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Competitiveness factors of Brazilian municipalities: proposal for an analysis model

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This study proposes a model to analyze the competitiveness of Brazilian municipalities. The research was conducted in two stages: (i) a bibliometric review, covering the period from 2000 to 2014, to identify the variables adopted in the worldwide literature analyzing factors of municipal competitiveness and regional development; and (ii) a study on which of these factors are available, in a structured form, from official sources in Brazil, in order to collect secondary data and observe the situation at the municipal level. As a result, from the 88 indicators identified in the literature, 64 were available in different data bases in Brazil. The theoretical construct derived from this review is the conceptual basis for the proposed model and consists of six formative analytical dimensions: science and technology, economics, demography, infrastructure, education and health.

Keywords: municipal competitiveness; bibliometric review; theoretical construct; open data.

Fatores de competitividade dos municípios brasileiros: proposta de modelo de análise

O objetivo deste estudo é propor um modelo para analisar a competitividade dos municípios brasileiros. Para tanto, duas etapas de trabalho foram desenvolvidas: (i) por meio de revisão bibliométrica compreendendo o período de 2000 a 2014 buscou-se identificar quais são as variáveis adotadas na literatura mundial para analisar fatores de competitividade municipal e desenvolvimento regional; e (ii) pesquisar quais desses indicadores se encontram disponíveis de forma estruturada em fontes oficiais no Brasil para coleta de dados secundários e observação no nível municipal de análise. Como resultado, dos 88 indicadores identificados na teoria, 64 encontram-se disponíveis em distintas fontes de dados no Brasil. O construto teórico derivado desta revisão, base conceitual para o modelo proposto, compreende seis dimensões analíticas formativas: ciência e tecnologia, economia, demografia, infraestrutura, educação e saúde.

Palavras-chave: competitividade municipal; revisão bibliométrica; construto teórico; dados abertos.

Factores de competitividad de los municipios brasileños: propuesta de modelo de análisis

El objetivo de esta investigación es proponer un modelo para analizar la competitividad de los municipios brasileños. Para este fin, se han desarrollado dos etapas: (i) mediante análisis bibliométrico durante el período de 2000 a 2014, se buscó identificar las variables adoptadas en la literatura mundial para analizar factores de competencia municipal y desarrollo regional; y (ii) investigar cuales de estos indicadores se encuentran disponibles de modo estructurado en fuentes oficiales en Brasil para la recolección de datos secundarios y observación en nivel municipal de análisis. Como resultado, de los 88 indicadores identificados en teoría, 64 se encuentran disponibles en distintas fuentes de datos en Brasil. El constructo teórico derivado de esta revisión, la base conceptual para el modelo propuesto, comprendió seis dimensiones analíticas formativas: ciencia y tecnología, economía, demografía, infraestructura, educación y salud.

Palabras clave: competitividad municipal; análisis bibliométrico; constructo teórico; datos abiertos.

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1. INTRODUCTION

Learning about the factors that can structure the capacity of competitiveness and development of the cities allows to support public policies, to guide development strategies and, mainly, to monitor the implementation of policies based on empirical evidence (Baker and Wong, 2006; Avrămescu, 2012). In addition, it allows comparisons with other cities in the same region, from the same country or at a global level, highlighting the characteristics that should be carefully observed by local society (Celis, 2009), which may become a competitive advantage or disadvantage (Porter, 2009).

Investigations about the disparities of territorial development have always been present in the academic world from the beginnings of modern social science with the religious thesis (Weber, 2007). Later, with the fall of Smithian economic liberalism (Hobsbawm, 1995) and the evolution of a Keynesian social welfare state to the Schumpeterian (Arienti, 2003), or Fordist to the post-fordist (Clark et al., 2000), the thesis became a favorable environment to researches and implementation of innovations. It has happened either through technological cumulative development (Nelson and Winter, 1982) — evolutionary theory — or by breaking with dominant technological paradigms (Dosi, 1982; Freeman et al., 1982; Perez, 2004) — neo-Schumpeterian theory — so as to these organizations, immersed in their environments, or innovation systems (Johnson et al., 2003), could expand more and more "productive services" from the resources at their disposal (Penrose, 2006).

The various theoretical currents that emerged in economic geography during the second half of the twentieth century, after World War II, are essentially marked by the combination of different scientific knowledge (politics, geography, economics, etc.) and the dependency on their epistemological and interpretative communities (Scott, 2000). And, as in the scientific paradigms (Kuhn, 2006), they had periods of growth and of obsolescence across the years.

The strategic imperative of the regions is to plan for the attraction and retention of innovative organizations, skilled labor, knowledge workers and investments, especially those that enable ever more structuring conditions of the environment (including offers of high technology jobs and quality of life), within which productive firms can thrive (Bristow, 2010). In other words, regional competitiveness is therefore the ability to attract and retain organizations with stable or increasing market share in their activities, while sustaining a stable or growing standard of living for their locality (Storper, 1997). External or exogenous factors are fundamental components in the organizations scenario where they are immersed and formulate their strategies. In turn, they promote competitiveness and development for both companies and the city, region or country.

