ISSN 2175-3369

Scientific Article **doi: 10.1590/2175-3369.017.e20240028**

urbe
Revista Brasileira de Gestão Urbana
scielo.br/urbe

PUCPRESS

Institutional capacity for basic sanitation planning: insights from Brazil

Capacidade Institucional para Planejamento de Saneamento Básico: Insights do Brasil

Juliana Maria de Araújo [a]
Viçosa, MG, Brasil
[a] Universidade Federal de Viçosa (UFV)

Luiz Paulo Rigueira de Morais [a]
Viçosa, MG, Brasil
[a] Universidade Federal de Viçosa (UFV)

Fernanda Maria de Almeida [a]
Viçosa, MG, Brasil
[a] Universidade Federal de Viçosa (UFV)

How to cite: Araújo, J. M., Morais, L. P. R., & Almeida, F. M. (2025). Institutional capacity for basic sanitation planning: insights from Brazil. *urbe. Revista Brasileira de Gestão Urbana*, v. 17, e20240028, 2025. https://doi.org/10.1590/2175-3369.017.e20240028

Abstract

Although the literature on sanitation is vast, the relationship between the local institutional structure and planning capacity remains a gap in the area, affecting the performance of local policies to expand access to these services. Contributing to this discussion, we aim to understand the effects of local institutional capacity on the development or not of local public policies for basic sanitation (PPSB) by Brazilian municipal managers. Using descriptive statistics, correlation analysis and binomial logistic regression, we analyzed a panel of data from the municipalities of Minas Gerais state from 2010 to 2019. We therefore propose a model that verified different dimensions of the institutional capacity of these municipalities, confirming their effects on the probability of developing municipal basic sanitation policies. We found that higher levels of income negatively influenced the likelihood of policy realization, while higher levels of expenditure encouraged policy

JMA é Doutoranda em Administração e Mestra em Administração pela Universidade Federal de Viçosa, e-mail: juliana.m.araujo@ufv.br
LPRM é Doutorando e Mestre em Administração, e-mail: luiz.morais@ufv.br
FMA é Doutora em Economia Aplicada, professora de Administração e Contabilidade, e-mail: fernanda.almeida@ufv.br

making. The results also suggest that efforts towards greater governance and social involvement can contribute greatly, since, in addition to the lack of adequate resources and training, the public manager's political will can constitute one of the central obstacles to universalization access to basic sanitation services.

Keywords: Public Policies for Basic Sanitation. Institutional Capacity. Basic sanitation. Panel data.

Resumo

Embora a literatura sobre saneamento seja vasta, a relação entre a estrutura institucional local e a capacidade de planejamento continua a ser uma lacuna na área, afetando o desempenho das políticas locais para expandir o acesso a estes serviços. Contribuindo para esta discussão, objetivamos compreender os efeitos da capacidade institucional local no desenvolvimento ou não de políticas públicas locais de saneamento básico (PPSB) pelos gestores municipais brasileiros. Utilizando estatística descritiva, análise de correlação e regressão logística binomial, analisamos um painel de dados dos municípios mineiros de 2010 a 2019. Propomos, portanto, um modelo que verificou diferentes dimensões da capacidade institucional desses municípios, confirmando seus efeitos sobre a probabilidade de desenvolvimento de políticas municipais de saneamento básico. Constatou-se que níveis mais elevados de rendimento influenciaram negativamente a probabilidade de realização das políticas, enquanto níveis mais elevados de despesas incentivaram a elaboração de políticas. Os resultados sugerem também que os esforços para uma maior governança e envolvimento social podem contribuir sobremaneira, uma vez que, além da falta de recursos e formação adequados, a vontade política do gestor público pode constituir um dos obstáculos centrais à universalização do acesso aos serviços de saneamento básico.

***Palavras-chave**: Políticas Públicas de Saneamento Básico. Capacidade Institucional. Saneamento básico. Dados em painel.*

Introduction

Although the literature on basic sanitation is comprehensive, the resources needed for the effective planning of this type of service remain a knowledge gap in the area. Institutional structures and established arrangements, especially in decentralized environments, directly influence the progress of the sector, widening the gaps between policy design, its implementation and the results obtained (Ekane et al., 2020; Mason et al., 2020).

The analysis of the capacity of institutions in the formulation and implementation of public policies has proved to be an important agenda for the social sciences (Duarte et al., 2018). From this perspective, the territorial management of public services would depend on the institutional capacity of local governments, which would directly influence the fulfillment of public objectives and goals (Fernandes, 2016; Pinheiro et al., 2015). Thus, efforts are added in the search for institutional capacities that best provide results in policies, making the topic very relevant to international organizations, national and local governments (Fernandes, 2016).

Institutional capacity can be defined "as the set of capabilities of institutions to achieve public objectives" (Martins, 2021, p. 165). According to Martins (2021), it is related to the set of attributes of institutions that enable the achievement of their objectives. Thus, the concept deals with the organizational apparatus, having its components differentiated according to the area of public policy analyzed, covering political, administrative, human and financial resources, among others (Huerta, 2008).

In Brazil, since the 2000s, there has been a concern to improve the quality of public institutions, especially in municipalities, in an attempt to strengthen the institutional capacities of subnational entities (Fernandes, 2016). These efforts followed the Federal Constitution of 1988, which guaranteed municipalities the responsibility and autonomy necessary to propose and implement their own social policies in the areas of health, education, social assistance, housing and basic sanitation (Arretche, 2012).

Particularly regarding basic sanitation, one of the areas with the greatest impact on public health and quality of life (Roesler & Werner, 2020), what is verified is the historical difficulty for the elaboration of policies by most municipal managers, see the large number of municipalities that do not adopt them. According to data from the 2019 National Sanitation Information System, less than half of the 624 municipalities with reported data confirmed having implemented the PPSB (Snis, 2020).

The municipal public policies for basic sanitation consist of an instrument for implementing the planning of services carried out through the municipal basic sanitation plan, both instituted by the sector's legal framework and the obligation of service holders. According to the first Legal Framework for basic sanitation, the management of services would be divided into four types: provision, regulation, inspection and planning, the latter being non-delegable and the responsibility of the municipalities, holder of the services (Romão, 2018).

Several factors could be influencing the probability of elaborating sanitation policies, such as lack of financial resources (Lisboa et al., 2013), dependence on budget transfers (Roland et al., 2020), lack of political will from the manager and management changes (Lisboa et al., 2013; Romão, 2018). Because of this and in view of the low levels of access to sanitation, especially in small municipalities, the importance of discussing the institutional capacity of municipalities for planning and providing this service through the PPSB is growing (Oliveira & Soares, 2020).

