differences between Brazilian macroregions are also expected due to the historically unequal resource distribution (SANTOS; KUWAJIMA; SANTANA, 2020). In addition, there are regional particularities concerning the provision of basic sanitation services.

Therefore, this is an exploratory and descriptive study, focusing on the national situation of MBSP elaboration. Previous studies on municipal planning in Brazil evaluate cases of specific municipalities or document contents with more restricted space-time cuts (FARIA *et al.*, 2022; LISBOA; HELLER; SILVEIRA, 2013; PEREIRA; HELLER, 2015; SANTIAGO *et al.*, 2019). In addition, information systems and databases on sanitation are generally incomplete and prioritize quantitative approaches (BRASIL, 2014). This study sought to understand the planning challenges, starting with quantification based on a complete and original database. Given the context, this article aims to present the panorama of MBSP elaboration in Brazilian cities and discuss gaps and potentialities based on spatial distribution, population, and municipal human development criteria.

## METHODOLOGY

### Database characterization

The panorama of planning in basic sanitation in Brazil was designed based on exploring a database with information on the elaboration of all MBSP in Brazil. The database was developed during the project “*SanBas: Training and development of Municipal Basic Sanitation Plans (MBSPs) in councils with a population of up to 50,000 inhabitants in the state of Minas Gerais: an action research in the field of technology, social control, communication and empowerment on basic sanitation public policies*”. The project began in 2016 and has been formalized through the Term of Decentralized Execution 002/2016, process 25190.007.343/2016-10, which established a partnership between the Federal University of Minas Gerais and the National Health Foundation. The mentioned foundation was linked to the Ministry of Health and used to share responsibility for basic sanitation in municipalities with less than 50,000 inhabitants.

The initial data collection process was based on the MBSP panorama published by the Ministry of Cities in 2017 (BRASIL, 2017). In this context, the data was verified and updated, with searches for information on cities not considered by the panorama. Data collection took place until June 2021.

The information on MBSP elaboration of the 5,570 Brazilian municipalities was directed to two central questions: “Does it have MBSP?” and “Was the MBSP located?”. They were answered through active search, according to the following steps:

- Google search using keywords.
- Search on City Hall and City Council websites.
- Search on river basin agencies and committees.
- Search on electronic websites of different regulatory agencies of sanitation services.
- Search on federal and state transparency portals.
- Search on electronic websites of state departments related to basic sanitation.
- Search on the National Sanitation Information System (NSIS), referring to 2019.

The first question was answered by the identification of any reference to the MBSP existence in each of the municipalities, according to the active search. The second one was also filled according to the location of these documents in various other sources of plans availability, such as the National Health Foundation, institutional websites, published news, and direct contact via telephone or e-mail with those responsible for the municipal sectors. The files were organized on the RIOS Platform — River of Organized and Solidarity Information, and the documents are available for download on the Infosanbas website: <https://infosanbas.org.br/>.

Data on geographic location, population, and HDI were collected from the Brazilian Institute of Geography and Statistics (IBGE) databases to characterize the municipalities. In addition, information about the plans was gathered, regarding funding organization, developer institution, completion, and revision dates, if applicable.

It is important to note that this database has supported different studies. Amaral (2019) evaluated social participation in planning, while Pacifico (2020) analyzed the relationship between health and sanitation in the texts of the studied plans. In scientific articles, the approach of rural territories by the plans (FRANCO; BARRA; GOMES, 2022), and the panorama of MBSP and Urban Drainage Master Plans in small municipalities of Minas Gerais (FARIA *et al.*,

2022) were analyzed. In addition, a case study of 16 MBSP in Minas Gerais considered aspects related to drainage and management of rainwater and its relationship with arboviruses (FARIA *et al.*, 2023). However, for the first time, the database analysis carried out in this study is nationwide.

### Inconsistency analysis of the database

The information displayed in the spreadsheet was checked to analyze the consistency and validate the database. In the first stage, 22 empty cells were identified, associated with 8 municipalities. The missing information represented 0.056% of the total data collected, comprising 0.14% of the municipalities. No empty cells were identified for the central questions related to the MBSP elaboration. Therefore, incompleteness did not affect the initial data analysis. Information on total population and HDI was completed according to the 2010 Brazilian Demographic Census (IBGE, 2012).