Many studies of economic development focus on national states as a unit of analysis, but social scientists have already understood that there are substantial differences in the economic development of regions in every nation in the world (Porter, 2003). On the other hand, empirical studies with large samples of regions are rare (Porter, 2003). Discussions on the different types of indicators used to analyze disparities in development have been the reason for research in this field of knowledge (Clark et al., 2000).

There has been many critiques due to the simplification of development evaluation based on only economic factors (Celis, 2009; Sen, 2010; Goletsis and Chletsos, 2011), and not observing other factors (social, institutional, cultural, educational, etc.) which also interfere in the development (Clark et al., 2000; Booysen, 2002). In other words, evaluating development has as presuppositions the notion of multidimensionality and the need for objective foundations when constructing multidimensional composite indices (Ravallion, 1996; Deichmann, 1999).

Based on foregoing, the proposal of this study is to establish the methodology of analysis for municipal competitiveness. It starts with the identification of quantitative indicators adopted in the literature about municipal competitiveness and regional development in the last years (2000 to 2014). In order to make the later empirical analysis feasible, the work identifies which indicators are available for the Brazilian municipalities. The unit and level of analysis are the cities, relevant territorial delimitation that defines the scope of consultation to secondary databases available in Brazil.

The objective of this study is to propose a model to analyze the competitiveness of Brazilian municipalities. The work has a theoretical framework to delimitate the research field. The methodological rigor of the consultation to the bases of periodicals is a determining pillar to reach the desired results and thus to design the scenario and the proposed model of variables (construct). For this, the present research aims to develop two specific objectives, namely: (i) bibliometric analysis of the quantitative indicators adopted in the regional competitiveness literature; and (ii) which of these indicators are available in the main Brazilian databases for the municipal analysis unit. The first gives conceptual support to the empirical verification of the second.

It is observed that both specific objectives are intertwined and are interdependent, because it would only be possible to construct at the end of this work a theoretical construct that could be objectively observed (Comte, 1978).

In order to achieve these objectives, the next section of bibliographic review defines the conceptual and theoretical bases adopted in the work. Next, the methodology section describes all the steps taken to develop bibliometric analysis, presenting together the results of the consultations carried out on the existing articles in the world literature on the subject. Next, the indicators observed in the literature are related and, together, the data sources available or not available in Brazil are presented for data collection of these variables at the municipal level. Finally, a discussion section presents the main results of this review.

2. BIBLIOGRAPHIC REVIEW

The free operation of market mechanisms in capitalist societies accentuates regional imbalances, that is, the development of "poles of growth" where rich regions become richer and poorer regions increasingly poor (Perroux, 1955). In this sense, the spatial polarization of development creates economic inequalities followed by social inequalities, and this plays a central role for tensions, social conflicts and political instability (Ohlan, 2013). The development of physical infrastructure accompanied by opportunities in education and skills training can generate significant improvements in livelihood and income generation, and result in better sharing of the fruits of economic growth with underdeveloped areas (Ohlan, 2013).

These characteristics are understood as the organization and management of the strategy of the "old" regional development policy (Cabugueira, 2000), in which the central state administration proposed regional policy management. The "new" local economic policy has decentralized management, which becomes operative through intermediary organizations that provide services of a technological, formative and / or financial nature to companies, aiming to exploit the region's potential for endogenous development (Cabugueira, 2000).

According to Thissen and collaborators (2013), the internal and external economies of firms are the means of influencing the economic development of the regions, as well as the levels of production specialization. However, analyzing the internal factors of firms that enable stimulating innovations (in products, services, organizational, etc.) refers to other lines of research and is the firm's own task. Therefore, according to the same authors, the five most relevant external factors to productive organizations (focus of this analysis) are: (i) availability of natural and educational resources; (ii) educational level, innovation and creativity of the working class; (iii) economic agglomeration; (iv) levels of specialization, clusters and concentration of companies; and (v) transportation networks and costs.

The region's standard of living (well-being) is determined by the productivity of the available natural, human and financial resources; therefore, the appropriate definition of competitiveness would be productivity (Porter, 2000; Bristow, 2005). From these premises, the so-called "New Regionalism" arises, starting from the concept of competitiveness and the belief that regions should be the primary focus of economic policies (Lovering, 1999).