Given the above, it is important to understand the relationship between the institutional capacity of municipalities and the potential for formulating basic sanitation policies. Thus, this study aims to verify the influence exerted by local institutional capacity on the probability of elaborating municipal public policies for basic sanitation (PPSB).

To this end, an analysis is proposed with a data panel containing information from the 853 municipalities in the state of Minas Gerais, from 2010 to 2019. Thus, using descriptive statistics, correlation analysis and binomial logistic regression considering a total of 8,530 observations, a model was proposed that verified different dimensions of the institutional capacity of these municipalities.

When analyzing the formulation of public sanitation policies in a diverse context such as the state of Minas Gerais, considered one of the most heterogeneous states in Brazil (Oliveira & Siqueira, 2010), it allows a glimpse of how different levels of institutional capacity have impacted the formulation and implementation of public policies in Brazilian municipalities, which face the same heterogeneity. In this way, it is expected to contribute to the understanding of the planning and management of basic sanitation policies at the municipal level, in view of its importance for the achievement of universalization of services and for the improvement of health indicators and quality of life.

Institutional capacity and local situation as limitations on the planning and delivery of sanitation services

The capacity of government institutions is a classic theme that has become more relevant since the 1990s (Huerta, 2008). Despite the numerous interpretations, in short, the concept refers to the set of resources of governments to achieve public purposes in the most diverse areas (Martins, 2021; Ospina, 2002). Currently, the concept is strongly related to governance, incorporating the ability of organizations to act efficiently, absorbing responsibility as it strengthens accountability (Ospina, 2002).

For Huerta (2008), the instrumentalization of the concept of institutional capacity must be guided by the adopted definition, contemplating not only human elements and organizations, but also the political, economic and social environment. In empirical terms, the literature review prepared by Fernandes (2016) shows numerous attempts to instrumentalize the concept, incorporating financial elements, infrastructure, bureaucracy quality, among others.

The gap between policy formulation and implementation and the results achieved is not new or specific to sanitation. However, the interdisciplinarity of the sector and the wide range of institutions involved in the provision and management of services may end up fragmenting efforts and, consequently, affecting the performance of actions (Shordt & Snel, 2002).

Even in the face of attempts to prioritize projects related to the provision of sanitation, the management of services is greatly hampered by new modes of governance, inadequate budgets, in addition to the fragmentation and lack of coordination of actions (Ekane et al., 2020). On the contrary, a strong capacity of the State in the management of sanitation, combined with the guarantee of social participation, can be an ally in the provision of services (Baer, 2014).

Thus, the literature shows a direct relationship between adequacy in the provision of sanitation services and the quality of institutions. As an example, one in three sanitation projects financed by the World Bank in Africa in 2010 had low performance, whether in terms of meeting objectives, sustainability or schedule (Matsumura, 2012). Still according to the author, among the main causes of the unsatisfactory results were the insufficient institutional development of the countries, excessively optimistic goals and lack of income.

Corroborating this finding, Hamdy, Abu-Zeid and Lacirignola (1998) drew attention to the fact that the inefficiency and unsustainability in the provision of drinking water services were related to the weakness of existing institutions, especially in areas still under development. Thus, strengthening institutions for proper management of resources, recognizing local peculiarities and formulating long-term strategies that fit each context is of paramount importance. Therefore, the local development of new public policies, management skills, and the guarantee of human and financial resources would be essential.

In a more recent study, Adams, Velarde and Burnes (2020) also found that locations with better institutional capacities, characterized by political, administrative and management factors, had better performance in public services, such as water supply. Institutional capacity would also be associated with sustainability in the provision of services. In this sense, Bos (2006) states that sustainability would be achieved through a broad capacity building in the sector, reconciling technical, social, political and institutional elements.

It is understood, therefore, that the elaboration of sanitation policies and, consequently, the universalization of services, could be affected by the lack of financial resources, lack of qualified professionals, excessive expenses for providing services, among other aspects. Thus, institutional capacity, especially with regard to qualified employees and financial investments, would influence the planning of services.

In Brazil, the situation is consistent with the global reality. In interviews with 15 public managers in the Zona da Mata region of Minas Gerais in 2013, the lack of financial resources was cited by most managers as a limiting factor in the preparation of basic sanitation plans (Lisboa et al., 2013). Despite this, some of them still believed that the revenues of the municipalities would be sufficient for this and that the biggest problem would be related to the political will to carry out the planning, in addition to the lack of qualified employees.

Therefore, institutional capacity would be important not only for provision, but also for sanitation planning, enabling the achievement of established goals. In this context, in view of the importance of local sanitation policies, the hypothesis of this study is:

H1: The greater the institutional capacity of the sanitation sector in the municipality, the greater the probability of preparing the PMSB.

In addition to institutional capacity, another aspect that interferes in the planning of sanitation services and, consequently, in the elaboration of municipal policies, is linked to the local situation itself and the existing disparities in terms of resource concentration. In this sense, larger municipalities, for example, tend to concentrate technical capacity for the provision of sanitation services, which is facilitated in these places (Costa et al., 2020).

In addition, historically, indicators of access to sanitation are higher in places with a higher rate of urbanization, which leads to more development and quality of health in these places (Tavares et al., 2019). Also, there is an association between the sanitation indicators and the Gross Domestic Product (GDP) per local capita, so that the greatest deficits in access to services are concentrated in locations with lower GDP, which precisely concentrate low financial capacity to carry out of the necessary investments in the sector (Cunha & Borja, 2018). Thus, it can be inferred that municipalities with a higher rate of urbanization and better socioeconomic conditions also concentrate more resources for the effective planning of sanitation services, resulting in higher access indicators.

Differences in relation to the local situation also reflect the ability to pay for the sanitation services provided, which is lower in more vulnerable locations. Families with lower income levels are unable to pay for services, which, in addition to making their access unfeasible, reduces the return on investments made in the sector (Oliveira & Ervilha, 2020). In addition, investments in basic sanitation have been motivated more by the possibility of economic return than by the social benefits that access to services entails (Saiani, 2007).

Considering the association of basic sanitation with health and quality of life indicators (Azevedo & Rodrigues, 2019; Heller, 1998; Silva et al., 2018; Soares et al., 2002), another possibility would also be the elaboration of PMSB with a view to enabling better health indicators in these places, incurring in a reduction of expenses in this sector. The elaboration of these policies could be a way to improve the local basic health condition, especially in places with a higher aging rate, where longer health care is needed (Oliveira et al., 2013).