In the second step, an active search was carried out to check the situation of each of the municipalities in which the answer to the question “Does it have MBSP?” was “No”, and the answer to “Was the MBSP located?” was “Yes”. It was identified that 50 municipalities, according to the database, do not have the plan but had their documents located. The last city declaration to the NSIS in 2020 was used to verify the first case. Among the 50 municipalities marked with a negative answer to the question “Does it have MBSP?” 9 affirmed the existence of a plan and 9 did not declare to the system. Such divergence may have occurred due to the period in which the platform was consulted by the group involved in the construction of the database since the collection process took place from 2017 to 2021.

Regarding the location of the MBSP, 28 municipalities had access links registered for its plans. Of those, two did not have the corresponding content. Notably, among these cities that had their plans located, 21 declared that they did not have a plan or did not declare it to the NSIS in 2020. This situation reflects the imprecision of the self-declaration. In addition, there is a possible lack of knowledge among the municipalities’ teams, as was also identified in the study developed by Queiroz and Zapata (2022). For the other 22 municipalities analyzed which did not have access links to the plans registered in the spreadsheet, two declared that they had them and were located.

Based on the investigation carried out, 13 municipalities actually had a negative response to the existence of MBSP but had their documents located. For the other 37, the necessary changes were made to adapt the data. Despite the identified divergences, they represent 0.07% of the studied universe, not compromising the use of the database for the construction of the panorama of the municipal plans.

### Data processing and mapping

The collected data were analyzed and treated quantitatively, using tabular and graphic descriptions. The Microsoft Excel software — version 2204 and the QGIS 3.22 — Long Term Release software were used to organize the data. Both enabled mapping information on Brazilian territory and applying filters based on the attributes available in the database. The maps elaboration in QGIS was carried out using shapefiles of the municipal grid and the federation units made available by IBGE (2022) with the SIRGAS 2000 Geodetic Reference System.

With the general mapping of the national territory, absolute numbers were analyzed concerning the answers obtained for the two central questions of the

study. In a later phase, cutouts were made considering spatial subdivisions by macroregions, and indicators of population size and HDI, as shown in Figure 1. For division by size, the stratification adopted by different public sectors was considered (BRASIL, 2005; SÃO PAULO, 2023), mainly focusing on the classification of small municipalities, which was in line with the National Health Foundation’s field for sanitation actions — population of less than 50,000 inhabitants (FUNASA, 2021). The subdivision of HDI followed the classification of the United Nations Development Program (UNDP, 2022).

Kruskal-Wallis test was performed with a Dwass-Steel-Critchlow-Fligner (DSCF) test, as in the study developed by Bressane *et al.* (2022), to verify the correlation between MBSP elaboration and the specified criteria. Kruskal-Wallis test is a nonparametric method traditionally adopted to compare three or more groups with categorical variables. It identifies whether at least two analyzed groups have different distributions (COUCH *et al.*, 2019). DSCF test allows for pairwise analysis in multiple comparisons. Data were analyzed using the Jamovi software — version 2.3.18.0, at a 95% confidence level.

## RESULTS AND DISCUSSION

### Municipal Basic Sanitation Plan analysis in absolute numbers at the national scale

The primary data analysis found that 65.7% of the Brazilian municipalities indicated the existence of MBSP, according to the active search. However, only 40.7% of the 5,570 Brazilian cities had their respective plan located. The thematic maps in Figure 2 are built based on the central questions (A) “Does it have MBSP?” and (B) “Was the MBSP located?” demonstrating the results observed throughout the national territory.

The maps show the discrepancy between the data presented on MBSP existence and the documents located by the SanBas work team. About affirmative answers, there was a difference of 38% between the two questions asked. For negative answers, there was an increase of 97% for the number of documents not located in relation to the declaration of the non-existence of MBSP.