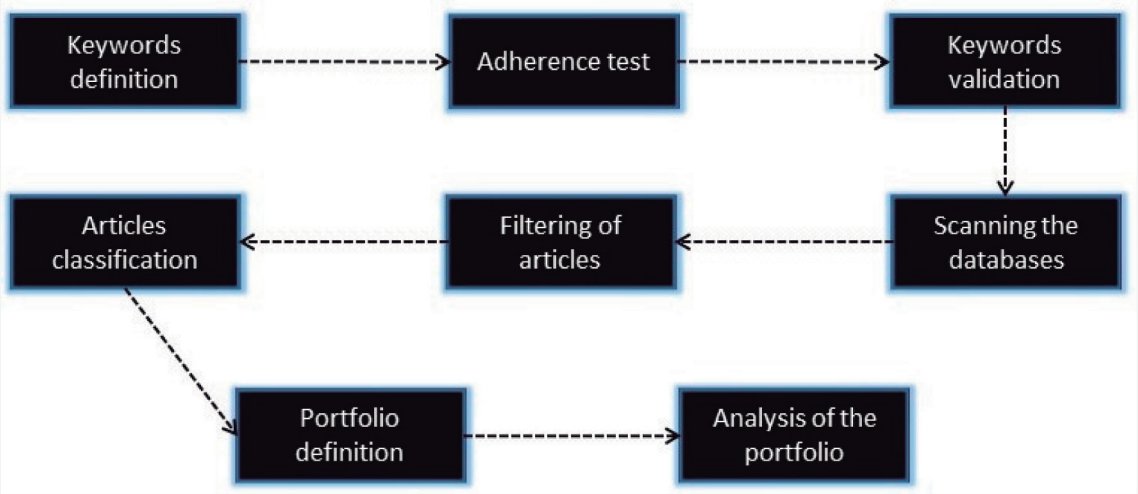
Microeconomic productivity (firm) is considered a necessary condition, but not enough to obtain financial returns, market share, and macroeconomic and welfare improvements to the local population. Therefore, a region is competitive when it has the conditions that enable the improvement of the living standards of its inhabitants (Thissen et al., 2013). These conditions include a mix of firms' competitive edge and the attractiveness of the regional environment to business and human capital in an international context.

The bibliometric review, presented below, complements this theoretical foundation of the work and indicates which are the indicators to be considered in the development of a model of municipal competitiveness analysis.

3. METHODOLOGY OF BIBLIOMETRIC REVIEW

The bibliometric analysis carried out in this research was conducted using the ProKnow-C process, which quantitatively measures the scientific production, exploring databases and evidencing parameters and variables of a set of articles (bibliographic portfolio) such as authors, quotations, references and relevance of journals (Lacerda et al., 2012; Ruthes and Silva, 2015). The steps performed are shown in figure 1.

FIGURE 1 BIBLIOMETRIC ANALYSIS PROCESS



Source: Elaborated by the authors.

The following topics explain each step, given the sequential order shown in figure 1 and the objectives of this proposal.

1) *Keywords definition*: as one of the objectives of the work was to raise indicators related to the competitiveness of cities, it was adopted keywords in English taking into account synonymous words and/or equivalents since they were in the title, abstract or keywords of published articles. Therefore, for the competitiveness of municipalities (group 1), the following keywords were adopted: (i) "Regional Development"; (ii) "Competitive Cities"; (iii) "Competitive City"; (iv) "Competitive Urban"; and (v) "Performance Cities"; (vi) "Performance City"; (vii) "Competitiveness Cities"; and (viii) "Competitiveness City". To reduce the number of non-adherent articles to the analytical proposal of this project, keywords related to indicators (group 2) were added: (i) "Indicator"; (ii) "Indicators"; and (iii) "Quantitative";
2) *Adherence test*: through the keywords defined in the previous step, the adherence test was carried out in Capes journals and in the Google Scholar site;
3) *Keywords validation:* the keywords validation process was conducted together with specialists in the theme (in all, five academic pairs), seeking to include or change the terms adopted, or even the creation of new groupings of keywords;
4) *Scanning the databases*: the scanning process took place in the bases of selected journals (Proquest, Ebsco, ScienceDirect and Emerald) and for all possible combinations of keywords (12 combinations previously presented);
5) *Filtering of articles:* In this stage, 116 documents were excluded from the 343 articles identified in the previous step because they were repeated within the database, remaining 227 to be analyzed in the next stage of the portfolio's constitution process;

6) *Classification of articles*: After excluding duplicate articles in the previous phase, the following components of the remaining articles were read: (i) title and subtitle; (ii) summary; and (iii) keywords. The purpose of this reading was to eliminate articles unrelated to the purpose of this investigation. In the first phase of classification, the articles were evaluated according to the adherence to the proposed theme of this research, that is, those that even after the filters previously adopted remained in the database. In the second phase, the articles were separated regarding their contribution to the discussion on multiple indicators related to competitiveness and regional development. Therefore, articles dealing with a modeling with several (three or more) related indicators were integrated into the portfolio of analysis. Those articles that approached the theme, but from the perspective of using one or two indicators (sometimes related to sustainability), have been integrated into the overall portfolio of the study because they can serve as references for further analysis;
7) *Portfolio definition*: As explained previously in step 6, the final portfolio of articles was then segmented into two categories (portfolio analysis and general). Overall, 83 articles were classified as studies dealing with competitiveness and regional development, however, 26 of these, in a first interpretation, were considered potentially aligned with the proposal of this study, that is, they had multiple indicators (three or more) for analysis competitiveness. In summary, 26 articles were selected for deepening (reading in full) and, consequently, defining the main dimensions and indicators related to the municipal competitiveness theme;
8) *Analysis of the portfolio*: this analysis allows to identify the indicators adopted and the frequency of use in the literature (Bardin, 2011), as well as the potential contribution to the analytical model. The procedures adopted were: (i) identification and grouping of the indicators; and (ii) frequency of use. The results of this evaluation can be seen in the next section.