Therefore, basic sanitation planning can be influenced by several factors, covering not only aspects related to institutional capacity but also those related to the local situation itself. A deeper understanding of these elements and their influence on the elaboration of municipal sanitation policies is of great value for the effective planning of services and the increase in access rates, allowing for improvements in collective health and the population's quality of life.

Methodological procedures

Analysis units and variables

As already discussed, the units of analysis adopted in this study consist of the 853 municipalities in the state of Minas Gerais during the period from 2010 to 2019, making a total of 8,530 observations. The period was chosen due to the enactment of the first legal framework for sanitation in 2007. Since municipalities should, from this date onwards, develop their sanitation policies and plans, it was decided to consider a 3-year interval so that there would be enough time for sanitation planning and, consequently, for the development of sanitation policies - a dependent variable in the model. The year 2019 as the end of the time series was due to the lack of more recent data at the time of collection.

The database created contained a value for each variable per municipality and corresponding year, totaling 8530 lines. The database created contained a value for each variable per municipality and corresponding year, totaling 8530 lines. As there were missing data for some variables and municipalities, an unbalanced panel with 2589 observations was created in the final model obtained through regression.

Out of a total of 8,530 observations, referring to the 553 municipalities of Minas Gerais for the period 2010-2019, PP sanitation had 4,736 missing data. This reflects one of the difficulties of analyzing sanitation planning in the state, given the proportion of municipalities that did not report data throughout the period. The other variables had fewer missing values: Operating income (597), total expenses (598), employees (599), Revenue (7); GDP (0); Bolsa_Familia (0); Urbanization (0); Aging (0); expenses_health (14). When segregated by year, it was noted that in 2010 there were 646 municipalities with missing information for some of the variables used in the model. In 2011, the number of municipalities with missing data was 650, followed by 556 in 2012, 312 in 2013, 264 in 2016, 285 in 2017, 314 in 2018 and 260 in 2019. In 2014 and 2015, all 853 municipalities had missing data, since no data was provided regarding the existence or not of sanitation policies in that period.

The choice of municipalities in Minas Gerais was because it is considered one of the most heterogeneous states in Brazil, coexisting with locations with high and low socioeconomic and human development indicators (Oliveira & Siqueira, 2010). The heterogeneity in relation to local characteristics makes it possible to analyze the formulation of public sanitation policies in a diversified context, which is even quite similar to municipal disparities when analyzing the rest of the country.

Data were collected from the following official sources (Table 1): Brazilian Institute of Geography and Statistics (IBGE), Minas Gerais Social Responsibility Index (IMRS) and National Sanitation Information System (SNIS).

Table 1 – Variables used, theoretical expectation, theoretical basis and source

Dimension	Variable	Description
-	PPsanitation	Dummy variable that represents the existence of a public sanitation policy in accordance with Law 11,445/2007. 1 was assigned to yes and 0 to no. Source: SNIS
Financial Institutional Capacity	Operating income	Ln of direct operating income per capita with sanitation services (FN001). Source: SNIS
	Total_Expenses	Ln of per capita expenditure on sanitation services (FN017). Source: SNIS
Capacity Institutional Technical	employees	Total number of own employees, available to the service provider, per 10,000 inhabitants (FN026). Source: SNIS
municipal tax collection	Revenue	Ln of the per capita budget revenue of the municipal administration. Source: IMRS
economic condition	GDP	Ln of Gross Domestic Product per capita, at current prices. Source: IBGE
Social vulnerability	Bolsa_Família	Average monthly value per capita of transfers from the Bolsa Família program. In BRL. Source: IMRS
Demography	Urbanization	Ratio between the total number of people residing in the urban area of the municipality and its total resident population. In %. Source: IMRS
health need	Aging	Municipal aging index. * In %. Source: IMRS
	Expenses_Health	Ln of per capita expenditure on health activities. Source: IMRS

* Number of resident persons aged 65 or over, divided by the number of resident persons under 15 years of age, multiplied by 100.
Source: own elaboration based on collected data

As a proxy for institutional capacity in the area of sanitation, financial elements (revenues and expenses) and technical elements (number of employees) were considered. The technical and financial dimensions would be associated with management capacity, which is one of the constitutive dimensions of the concept of institutional capacity (Martins, 2021). Despite acknowledging that other elements may influence the ability to design public policies, it is believed that financial and technical capacity are crucial elements for the proper planning of sanitation services, in line with the literature in the area, as already discussed in the literature review session.

Empirical analysis

Initially, to better understand the data and their evolution over time, descriptive statistics were calculated for each of the variables, showing the mean and standard deviation values. To achieve the proposed objective, which consists of analyzing how institutional capacity influences the elaboration of municipal basic sanitation policies in Minas Gerais, the technique of Binomial Logistic Regression (RLB) was used with panel data. The option for panel data was due to the possibility of analyzing variations between municipalities and over time, enhancing the quality of the estimation of results.

The RLB is indicated for models with a binary dependent variable, that is, which assume only values 0 or 1, as is the case of the existence (or not) of sanitation policies. In these cases, the calculation of the model by ordinary least squares becomes biased, using the maximum likelihood for parameter estimation (Gujarati & Porter, 2011). Thus, the RLB allows the calculation of the probability of occurrence of the event of interest, having its formula in this study given by:

$$\ln\frac{(ppsaneamento_{it})}{(1-ppsaneamento_{it})} = \beta_0 + \beta_1 Receita\_Operacional_{it} + \beta_2 Despesas\_Totais_{it} + \beta_3 Empregados_{it} + \beta_4 Receita_{it} + \beta_5 PIB_{it} + \beta_6 Bolsa\_Família_{it} + \beta_7 Urbanização_{it} + \beta_8 Envelhecimento_{it} + \beta_9 Gastos\_Saúde_{it} + \varepsilon_{it}$$

In which:

ppsaneamento: represents the probability of municipality i at time t having drawn up a basic sanitation policy in line with Law 11,445/2007;

x_(it)represents the set of independent variables for municipality i at time t.

β _0:represents the constant;

β _(1,2,…,9): are the estimated coefficients for each independent variable;

ε _it:is the error term of the model.

To select the most suitable model for the research data, the Hausman test was used (H0: random effects model; Ha: fixed effects model). Through this test, the null hypothesis was rejected at a significance level of 1%, confirming that the fixed effects model would be the most suitable for the data. Furthermore, Wooldridge's endogeneity test was performed, showing that all explanatory variables in the model were exogenous, with no need for corrections.

Results and discussions

Data characterization

For the average values and standard deviation of the variables for all years incorporated in the analysis, we can highlight, firstly, the temporal variation in the existence of municipal basic sanitation policies, which was 82% (of the municipalities with informed data) in 2010 and increased to 48% in 2019. More than a decade after the enactment of the legal framework of sanitation (Brasil, 2007), the need to understand why such policies have not been implemented is reiterated.