It must be highlighted the possibility of erroneous and outdated information available on institutional websites. It was also found in the study developed by Marino, Chaves and Santos Júnior (2018) who analyzed the technical capacity of Brazilian municipalities in solid waste management. The authors pointed out that this fact is common, especially in small cities.

It is also noted that the SNIS, one of the data sources used to indicate the existence of PMSB, has a self-reporting and non-compulsory nature in

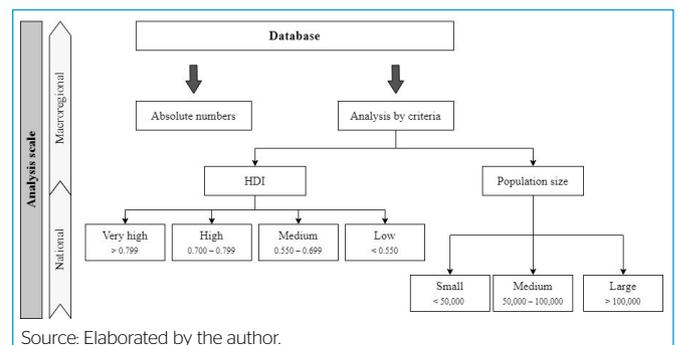
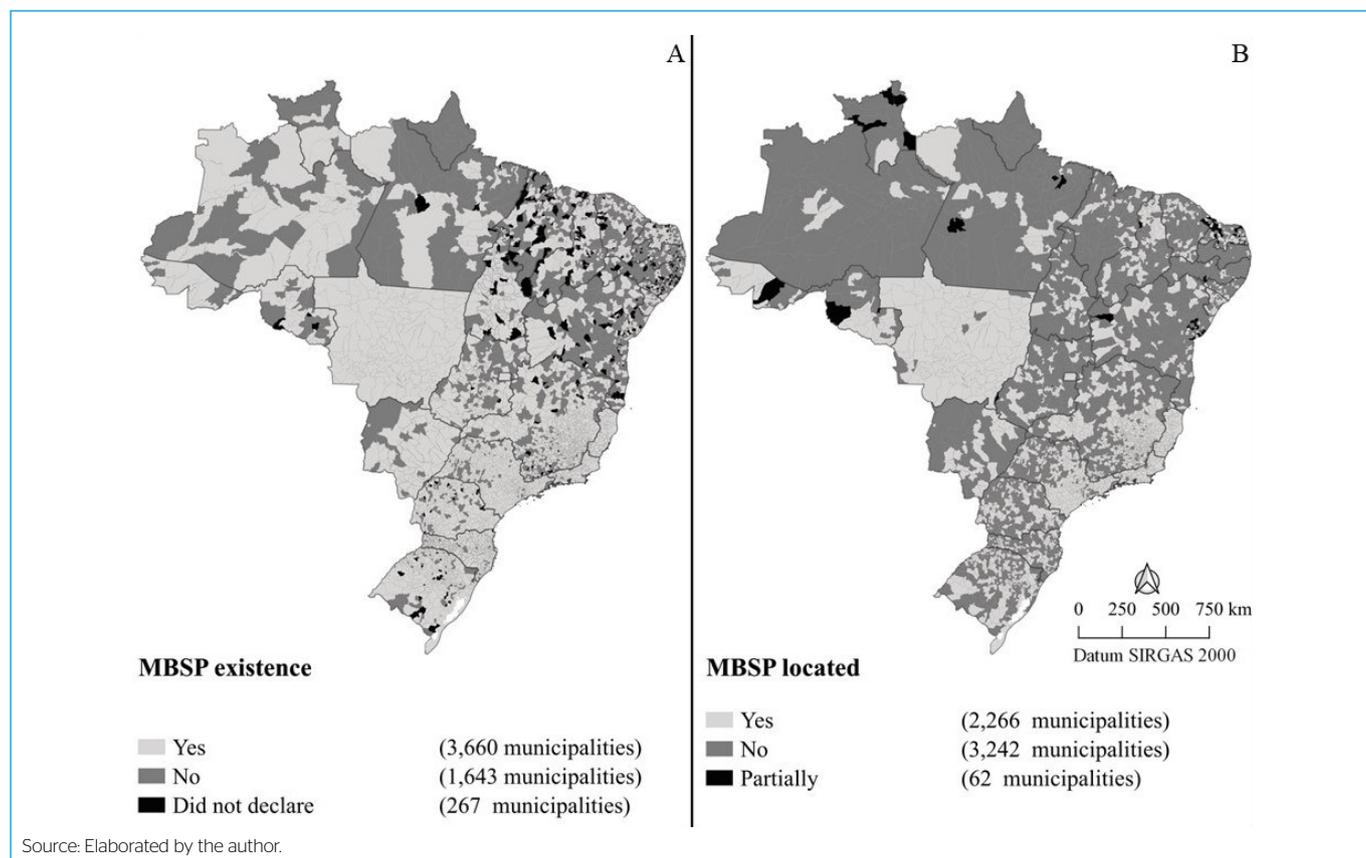