4. REVIEW OF PUBLICATIONS

From the formation of the analysis portfolio, it was possible to have a portrait of these publications. From the articles extracted, there is little concentration on the same journal. The most representative, with two or more publications according to the selection criteria adopted, were: (i) Regional Studies; (ii) Economic Science Series; (iii) European Journal of Operational Research; and (iv) Social Indicators Research. As the proposed theme is of great practical interest to public policies and requires a multidisciplinary approach for analysis, it can be observed that articles were drawn from different areas of science, such as geography, economics, environment and administration. However, regardless of science, there are trends of repetition of some indicators, and some end up being of specific interests of some branch of science. For example: concern in geography with more detailed indicators related to the environment theme. Because some of the studies analyzed presented a rather large set of indicators (more than 70) and others less (more than five), but always exposed in the works within theoretical categories (infrastructure, demography, regional structure, etc.) this research was chosen to create a taxonomy of the indicators based on the characteristics and concepts of the variables, in order to facilitate the systematization of the data for analysis and, consequently, the presentation itself.

Therefore, nine analytical categories have been created and, consequently, they name the following subsections of the present study: (i) science and technology; (ii) demography; (iii) economy; (iv) education; (v) public administration; (vi) infrastructure; (vii) environment; (viii) health; and (ix) social. It should be emphasized again that the proposed categories are not intended to be conclusive, but only aimed at structuring the presentation of the variables obtained in the review according to common characteristics, in light of the researcher's interpretation and the categories observed in the bibliographic references. The following subsections presents the indicators for each analytical category, as well as the available data source in Brazil at the municipal level. All the analyzed works are based on secondary data for development; therefore, it was verified the availability of this data for all Brazilian municipalities, in national data sources. It is observed that the articles do not necessarily depart from a theoretical definition of indicators for analysis, but from the use of indicators organized and available in the country (Ohlan, 2013) in order to begin to identify the latent dimensions of the indicators (often by exploratory factorial analyzes) and the subsequent conduction of comparative analyzes between cities or regions. That is, the process starts from the empirical process, not from the theory, always seeking to reduce the hundreds/thousands of data in index compositions or latent factors (Michalek and Zarnekow, 2012), and which are more significant from an academic and practical point of view. The open databases consulted in this research are of national scope (IBGE, MDIC, TEM, etc.), that is, sometimes some of the indicators may be available at the state or regional level (Secretaries of State, City Halls, etc.). However, this situation would result in the need for manual query to the websites of each of these entities. In addition to the data not necessarily be collected and drawn from homogeneous methodologies among the states and/or municipalities, thus it is impossible to use the data. So, we discarded them from the final conceptual model.

4.1 SCIENCE AND TECHNOLOGY (S&T)

Indicators identified and framed in this category can be seen in box 1. Column 1 shows the full names of the indicators, in column 2, the abbreviated name of the variable, in column 3, the database in which the value of the indicator for each Brazilian municipality can be found. And, finally, in column 4, the number of citations made to the indicator in the articles analyzed. It should be emphasized that all subsections will present the same format and presentation content of the indicators.

The S&T category seeks to group the indicators that represent the allocation of science and technology resources as in a typical input-output system (Wang et al., 2012). On one hand, human and financial resources are included in the definition of science and technology (inputs), and, on the other hand, the results of scientific research and diffusion as technologies in the market can be understood as direct and indirect benefits (outputs) of the regional innovation system (Johnson et al., 2003; Wang et al., 2012).

BOX 1 SCIENCE AND TECHNOLOGY INDICATORS

Indicators	Variable	Database	Citation
Patents	PATENT	Orbit	4
Percentage of high technology patents	PALTEC	Orbit	1
Number of indexed articles published	ARPUB	Ebsco/ProQuest	2
Number of technology transfer contracts	CONTT	*Not available*	1
High technology product launches	PROATE	*Not available*	1
Percentage of skilled workers (tertiary and postgraduate)	TRESP	Rais — MTE	5
Percentage of employees in science & technology	EMPCT	Rais — MTE	3
Percentage of employees in high technology sectors	EMPAT	Rais — MTE	3
Investments in R&D with private or public capital as a percentage of GDP	INVPD	*Not available*	6

Source: Elaborated by the authors.

The indicators "patents" and "percentage of high technology patents" are possible to obtain by counting them on indexed bases of international patents (as an example: Orbit or Thomson), as well as the "number of indexed articles published" from indexers like Ebsco, Proquest, etc. For these three variables a specific research work is required, with risks of inconsistencies due to uncertainties regarding the registration of scientific productions (patents or articles) in the municipality in which they were developed or originated, which would require specific criteria in the consultation process and possibly a qualitative "check".

For the indicators "number of technology transfer contracts" and "high technology product launches" no database was identified in Brazil that contains this type of information at any territorial level (municipal, state or federal). For "Investments in R&D with private or public capital as a percentage of GDP" the Brazilian Institute of Geography and Statistics (IBGE) has data for some Brazilian states, but not at the municipal level.

Regarding the other indicators presented, all can be extracted (through cross referencing) from the Annual Social Information Relation database of the Ministry of Labor and Employment (Rais — MTE), available for consultation on the Internet at the Ministry's own website. This basis is constituted from the obligation of annual sending, by all the Brazilian employers, on the labor activity at the end of each fiscal year. These indicators could be drawn annually from 2002 to 2014.