A more careful analysis of the data reveals that this percentage is calculated only with the municipalities that reported data (Table 2). In 2010, there was no data for about 75% of Minas Gerais cities. Thus, this percentage also indicates that there has been greater dissemination of data by service providers, and in 2019 the absence of data on policies was verified in approximately 27% of municipalities. Therefore, these data do not indicate that there is a decrease in the implementation of policies, but that there are more cities with informed data, which is favorable from the point of view of local knowledge of the sanitation sector.

The lack of data on the sector is not exclusive to the sample of municipalities in this study. In fact, there is a great deficiency in the data available globally, as well as inaccuracies in relation to the information, as is the case of institutions that measure the population with access to sources of drinking water without, however, guaranteeing that this access is regular and reliable (Satterthwaite, 2016). Nevertheless, it is estimated that in 2017 around 785 million people did not have access to safe drinking water and approximately 2 billion did not have access to sanitation services in general (Swe et al., 2021).

Also, a chi-square test ($p< 0.01$) showed that the elaboration of sanitation policies is related to the population size of the municipalities, so that the largest cities have greater planning capacity for this class of services. Through ANOVA tests ($p<0.01$), this association was also confirmed in relation to the variables that represent the dimensions of abilities focused on in this study (See Appendix 1).

Revenues and expenses with sanitation services are also greater the larger the size of the municipality, which reveals a concentration of capacities in locations already privileged by the concentration of human capital, financial resources and infrastructure. In relation to technical capacity, measured by the number of employees available to the service provider, higher average values were found in municipalities with a population of up to 5,000 inhabitants and in those with more than 20,000 inhabitants. This finding may be related to the way in which services are provided, which can be provided directly or through concessions.

The concession of sanitation services was greatly encouraged by PLANASA, in force in the 1970s and 1980s, which conditioned the receipt of resources for the sector on the transfer of services to the states. As a result, even today a significant influence of large State Companies in the provision of this type of service can be seen, especially in larger municipalities (Rossoni et al, 2015). Furthermore, population growth leads to the expansion of services, leading to an increase in the workforce in the sector (Muoria et al., 2019). On the other hand, smaller municipalities face several challenges in the management of sanitation services, making it difficult to provide this type of service and requiring a larger workforce so that the population has access to sanitation (Turini et al., 2019).

Still in relation to the variables that represent the financial dimension of institutional capacity, there was an increase in operating revenues and total expenses per capita with sanitation services. However, in view of the high standard deviation values for some variables, a great heterogeneity was noticed between the data, denoting that the state of Minas Gerais has municipalities with different levels of capacity.

With regard to technical institutional capacity, there was an increase in the number of own employees available to the service provider (10.46 in 2010 to 11.70 in 2019), despite being much lower than the increase in expenses and revenues, which increased approximately 68% and 80%, respectively. This may be related to a disproportionate

increase between financial and technical variables, that is, an increase in costs and revenues with sanitation services without there being, in the same proportion, an increase in the number of employees in the sector. In addition, this variable showed high standard deviation values, again evidencing the unequal context in which sanitation services are provided.

Table 2 – Descriptive statistics of the variables used

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
PPsanitation (%)	Average	0.82	0.19	0.23	0.18	-	-	0.40	0.47	0.45	0.48
	Standard deviation	0.38	0.39	0.42	0.38	-	-	0.49	0.49	0.49	0.50
Operating_Revenue (per capita) (BRL)	Average	89.66	96.93	102.36	108.31	114.48	122.31	138.85	132.13	160.57	181.20
	Standard deviation	56.33	60.85	67.38	69.75	74.05	75.27	90.34	83.64	102.56	113.74
Total_Expenses (per capita) (BRL)	Average	100.08	104.02	120.70	122.22	132.75	153.92	167.37	147.50	167.78	205.02
	Standard deviation	51.74	54.66	67.74	64.47	70.38	78.29	98.79	70.03	79.72	156.39
Employees (Units)	Average	10.46	10.17	11.63	11.00	11.67	11.26	11.29	11.08	11.70	13.63
	Standard deviation	13.22	6.36	19.58	6.68	7.00	6.84	7.01	7.35	7.49	28.91
Revenue (per capita) (BRL)	Average	1577.62	1862.44	1996.23	2138.64	2339.04	2440.04	2744.19	2744.19	2848.91	3485.25
	Standard deviation	763.59	923.63	1038.18	1186.06	1228.18	1090.66	1271.32	1271.32	1343.47	1733.32
GDP (per capita) (BRL)	Average	11266.88	13447.94	14827.30	15296.97	16195.24	16425.13	18009.61	18822.66	20026.93	21386.14
	Standard deviation	13218.10	17330.60	18202.48	18595.56	17447.54	15265.15	16207.96	19446.77	22198.88	24512.45
Bolsa_Família (per capita) (BRL)	Average	7.56	8.98	10.94	12.49	13.33	13.28	13.58	13.92	14.56	14.48
	Standard deviation	3.66	4.23	5.47	7.00	7.92	8.12	8.71	9.63	10.11	10.21
Urbanization (%)	Average	67.91	68.49	69.31	69.88	70.67	71.54	72.39	72.64	73.68	75.75
	Standard deviation	18.98	18.86	18.58	18.12	17.81	17.47	17.16	17.15	16.38	15.50
Aging (%)	Average	40.61	40.56	40.11	35.94	37.22	39.31	41.23	43.07	59.79	58.94
	Standard deviation	12.43	12.28	4.12	3.88	3.96	4.18	4.19	4.17	6.42	6.32
Health_Expenditures (per capita) (BRL)	Average	372.25	409.99	472.78	504.11	610.44	600.40	646.08	693.52	757.59	807.98
	Standard deviation	160.58	181.54	220.41	233.05	285.35	266.90	277.23	300.57	323.67	344.08

Note: In the fields with "–" there was no data reported in the period. For the construction of this Table, it was decided to use the variables referring to financial values without the ln for a better understanding of the variability of the data.

Source: Search results.

Effect of institutional capacity on the elaboration of PPSB

The final model obtained for the Binomial Logistic Regression with panel data had a total of 2,589 observations due to the existence of missing data (unbalanced panel). Furthermore, the model as a whole is statistically significant at the 1% level according to the chi-square likelihood ratio test (Table 3).