Figure 1 - Methodological process for database analysis.



**Figure 2** - Mapping of Brazilian municipalities on Municipal Basic Sanitation Plan existence (A) and location of plans (B).

the collection of information, which may be associated with the observed disparity. Several authors have already mentioned that the system's methodological process compromises the reliability and accuracy of the information (CAIÇARA *et al.*, 2022; FARIA *et al.*, 2022; NASCIMENTO; MENDES, 2021; TEIXEIRA; AZEVEDO; JULIEN, 2021). Similar to the results of this study, Faria *et al.* (2022) identified that much information on MBSP made available on the NSIS does not portray reality. In the study's sample universe, represented by small municipalities in Minas Gerais, almost one-third did not respond to the information system, and a portion of the responses was wrong. The authors pointed out that sometimes the person responsible for filling out the form may not recognize the data requested by the system or may even be unaware of the plan's existence (FARIA *et al.*, 2022). Regarding the requested information, the system managers recognize methodological limitations associated with terminology standardization and seek to minimize them by describing the variables (TEIXEIRA; AZEVEDO; JULIEN, 2021).

In addition, the SanBas work team recurrently reported difficulties in accessing documents or contacting city halls, which also corroborates the number of plans not located. Such obstacles were also observed by Marino, Chaves and Santos Júnior (2018), who highlighted the difficulty of telephone contact with city halls. Access to the plans is easier when they are developed by river basin agencies or in partnership with educational institutions via Terms of Decentralized Execution, e.g., since the transparency of processes motivates the publication of documents on the electronic addresses of the acting institutions (AMARAL, 2019).

### Municipal Basic Sanitation Plan analysis in absolute numbers at the macroregional scale

The graphs in Figure 3 show the proportion of results for the existence of MBSP (Figure 3A) and the location of the documents (Figure 3B) in the municipalities distributed in the five Brazilian macroregions.

Southeast and South presented the best results for plan elaboration with values above 80%, based on information from the active search. However, the regions showed considerable differences in terms of the actual location of the plans. Among the documents located, the positive highlight still occurs for the Southeast region, where plans were identified for 60.4% of the municipalities. Historically, these regions were prioritized in resources distribution, which used to be directed to urban centers (SANTOS; KUWAJIMA; SANTANA, 2020).

The Northeast showed incipient results to the first and second questions, with 38.5% indicating the existence of MBSP and only 22.9% of the plans localized. In their study, Marino, Chaves and Santos Júnior (2018) highlighted the difficulty in communicating with city halls in the region, where they could not establish telephone contact with 76% of the municipalities studied. The authors indicated that this represents a structural problem and a degree of regional isolation.

In the panorama published in 2017, the Northeast also had the lowest proportion of municipalities with MBSP among the macroregions, with only 10% of the sample declaring its existence (BRASIL, 2017). The numbers demonstrate little evolution in the development of planning for public sanitation policy. This region, along with the North, shows inequalities in the provision of water supply and sewage services, as well as in the elaboration of policies compared to other regions (ARAÚJO; FERREIRA; SILVEIRA, 2022).