4.2. DEMOGRAPHY

Demographics include factors that describe characteristics of the population and the distribution of local society by different strata (Soares et al., 2003; Baker and Wong, 2006; Delis et al., 2009; Pinto and Guerreiro, 2010; Michalek and Zarnekow, 2012; Ohlan, 2013). The indicators identified in the analysis portfolio that fit this category can be seen in box 2.

BOX 2 DEMOGRAPHIC INDICATORS

Indicators	Variable	Database	Citations
Population Density	DENPO	IBGE	9
Population up to 24 years old	POJOV	IBGE	6
Percentage of population aged 25-64 years old	POPEA	IBGE	5
Porcentage of population over 65 years old	POIDO	IBGE	5
Percentage of the population between 25 and 64 years old with low educational level	PEBNE	IBGE	9
Percentage of the population aged 25-64 years old with a medium educational level	PEMNE	IBGE	7
Percentage of the population between 25 and 64 years old with high educational level	PEANE	IBGE	7
Percentage of foreigners in the population	ESTPO	IBGE	2
Gini Index	IGINI	IBGE	1
Ethnic diversity	DIVETN	IBGE	1
Gender Ratio	RAGEN	IBGE	1
Life expectancy	EXPVID	IBGE	1
Poverty rate	TXPOB	IBGE	1

Source: Elaborated by the authors.

All the indicators presented are available in the last IBGE demographic census (2010), but they are extracted in two different ways for subsequent quantitative analysis, since some indicators are already consolidated (metadata) on the IBGE website for each Brazilian city, such as: Gini index, population density and life expectancy. For the other indicators mentioned in box 2, metrics are established in order to operationalize the calculation the microdata base from the census itself.

4.3 ECONOMY

Economy include the factors that reflect the population standard of living, income, economic structure, labor market and business environment (Khee Giap et al., 2008; Monastiriotis, 2009; Pinto and Guerreiro, 2010; Dunford, 2013). In light of this, the indicators identified in the literature that fall into this category can be observed in box 3.

For the indicators bank deposits per 10,000 inhabitants, per capita fuel sales and per capita energy consumption, no data sources were available in Brazil at the municipal level (for this conclusion, we have consulted the websites of the Brazilian Federation of Banks — Febraban and Electric Power National Agency — Aneel).

It is possible to operationalize the calculation for other indicators by crossing data from a single microdata base, such as the IBGE (Demographic Census) and Rais — MTE, and for these cases there is a single database citation in the corresponding column. While for other variables, such as GDP

per employee and import and export values per 10 thousand inhabitants, it is necessary to cross the microdata from two different bases, in the examples presented, IBGE and Rais — MTE, and Ministry of Development, Industry and Commerce (MDIC) and IBGE, respectively.

There are variables that require specific studies to operationalization of the calculation, such as labor productivity and turnover, although the GDP proxy per employee is regularly used as a measure of labor productivity.

BOX 3 DEMOGRAPHIC INDICATORS

Indicators	Variable	Database	Citations
GDP *per capita*	PIBCAP	IBGE	11
GDP per employee	PIBEMP	IBGE and Rais	1
Import values per 10 thousand inhabitants	IMPHAB	MDIC	1
Export values per 10 thousand inhabitants	EXPHAB	MDIC	2
Number of hotels per thousand inhabitants	HOTHAB	Rais — MTE	2
Percentage of companies in the primary sector in relation to total	EMPRIM	Rais — MTE	4
Percentage of companies in the secondary sector in relation to total	EMSEC	Rais — MTE	5
Percentage of companies in the terciary sector in relation to total	EMTER	Rais — MTE	4
Percentage of public sector companies in relation to total	EMPUB	Rais — MTE	1
Percentage of private sector companies in relation to total	EMPRIV	Rais — MTE	2
Percentage of primary sector employees in relation to total	TRABPRI	Rais — MTE	8
Percentage of employees in the secondary sector in relation to the total	TRABSEC	Rais — MTE	9
Percentage of employees in the tertiary sector in relation to the total	TRABTER	Rais — MTE	7
Bank deposits per 10 thousand inhabitants	DEPHAB	*Not available*	2
Sale of fuel per inhabitant (kg)	COMBHAB	*Not available*	1
Average Household Income	RENMED	IBGE	2
Average salary	MEDSAL	Rais — MTE	9
Median salary	MEDIANA	Rais — MTE	2
Wage Variation	VARSAL	Rais — MTE	3
Percentage of employees in the total population	EMPOP	IBGE	4
Percentage of male employees in relation to total	EMPHOM	Rais — MTE	1
Percentage of female employees in relation to total	EMPMUL	Rais — MTE	1
Labor productivity	PRODUT	IBGE and Rais	3
Turnover	TURN	Rais — MTE	2
Unemployment rate of young people (up to 25 years)	DESJOV	IBGE and Rais	3
Unemployment rate	DESEMP	IBGE	9
Per capita energy consumption	CONENE	*Not available*	2
Percentage of total population with income	POPREN	IBGE and Rais	2

Source: Elaborated by the authors.