Table 3 – Binomial Logistic Regression Results

	Coefficient	**standard error**	**z**	**p-value**
Operating_Revenue (ln)	-0.638**	0.267	-2.39	0.017
Total_Expenses (ln)	0.624**	0.267	2.33	0.020
employees	-0.020	0.015	-1.35	0.177
Revenue (ln)	-0.210	0.470	-0.45	0.655
GDP (ln)	-0.251	0.323	-0.78	0.437
Bolsa_Família	-0.063***	0.015	-4.01	0.000
Urbanization	-0.003	0.004	-0.84	0.403
Aging	0.039***	0.006	6.39	0.000
Health_Expenses (ln)	0.865***	0.266	3.25	0.001
Hausman test	**Chi2(9)**	**p-value**	**suggested model**	
	40.24	0.000	Fixed Effects	

Note: Coefficients are in ln of the odds ratio. *** Significant at 1%. ** Significant at 5%. *Significant at 10%.
Source: Search results.

Of the variables included in the model, four were not significant to explain the probability of preparing the PPSB in Minas Gerais: municipal budget revenue, GDP, number of employees and urbanization rate. This result is contrary to the theoretical expectation adopted in the study, which was based on the assumption that the elaboration of the referred policies was facilitated in more urbanized locations, with greater collection and as well as better levels of human capital and tax collection.

Thus, despite the literature pointing out that indicators of access to basic sanitation are higher in places with higher GDP and urbanization rate (Cunha & Borja, 2018; Tavares et al., 2019), *this* cannot be extrapolated to the planning capacity and institutionalization of the PPSB. This indicates that the local economic level and urbanization do not necessarily constitute aspects that influence the planning capacity of services, even if the literature suggests a positive influence on the management and provision of sanitation.

It is important to highlight that the urbanization rate over the period under analysis showed a significant increase, which is approximately 11%. The rapid increase in population in urban areas is also related to the need for State capacities to provide essential services, which often go beyond existing resource levels (Okurut et al., 2015). In theory, the increase in the urban population would favor the expansion of the provision of sanitation services, but what is verified is a residual increase in the indicators of access to this type of service (Sousa & Costa, 2013; Tavares et al., 2019).

Likewise, the level of municipal budget collection has no effect on the probability of policy making, which is constituted by revenues foreseen in the municipal public administration budget. This may be linked to the way sanitation is managed, which has its own revenues and other forms of financial investment through costly and non-costly resources.

The municipal collection (revenue) also showed an increase in the period under analysis, which is approximately 120%. Soon, there was an increase in budget revenue, that is, in the financial resources available for the implementation of public policies. This increase may be associated with the increase in GDP, which was more than 77% in the analyzed period. In fact, Furtado (2012) found a positive correlation between GDP and budget revenues in 5,212 Brazilian municipalities, so that municipalities with better economic conditions had higher levels of revenue. According to Appendix 1, the correlation between these variables was also verified in the present study, which confirms the association between the collection of municipalities and their GDP.

According to Table 3, the number of employees working in sanitation was not statistically significant, showing that there is no influence of this variable on the probability of carrying out PPSB. This indicates that sanitation planning is not necessarily limited by the absence of technical personnel. Despite this, the variable incorporated in this study is not able to measure the level of qualification of employees in the sector, and it is not possible to state that more specialized employees would not influence sanitation planning.

Still focusing on the variables of interest in this study, denoted by the dimensions of institutional capacity, the results also diverged from the theoretical expectations adopted, despite being statistically significant. According to Table 3, it was found that the probability of elaborating the PPSB increases when expenses with services are increased but decreases with the increase in operating revenues.

Therefore, institutional capacity exerts a varied effect on the elaboration of municipal sanitation policies. While revenues are negatively associated with sanitation policies, expenditures increase the likelihood of implementing such policies. Thus, service providers with higher revenues may offer less incentives for sanitation planning in municipalities. However, in the case of increased expenses, this planning may prove necessary, in an attempt to make the provision of services more efficient.

Therefore, if the service provider has satisfactory revenues, the municipality will be less likely to develop sanitation policies. However, with rising expenses there may be an incentive to plan and institutionalize sanitation policies, perhaps in an attempt to make service delivery more efficient. Although we were unable to demonstrate this relationship in this work, these results may be related to the findings of Lisboa, Heller and Silveira (2013) who interviewed public managers of municipalities in the Zona da Mata region of Minas Gerais. Some of these managers reported that the autarchy's revenues were sufficient for the elaboration of sanitation planning, but the great limiting factor would be the political will to do so.

Mason, Oyaya e Boulenouar (2020) argue that in decentralized environments with limited resources, it is necessary for public managers to be persuaded to assume greater commitments with the provision of sanitation services. This persuasion can take place through agreeing commitments with voters (delivery of public goods by exchanging votes), conditional transfers from the central government to subnational governments, or pressure from the sector's technical staff. Therefore, gaps between policy intentions and outcomes are affected not only by institutional resources, but also by political will, level of leadership, and priority given to the sanitation agenda at the local level (Ekane et al., 2020).

In theory, strengthening institutional capacities would make it possible to expand access to sanitation services, but what has been observed over the years is the difficulty of increasing these capacities (Austria et al., 2001). Issues inherent to the ownership of the service, attributed to the local government level; competence conflicts; and dominance of state-owned sanitation companies can limit the elaboration and effectiveness of the PPSB, since they generate divergences of interests within the institutional arrangement of the sector (Costa, 2010).

Faced with failures in the provision of sanitation services, an alternative widely used is the creation of a governance structure, increasing the necessary resources and conceiving joint responsibility for the results of actions, as is the case of partnerships between governments and community-based organizations in South Africa (Allison,

2002). In decentralized environments, governance depends on coordination capabilities, cooperation and commitment between service providers and different government levels, influencing the ability to deliver the expected benefits (Mason et al., 2020). Thus, the relationship between institutions, governance, and the results of policies on access to sanitation is evident.

It was also verified, in the social vulnerability *proxy,* a negative relationship with the probability of preparing the PPSB, represented by the resources spent with the Bolsa Família program. This variable indicates the ability to pay for basic sanitation services, which is lower in more vulnerable locations. This fact had already been discussed by Saiani (2007), concluding that investments in the sector are motivated more by economic returns than by the social benefits arising from guaranteed access to services.

The basic sanitation financing model itself, which has been affected by privatization and private partnerships, also ends up influencing urban segregation and social inequality, having an important impact on the low-income population's access to sanitation services. This is because these new financing models privilege spaces that are attractive to the private sector, since there is a need to remunerate shareholders and maintain investor expectations (Oliveira, 2020).