The Kruskal-Wallis test demonstrated a significant difference in the results on the elaboration of MBSP between the macroregions, with a p-value less than 0.001 for both proposed questions. However, the comparative analysis by pairs, using the DSCF test, showed no statistically significant difference in the existence of MBSP between the Midwest and Southeast macroregions. Regarding the location of the documents, the same was observed for the Northeast and North, in addition to the Midwest and South. When analyzing the evolution of spatial distribution of access to basic sanitation services in Brazil, Rodrigues, Venson, and Camara (2019) found similar results among the regions, with higher coverage

for Midwest and Southeast and minor evolution for the North and Northeast. These results may reflect similar bottlenecks and potentialities faced by the compared regions, mainly regarding the North and Northeast, which presented the lowest numbers in plan elaboration.

### Municipal Basic Sanitation Plan analysis by population size and Human Development Index criteria

The analysis of MBSP elaboration by population size and HDI criteria is presented in Figures 4 and 5.

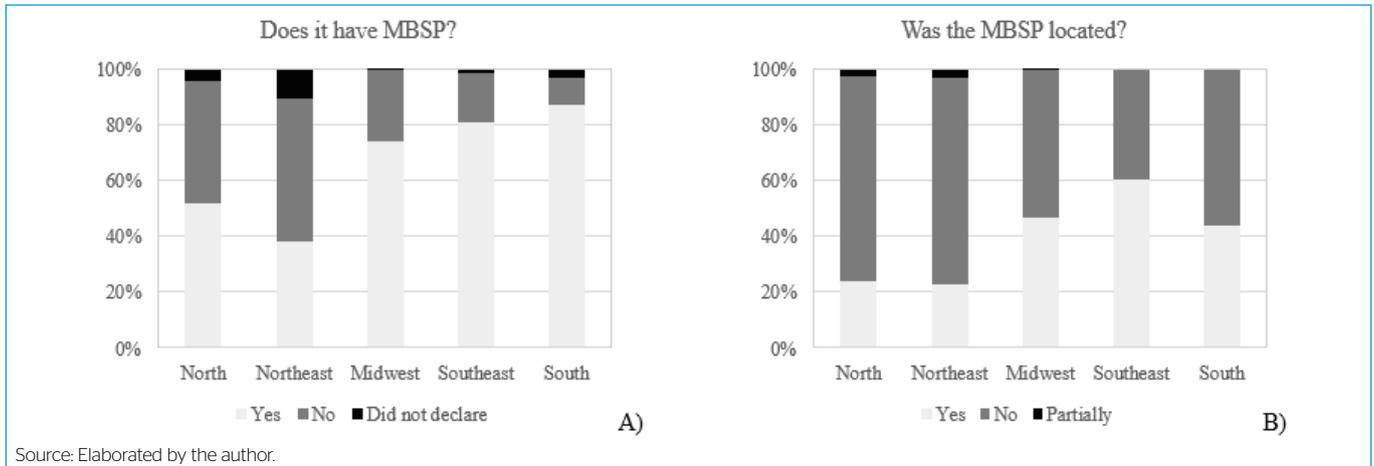


Figure 3 - Existence of Municipal Basic Sanitation Plan (A) and location of plans (B) in Brazilian macroregions.