4.4. EDUCATION

Education is understood as the capacity to offer training in human capital in a local society (Pinto and Guerreiro, 2010) and, consequently, of enabling structural conditions for individual freedom (Sen, 2010). The identified indicators falling within this category can be seen in box 4.

BOX 4 EDUCATION INDICATORS

Indicators	Variable	Database	Citation
Number of primary schools per thousand inhabitants	ESCPRI	MEC	3
Number of secondary schools per thousand inhabitants	ESCSEC	MEC	2
Number of faculties per thousand inhabitants	ESCTER	MEC	2
Number of primary school students	ESTPRI	MEC	1
Number of secondary school students	ESTSEC	MEC	1
Number of college students	ESTTER	MEC	2
Number of bookstores per thousand inhabitants	LIVHAB	Rais — MTE	1

Source: Elaborated by the authors.

The number of bookstores per thousand inhabitants requires the crossing of the Rais — MTE and IBGE microdata bases for the calculation. All other variables require to cross the bases, also microdata, of the Ministry of Education and Culture (MEC), from the annual census of education and IBGE.

4.5 PUBLIC ADMINISTRATION

Public administration is understood as practices, norms and investments made by the public sphere in order to obtain better levels of economic and social development for the municipalities (Soares et al., 2003; Michalek and Zarnekow, 2012). The identified indicators in this category can be seen in box 5.

BOX 5 PUBLIC ADMINISTRATION INDICATORS

Indicators	Variable	Database	Citation
Government expenditure per inhabitant (10,000)	GASHAB	*Not available*	2
Public expenses with security and fire	SEGINC	*Not available*	1
Local Administration Service Units	ATDADM	Rais — MTE and IBGE	1

Source: Elaborated by the authors.

The indicator Local Administration Service Units can be extracted at the municipal level from Rais — MTE and IBGE bases. For the other two variables it is necessary to collect data on the websites of each Brazilian cities. According to the public transparency law; in theory, these data must be made available. Therefore, it was considered not available for an eventual structured consultation of this information because it demands exactly a specific work for structuring this information.

4.6. INFRASTRUCTURE

Infrastructure is the material basis of a society that represents the regional structure and an environment that facilitates development (Khee Giap et al., 2008; Monastiriotis, 2009; Ohlan, 2013). The indicators identified in the literature that fall into this category can be observed in box 6.

BOX 6 INFRASTRUCTURE INDICATORS

Indicators	Variable	Database	Citations
Basic sanitation rate	SANBAS	IBGE — Households	2
Volume of water distributed per inhabitant (10 mil)	H20HAB	*Not available*	3
Domestic consumption of electricity per capita (10 kW h)	ELEHAB	*Not available*	2
Industrial electricity consumption per capita (10 kW h)	INDELE	*Not available*	1
Percentage of the population with regular access to the internet	POPINT	IBGE — Households	1
Number of telephones per capita (100/1.000)	TELHAB	IBGE — Households	2
Highways	RODOVIA	*Not available*	2
Rate of urbanization	TXURB	IBGE — Households	3
Number of banks per inhabitant	BANHAB	Rais and IBGE	1
Number of stores (commercial, hotels and restaurants) per inhabitant	EMPCOM	Rais and IBGE	1
Number of workers (commercial, hotels and restaurants) per inhabitant	TRACOM	Rais and IBGE	1
Accessibility to public transport	TRANSPUB	*Not available*	3
Accessibility to private transport	TRANSPRIV	*Not available*	1

Source: Elaborated by the authors.

The indicators volume of water distribution, consumption of domestic and industrial electricity and accessibility to public and private transportation have no data sources available in Brazil. Specifically, for highways, there is no structured information about the road modal that crosses each Brazilian city, however it is possible to later plot results of the analyzes in georeferenced maps from the coordinates of the Brazilian federal highways, or even using the coordinates of other modes (ports, airports and railways).

With regard to the variables of sanitation rate, urbanization rate and percentage of the population with Internet access and telephony, it is possible to extract them from the microdata base of the last household census (year 2010), a survey undertaken by the IBGE itself. For the other indicators (number of banks, stores and workers per thousand inhabitants) it is possible to obtain this information at the municipal level by crossing Rais - MTE microdata databases and IBGE demographic census.

4 .7. ENVIRONMENT

Environment is related to territories available in the municipality that can serve as factors of production or assets of social conviviality, but also can be affected by the activities developed by the society (Kladnik and Ravbar, 2003; Mann and Erdin, 2007; Michalek and Zarnekow, 2012; Nemeş, 2013). The indicators identified in the analysis portfolio that comprise this category can be seen in box 7.

BOX 7 ENVIRONMENT INDICATORS

Indicators	Variable	Database	Citation
Natural Monuments by Km²'	MONNAT	*Not available*	1
Areas protected by law	ARLPRO	*Not available*	1
Emission of pollutant gases per inhabitant	GASESHAB	*Not available*	1
Percentage of vacant land in relation to total	TERBALDIOS	*Not available*	1
Percentage of green areas in relation to total	ARVERDES	*Not available*	5
Percentage of areas in relation to the total dedicated to agricultural activities	ARATVAGR	*Not available*	3

Source: Elaborated by the authors.