With regard to the aging of the population and health expenditures, the results showed a positive association with the probability of performing the PPSB. Correlation analysis showed a positive correlation between both at a significance level of 1%. The literature shows, in fact, that the aging of the Brazilian population has been a growing process and that it gives rise to discussions mainly in the field of health and social security, in order to meet the needs of this part of the population (Piuvezam et al., 2016). In view of the benefits arising from sanitation services, which mainly encompass the area of health and quality of life, a likely effective strategy would be to invest in this class of services, as long as their quality and access by the population is ensured.

As already discussed, the aging process of the population is directly related to investment in long-term health, bearing in mind the needs of this part of the population. Thus, a possible explanation for the result obtained is the very relationship between sanitation and health, allowing managers to plan actions aimed at improving the health conditions of the population.

Finally, it is important to emphasize that, although the mandatory preparation of PPSBs originates from the enactment of the 1st Legal Framework for Sanitation in 2007, its update in 2020 does not invalidate the results of this study nor does it exempt municipalities from the need to carry out planning, which occurs through the preparation of sanitation policies and plans. Thus, although this is a major reform in the sanitation sector (Nunes, Anderaos & Leal, 2021), many of the elements present in the first Framework remain in its update in 2020 (Instituto Água e Saneamento, 2021).

Final considerations

The results of this study have relevant implications when analyzed in light of the second Basic Sanitation Law (Law 14,026/2020), which establishes goals for universal access to water and sanitation services by 2033. The law reinforces the need for advances in governance and local planning by requiring municipalities to formulate Municipal Basic Sanitation Plans and demonstrate technical and financial capacity to achieve the proposed objectives.

The regression model confirmed the relationship between institutional capacity and the probability of developing municipal basic sanitation policies. Therefore, local institutional capacity can be a determining factor for the effective implementation of sanitation policies, aligning with the guidelines of the new legislation. However, the findings differed from what was expected by indicating that operating revenues were associated with a lower probability of preparing the PPSB, while this probability increased the higher the expenses with the services provided. Therefore,

of the dimensions of institutional capacity analyzed, only expenses encourage the preparation of PPSB, which may mean a need for greater efficiency in relation to the sanitation services provided.

The results also suggest the possibility of economic returns as conditions for the elaboration of the PPSB. Therefore, the most vulnerable population, for not being able to afford the services, would be associated with a lower probability of preparing the PPSB, which lacks qualified professionals and financial expenditures for its implementation. In this regard, policies that prioritize the access of the poorest population to basic sanitation services would be necessary, in addition to raising the awareness of managers so that they invest in actions that aim at the effective universalization of access to these services.

Furthermore, the lack of planning in the sector may be related to the manager's own political will, meaning that this may be one of the greatest obstacles to sanitation planning. Since it was not included in this study, more work is needed on the factors that motivate public managers to develop municipal sanitation policies to prove this hypothesis. If confirmed, a strategy would be a broad incentive for managers to invest in sanitation planning at the municipal level, highlighting the benefits for quality and efficiency in providing services and for the quality of life of citizens.

Thus, in the Brazilian case, it appears that there is no positive relationship between the level of institutional capacities and sanitation planning, which directly affects the fulfillment of the goals of universalization of these services. It is necessary to understand, in a deeper way, the barriers to planning and local provision of sanitation. An important aspect would be the establishment of collaborative instances and the improvement of a governance structure that involves, in addition to the municipal entity, service providers, relevant actors and citizens.

Furthermore, the sector's challenges, as well as the weaknesses and asymmetries that affect local governments in Brazil, require the construction and maintenance of institutional capacities among Brazilian municipalities. Especially in areas of public management in which the municipal entity has been entrusted with the responsibility for planning and executing public policies, such as basic sanitation. Advances in understanding which capacities contribute to the elaboration of municipal public policies guarantee greater guidance to municipal managers in building these capacities, directly contributing to local development and the reduction of regional disparities.

As a limitation of this study, it should be noted that the data reported in the SNIS are self-reported by service providers. Therefore, the lack of data may be related to the institutional capacity itself, where locations with less capacity would tend to report less data, compromising the quality of the analyses. However, it is necessary to emphasize that this would be the most complete database in the sector, making it difficult to carry out analyzes of this size based on other types of data.

Acknowledgments

This work received financial support from the Brazilian Coordination for the Improvement of Higher Education Personnel (CAPES; financing code 001). The authors also thank Minas Gerais State Research Foundation (FAPEMIG) and Brazilian National Research Council (CNPq) for their support.

Declaração de disponibilidade de dados

O conjunto de dados que dá suporte aos resultados deste artigo está disponível no SciELO DATA e pode ser acessado em https://doi.org/10.48331/scielodata.WVDOIJ

References

Adams, A. S., Velarde, N. H., & Burnes, E. L. (2020). Institutional Capacity of the Water Utilities of Saltillo and Hermosillo, Mexico. *Frontera Norte*, *32*(2), 1–26.

Allison, M. C. (2002). Balancing responsibility for sanitation. *Social Science and Medicine*, *55*(9), 1539–1551.

Arretche, M. (2012). *Democraria, federalismo e centralização no Brasil*. Editora FIOCRUZ.

Austria, P. M., Reyes, A. G. de los, & Ortiz, V. B. (2001). Prioridades para el fortalecimieto de capacidades institucionales en el subsector de agua potable y saneamiento. *Ingenieria Hidraulica En Mexico*, *16*(2), 103–117.

Azevedo, R. F., & Rodrigues, F. M. (2019). Implantação do esgotamento sanitário, impacto na taxa de mortalidade infantil. *Revista de Enfermagem UFPE on Line*, *13*(e241415). https://doi.org/10.5205/1981-8963.2019.241415

Baer, M. (2014). Private Water, Public Good: Water Privatization and State Capacity in Chile. *Studies in Comparative International Development*, *49*(2), 141–167. https://doi.org/10.1007/s12116-014-9154-2

Bos, A. (2006). Capacity Building in the Water and Sanitation Sector at times of the MDGs. *Discussion Paper Prepared for the Round Table Meeting Organised by WaterLinks and PSO*.

BRASIL. (2007). Lei nº 11.445, de 5 de janeiro de 2007. *Estabelece as Diretrizes Nacionais Para o Saneamento Básico; Cria o Comitê Interministerial de Saneamento Básico; Altera as Leis Nos 6.766, de 19 de Dezembro de 1979, 8.666, de 21 de Junho de 1993, e 8.987, de 13 de Fevereiro de 1995; e Revoga a Lei Nº 6.* http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/lei/l11445.htm

Costa, B. S. (2010). *Universalização do Saneamento Básico: Utopia ou Realidade - A efetivação do Capital Social na Política Pública do Saneamento Básico*. Tese (Doutorado em Engenharia Ambiental) - Universidade Federal de Santa Catarina, Florianópolis.