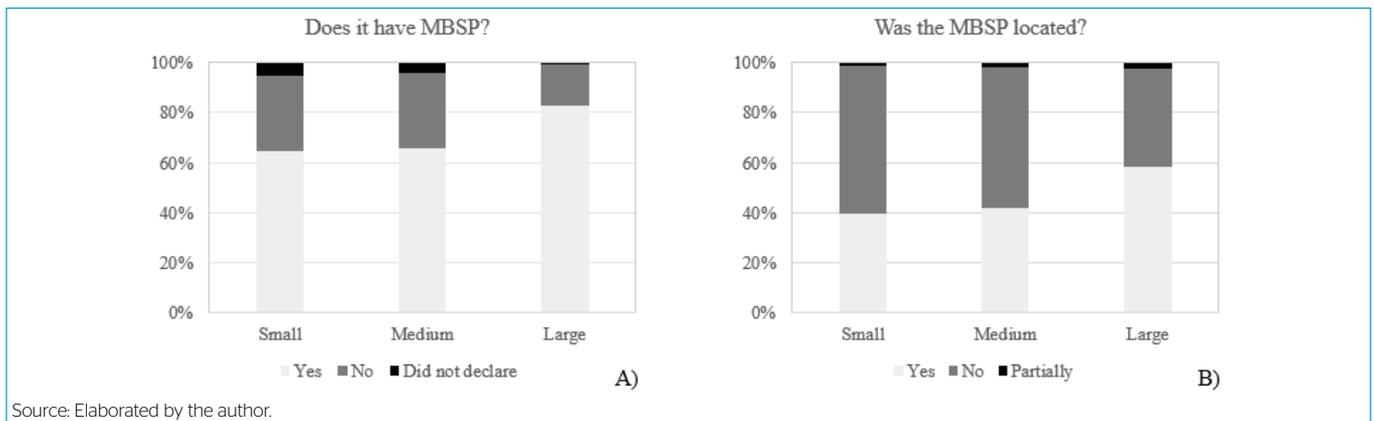


Figure 4 - Existence of MBSP (A) and location of plans (B) according to the population size of Brazilian municipalities.

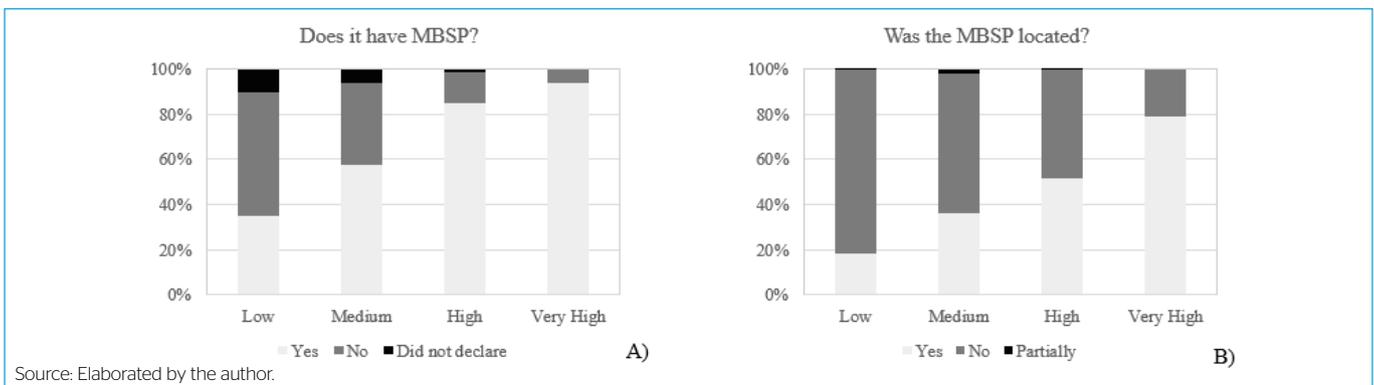


Figure 5 - Existence of Municipal Basic Sanitation Plan (A) and location of plans (B) according to the Human Development Index of Brazilian municipalities.

There is an increase in positive results for the existence of MBSP (Figures 4A and 5A) and for the location of documents (Figures 4B and 5B) as the population size and classification of HDI increase. Conversely, more negative responses to both questions are observed in smaller municipalities and lower HDI. Such differences are statistically significant at the 5% significance level, according to the Kruskal-Wallis test, in which p-values were less than 0.001 in the analysis of both datasets. The results indicate that, in general, the MBSP elaboration is associated with population size and HDI, confirming the hypothesis initially raised.

The paired analysis by the DSCF test showed that the differences observed for population size are significant only concerning large municipalities compared to medium and small ones. There are particular issues in the provision of sanitation services for small- and medium-sized cities, even in high-income countries, “due to more limited urban management capacity and lower revenues” (ANDERSSON, DICKIN, ROSEMARIN, 2016, p. 2). Despite this, previous studies discuss difficulties in planning, especially for small municipalities (FARIA *et al.*, 2022; LISBOA; HELLER; SILVEIRA, 2013; MARINO; CHAVES; SANTOS JUNIOR, 2018).