No data sources were available at the municipal level on the IBGE website for all environmental indicators.

4.8. HEALTH

Health is understood as the infrastructure of the locality that enables to provide quality of life to its society (Khee Giap et al., 2008; Perrons and Dunford, 2013). The indicators identified in the analysis portfolio that comprise this category can be seen in box 8.

For indicators number of hospitals, health centers and doctors per thousand inhabitants, it is possible to obtain the information by crossing Rais — MTE and IBGE microdata, and in relation to the other variables, by crossing the microdata bases of the Department of Informatics of the Brazilian National Health System (Datasus) and IBGE.

BOX 8 HEALTH INDICATORS

Indicators	Variable	Database	Citation
Number of hospitals per thousand inhabitants	SHOSP	Rais — MTE and IBGE	3
Number of beds in hospitals per thousand inhabitants	SCAMH	Datasus	2
Number of health centers per inhabitant (thousand)	SCSAU	Rais — MTE and IBGE	3
Number of physicians per inhabitant (thousand)	SMEDH	Rais — MTE and IBGE	2
Number of deaths up to 1 year of age per thousand inhabitants	SOBIT	Datasus	3
Number of deaths per thousand inhabitants	SMORH	Datasus	2
Number of births per thousand inhabitants	SNASC	Datasus	4

Source: Elaborated by the authors.

4.9. SOCIAL

Social means physical spaces or environments that favor the practices of coexistence and interaction between individuals according to norms of social order (Baker and Wong, 2006; Miles et al., 2008; Michalek and Zarnekow, 2012). The variables identified in the consulted literature that comprise this category can be observed in box 9.

BOX 9 SOCIAL INDICATORS

Indicators	Variable	Database	Citation
Number of cultural and leisure assets per thousand inhabitants	ATVCUL	Rais — MTE	3
Crime rate	TXCRIM	*Not available*	2

Source: Elaborated by the authors.

The number of cultural and leisure assets per inhabitant can be obtained by crossing the microdata bases of Rais — MTE and IBGE. Regarding the crime rate, no data source available in the country was identified for data collection.

5. DISCUSSION OF RESULTS

As discussed in the introductory section of this research, we sought to identify the quantitative indicators adopted in the literature on municipal competitiveness in recent years (2000 to 2014). Sequentially, we investigated which of these variables are available in secondary and structured data sources in Brazil for consultation/collection at the municipal level.

Faced with this initial research proposal, of an initial universe of 88 indicators addressed in the literature, 63 of them can be analyzed for each Brazilian municipality. Before moving forward in the discussion, it is necessary to highlight the importance of identifying the 25 uninformed indicators in Brazil at the municipal level, since these are variables that may be investigated by other researchers. This is the first finding of this study: what is the relevant information about the Brazilian municipalities that are not yet available for studies on municipal competitiveness.

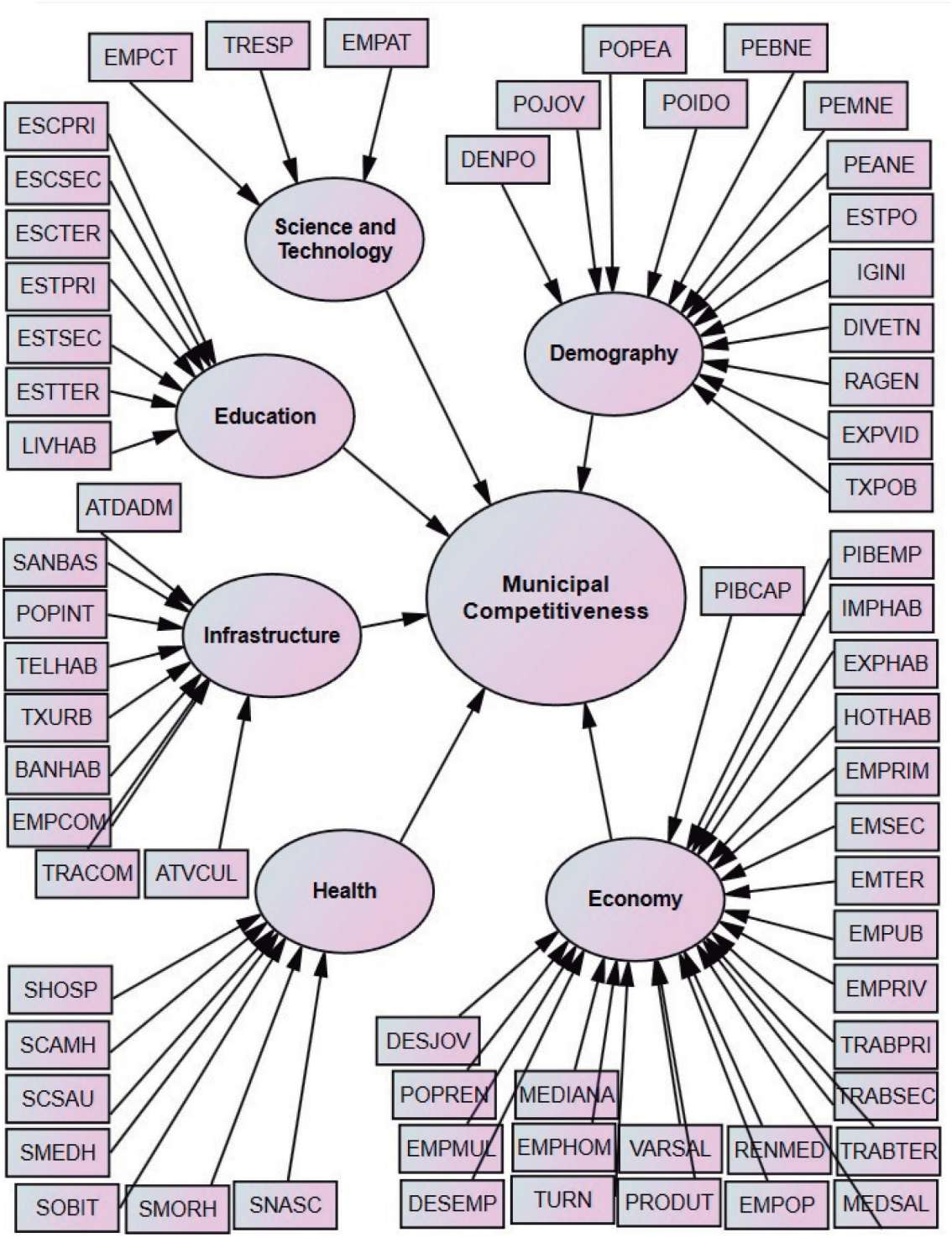
When analyzing these indicators from the analytical categories created and previously presented, the environmental category was completely dismissed from a later analysis of the data because it did not have any data available. For the categories public and social administration there was only one indicator representing each one, which were then incorporated into the infrastructure category. Figure 2 shows the theoretical construct developed in this study to analyze municipal competitiveness.