Costa, T. G. N., Lobo, C. F. F., & Soares, W. (2020). Condições e projeções de acesso ao saneamento básico nas cidades médias brasileiras. *Terr@Plural*, *14*, 1–22. https://doi.org/10.5212/terraplural.v.14.2013320.017

Cunha, M. A., & Borja, P. C. (2018). O programa de aceleração do crescimento no estado da Bahia e os desafios da universalização do saneamento básico. *Urbe. Revista Brasileira de Gestão Urbana*, *10*(suppl 1), 173–185. https://doi.org/10.1590/2175-3369.010.supl1.ao09

Duarte, L. B., Drumond, C. E. I., & Soares, N. S. (2018). Capacidade Institucional dos Municípios Baianos. *Revista Brasileira de Gestao e Desenvolvimento Regional*, *14*(1), 18–42. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-44782017000400003&lng=pt&tlng=pt

Ekane, N., Kjellén, M., Westlund, H., Ntakarutimana, A., & Mwesige, D. (2020). Linking sanitation policy to service delivery in Rwanda and Uganda: From words to action. *Development Policy Review*, *38*(3), 344–365. https://doi.org/10.1111/dpr.12428

Fernandes, F. S. (2016). Capacidade institucional: uma revisão de conceitos e programas federais de governo para o fortalecimento da administração pública. *Cadernos EBAPE.BR*, *14*(3), 695–704. https://doi.org/10.1590/1679-395128311

Gujarati, D. N., & Porter, D. C. (2011). *Econometria Básica* (5th ed.). Mc Graw Hill; Bookman.

Hamdy, A., Abu-Zeid, M., & Lacirignola, C. (1998). Institutional capacity building for water sector development. *Water International*, *23*(3), 126–133. https://doi.org/10.1080/02508069808686758

Heller, L. (1998). Relação entre saúde e saneamento na perspectiva do desenvolvimento. *Ciência e Saúde Coletiva*, *3*(2), 73–84. https://www.scielosp.org/pdf/csc/1998.v3n2/73-84/pt

Huerta, A. R. (2008). Una ruta metodológica para evaluar la capacidad institucional. *Política y Cultura*, *30*, 119–134.

Instituto Água e Saneamento. (2021). Saneamento 2021: Balanço e perspectivas após a aprovação do novo Marco Legal-Lei 14.026/2020. *São Paulo: IAS*.

Lisboa, S. S., Heller, L., & Silveira, R. B. (2013). Desafios do planejamento municipal de saneamento básico em municípios de pequeno porte: A percepção dos gestores. *Engenharia Sanitaria e Ambiental*, *18*(4), 341–348. https://doi.org/10.1590/S1413-41522013000400006

Martins, D. G. (2021). The state of the art of institutional capacity: a scoping review of the literature in Portuguese. *Cadernos EBAPE.BR*, *19*(1), 165–189. https://doi.org/10.1590/1679-395120190011

Mason, N., Oyaya, C., & Boulenouar, J. (2020). Reforming urban sanitation under decentralization: Cross-country learning for Kenya and beyond. *Development Policy Review*, *38*(1), 42–63. https://doi.org/10.1111/dpr.12408

Matsumura, K. (2012). *Causes of poor performance in world bank water and sanitation projects*. Thesis (Master of Science) - University of Colorado.

Muoria, E. W., Moturi, W. N., & Eshiamwata, G. W. (2019). Effects of Population Growth on Urban Extent and Supply of Water and Sanitation: Case of Nakuru Municipality, Kenya. *Environmental Management and Sustainable Development*, *8*(1), 42.

Nunes, C. M., Anderaos, A. A., & Leal, M. D. A. C. (2021). The 2020 Reform of the Water and Sanitation Services Sector in Brazil. *BRICS Law Journal*, *8*(2), 66-88.

Okurut, K., Kulabako, R. N., Abbott, P., Adogo, J. M., Chenoweth, J., Pedley, S., Tsinda, A., & Charles, K. (2015). Access to improved sanitation facilities in low-income informal settlements of east african cities. *Journal of Water Sanitation and Hygiene for Development*, *5*(1), 89–99. https://doi.org/10.2166/washdev.2014.029

Oliveira, A. de. (2020). Financial innovations and sanitation services: The battle between low-income users and shareholders. *Bulletin of Geography. Socio-Economic Series*, *47*, 63–74. https://doi.org/10.2478/bog-2020-0004

Oliveira, E. B. de, Bozzetti, M. C., Hauser, L., Duncan, B. B., & Harzheim, E. (2013). Avaliação da qualidade do cuidado a idosos nos serviços da rede pública de atenção primária à saúde de Porto Alegre, Brasil. *Revista Brasileira de Medicina de Família e Comunidade*, *8*(29), 264–273. https://doi.org/10.5712/rbmfc8(29)826

Oliveira, F. A. de, & Siqueira, W. B. (2010). *As muitas Minas: Ensaios sobre a economia mineira*. Conselho Regional de Economia.

Oliveira, J. B. De, & Ervilha, G. T. (2020). Serviços de saneamento básico em Minas Gerais e seus determinantes locacionais, demográficos e socioeconômicos. *Revista Brasileira de Estudos Regionais e Urbanos*, *12*(2), 243–267.

Oliveira, T. de B. G. de, & Soares, F. de M. (2020). Será o saneamento básico uma espécie de serviço público de interesse local? Um estudo à luz da teoria das capacidades estatais aplicada aos municípios brasileiros. *Revista Brasileira de Políticas Públicas*, *10*(3), 440–468.

Ospina, S. (2002). Construyendo capacidad institucional en América Latina: el papel de la evaluación como herramienta modernizadora. *VII Congreso Internacional Del CLAD Sobre La Reforma Del Estado y de La Administración Pública.*, 1–21. http://unpan1.un.org/intradoc/groups/public/documents/CLAD/clad0043618.pdf

Pinheiro, J. C. V., Lira, J. S. de, Bezerra, F. N. R., & Araujo, J. A. (2015). Análise da Capacidade Institucional na perspectiva de territórios rurais cearenses. *Perspectiva Econômica*, *11*(2), 135–142. https://doi.org/10.4013/pe.2015.112.04

Piuvezam, G., Costa De Lima, K., Santos De Carvalho, M., Guerra Pereira Xavier, V., Alves Da Silva, R., Rochelle Filgueira Dantas, A., & Medeiros De Araújo Nunes, V. (2016). Atenção primária à saúde e os idosos institucionalizados: a perspectiva da gestão municipal no Brasil. *Revista Portuguesa de Saude Publica*, *34*(1), 92–100. https://doi.org/10.1016/j.rpsp.2015.05.003