Lisboa, Heller and Silveira (2013) pointed out that the financial issue is the main limiting factor for planning in small municipalities. They do not have sufficient revenue and are heavily dependent on transfers of legal, constitutional, or voluntary origin, mainly from the Municipal Participation Fund, Tax on Circulation of Goods and Services, and agreements (BREMAEKER, 2020; LISBOA; HELLER; SILVEIRA, 2013). Transfers constitute more than 80% of the revenues of municipalities with up to 50,000 inhabitants. Only those with more than 200,000 inhabitants manage their tax revenues above the national average (22.99%) (BREMAEKER, 2020). This picture demonstrates that the similarities between the conditions for preparing the MBSP between small- and medium-sized municipalities may be strongly related to financial capacity. In these cases, planning is frequently neglected to the detriment of other population demands.

Problems related to human resources are also highlighted in small municipalities. In the study by Lisboa, Heller and Silveira (2013), the interviewees mentioned the limited professional qualification and municipal technical capacity as one of the main bottlenecks for planning. Marino, Chaves and Santos Júnior (2018) also observed the highest percentages of professionals with inadequate training and a lower capacity to deal with challenges, bureaucracies, and political aspects in small cities.

In addition, political, administrative, and technical factors, as well as the political will of managers, time investment, and human and financial resources should contribute to the effectiveness or not of plan elaboration. Methodological aspects also stand out, such as the lack of knowledge and experience of the professionals involved in proposing viable solutions, the lack of articulation between sectors, and the delegation of sanitation services to state companies or private companies (CASTRO; KOGA, 2019; LISBOA; HELLER; SILVEIRA, 2013; SPUHLER; LÜTHI, 2020). The mentioned factors are also seen in sanitation planning for other developing countries, as described by Narayan, Maurer, and Lüthi (2021) in a study that analyzed the barriers for city sanitation planning in India.

Regarding the HDI, the results demonstrate that there are indeed statistically significant differences between the classifications. An exception is observed for the MBSP existence in those municipalities with high and very high HDI

that converge in these aspects. The data are corroborated by the study developed by Coelho, Guth, and Loureiro (2020), who analyzed the relationships between municipal state capacities and the HDI of municipalities with fewer than 50,000 inhabitants. In their sample universe, the authors identified that “[...] the planning and management instruments are associated with the highest HDI-M categories” (COELHO; GUTH; LOUREIRO, 2020, p. 802), indicating that the act to plan is strongly related to high HDI scores. Despite the limitation of the study to small municipalities, the results of this research suggest that the trend extends to other categories.

## CONCLUSION

The overview of the MBSP demonstrates the incipient nature of the elaboration process, mainly regarding the availability of the documents of the elaborated plans. Regional patterns were observed, with the Northeast showing the most incipient results concerning the existence of MBSP and the location of documents. The Southeast stood out favorably, showing more than 60% of municipalities with identified plans. In addition, there was a correlation between plan elaboration and population size and HDI criteria, as proposed in the initial hypothesis. However, it should be highlighted that the differences between small- and medium-sized cities were not statistically significant. The difficulties experienced in planning in these places may present similarities.

From the panorama presented, it is suggested to deepen studies that aim to elucidate the situational picture. In this context, one should consider the specificities of each analyzed criterion regarding their intersection in the sanitation planning process. Furthermore, the analysis of public policies to encourage the elaboration of plans, and the expansion of the sample universe of studies for municipalities of distinct categories should contribute to the proposition of alternatives or solutions for the observed gaps. In addition, it is expected to boost the planning potential in a plausible way for the application in Brazil's social, economic, political, and cultural context.

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## AUTHORS' CONTRIBUTIONS

AMARAL, B. E.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. GOMES, U. A. F.: Funding acquisition, Project administration, Resources, Supervision, Validation, Visualization, Writing – review & editing.

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