Roesler, M. R. von B., & Werner, M. V. (2020). A insuficiência do saneamento básico brasileiro na saúde e vida escolar de crianças em situação de pobreza. *Expressa Extensão*, *25*(2), 45–55. https://periodicos.ufpel.edu.br/ojs2/index.php/expressaextensao/article/view/18284

Roland, N., Heller, L., & Rezende, S. (2020). A entrada na agenda brasileira do Projeto Nacional de Saneamento Rural (1985). *Revista de Administração Pública*, *54*(6), 1654–1671. https://doi.org/10.1590/0034-7612201900392

Romão, G. A. (2018). *Análise da formulação da política pública de saneamento básico em municípios goianos* [Dissertação (Mestrado em Administração) - Universidade Federal de Goiás]. https://repositorio.bc.ufg.br/tede/handle/tede/8567

Rossoni, H. A. V., Faria, M. T. S., Rossoni, F. F. P., Mingoti, S. A., & Heller, L. (2015). Características municipais determinantes da presença de diferentes prestadores de serviços de abastecimento de água no Brasil. *Revista DAE, 64(199), 27-46*.

Saiani, C. C. S. (2007). *Restrições à expansão dos investimentos em saneamento básico no Brasil: déficit de acesso e desempenho dos prestadores*. Dissertação (Mestrado em Economia) - Universidade de São Paulo, Ribeirão Preto.

Satterthwaite, D. (2016). Missing the Millennium Development Goal targets for water and sanitation in urban areas. *Environment and Urbanization*, *28*(1), 99–118. https://doi.org/10.1177/0956247816628435

Shordt, K., & Snel, M. (2002). Building institutional capacity for sanitation. *Waterlines*, *20*(3), 27–32.

Silva, C. O., Miranda, M. A., & Less, D. F. da S. (2018). Análise dos serviços de saneamento básico e a incidência de casos de Chikungunya no Bairro da Matinha em Santarém (PA). *Revista Ibero-Americana de Ciências Ambientais*, *9*(6), 133–146. https://doi.org/10.6008/cbpc2179-6858.2018.006.0015

SNIS. (2020). *25º Diagnóstico dos Serviços de Água e Esgotos 2019*. SNS/MDR.

Soares, S. R. A., Bernardes, R. S., & Cordeiro Netto, O. de M. (2002). Relações entre saneamento, saúde pública e meio ambiente: elementos para formulação de um modelo de planejamento em saneamento. *Cadernos de Saúde Pública*, *18*(6), 1713–1724.

Sousa, A. C. A. de, & Costa, N. do R. (2013). Incerteza e dissenso: Os limites institucionais da política de saneamento brasileira. *Revista de Administração Pública*, *47*(3), 587–599. https://doi.org/10.1590/S0034-76122013000300003

Swe, K. T., Rahman, M. M., Rahman, M. S., Teng, Y., Abe, S. K., Hashizume, M., & Shibuya, K. (2021). Impact of poverty reduction on access to water and sanitation in low- and lower-middle-income countries: country-specific Bayesian projections to 2030. *Tropical Medicine and International Health*, *26*(7), 760–774. https://doi.org/10.1111/tmi.13580

Tavares, F. B. R., Sousa, F. C. de F., Santos, V. É. da S., & Silva, É. L. da. (2019). Análise do Acesso da População Brasileira a Serviços de Saneamento Básico. *Res., Soc. Dev*, *8*(4), 1–15.

Turini, L. R., Lima, E. B. N. R., & de Moraes, G. F. (2019). Análise crítica da gestão do saneamento no estado do Mato Grosso, Brasil. *Labor e Engenho*, *13*, e019015-e019015.

Editor responsável: Luciene Pimentel da Silva

Recebido: 05-Feb-2024

Aprovado: 15-jan.-2025

APPENDIX 1

1. Correlation Analysis

Table 4: Pearson correlation between explanatory variables

Variables	(1)	(two)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) GDP	1,000								
(2) Total_Expenses	0.456 (0,000)	1,000							
(3) Operating_Revenue	0.427 (0,000)	0.792 (0,000)	1,000						
(4) Employees	0.112 (0,000)	0.174 (0,000)	0.043 (0,000)	1,000					
(5) Revenue	0.436 (0,000)	0.143 (0,000)	0.016 (0.140)	0.126 (0,000)	1,000				
(6) Bolsa_Familia	-0.419 (0,000)	-0.226 (0,000)	-0.248 (0,000)	-0.100 (0,000)	0.066 (0.171)	1,000			
(7) Urbanization	0.434 (0,000)	0.486 (0,000)	0.425 (0,000)	0.140 (0,000)	0.040 (0,000)	-0.344 (0,000)	1,000		
(8) Health_Expenditure	0.408 (0,000)	0.180 (0,000)	0.072 (0,000)	0.094 (0,000)	0.778 (0,000)	-0.003 (0.731)	0.078 (0,000)	1,000	
(9) Aging	0.087 (0,000)	0.126 (0,000)	0.039 (0,000)	0.082 (0,000)	0.468 (0,000)	0.062 (0,000)	0,000 (0.977)	0.436 (0,000)	1,000

Note: Significance in parentheses. Source: Study results.

2. Chi-Square Test

Table 5: Chi-square Test Results

population size		Municipalities without sanitation policies	Municipalities with sanitation policies
Up to 5 thousand inhabitants	Frequency	541	333
	Expected frequency	523.7	350.3
	row percentage	61.90	10.38
Between 5 and 10 thousand inhabitants	Frequency	669	386
	Expected frequency	632.2	422.8
	row percentage	63.41	36.59
Between 10 and 20 thousand inhabitants	Frequency	552	323
	Expected frequency	524.3	350.7
	row percentage	63.09	36.91
Over 20 thousand inhab.	Frequency	512	479
	Expected frequency	593.8	397.2
	row percentage	51.66	48.34

Pearson chi2(3) = 38.5548. Pr = 0.000. Cramer's V = 0.1008.

Source: Study Results.

3. Anova Tests

Table 6: ANOVA test results by population size and dimensions of institutional capacity

Population Size	Average Operating income	Average total expenses	Average number of employees
Up to 5 thousand inhabitants	86.76	120.68	12.84
Between 5 and 10 thousand inhabitants	103.99	123.30	10.66
Between 10 and 20 thousand inhabitants	122.59	137.58	10.03
Over 20 thousand inhabitants	196.41	196.75	12.25
Total	125.18	142.75	11.41
Anova p-value	0.0000	0.0000	0.0000

Source: Study Results.