It should be emphasized again that all created categories aim to simplify the presentation of the variables found in the theoretical review and follow a categorization proposed by the researchers themselves. In addition, the possibility of including new analytical categories and / or indicators is not excluded for two reasons: (i) structural factors of a city's competitive differentiation may be reflective of specific regional or non-observed issues. That is, the more indicators and dimensions can capture this differentiation, the more complete the construct will be; and (ii) there is no consensus within the analyzed portfolio on what would be the ideal factors within this construct; in other words, any new research analyzing data from regions or cities will also be exploratory, regardless of the country analyzed.

The proposal of adopting this investigative strategy of data exploration is the result of the articulation between the theories and methodologies observed in the papers included in the analysis portfolio. All focus on secondary data for development, and most do not describe in detail how the variables are operationalized. In other others, they do not start their investigations from the theoretical definitions of the indicators, but rather use the organized and structured indicators available in the countries analyzed (Ohlan, 2013). Therefore, it starts from the empirical process, rather than from the theory, always aiming to reduce the hundreds/thousands of data in composite indexes or latent factors (Michalek and Zarnekow, 2012) that are more significant from an academic and practical point of view. In addition, it is necessary to adapt the information available in the Brazilian scenario due to the way in which the data are available and the classifications adopted (for example: National Classification of Economic Activities — CNAE, legal nature of organizations, etc.).

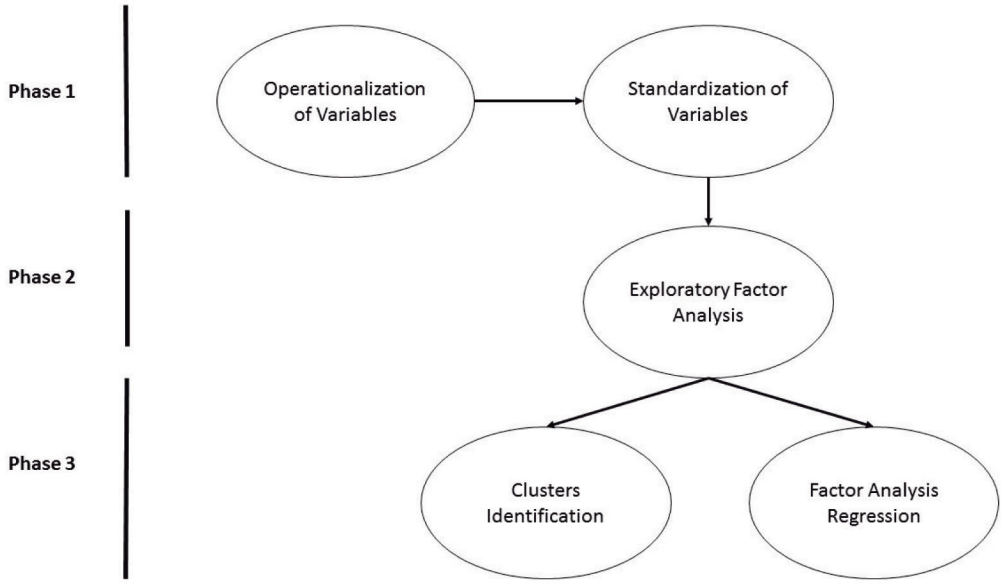
In general, as suggested by Eco (1997), this study proposed to develop a panoramic work in order to analyze similar studies carried out on municipal competitiveness factors of an experimental and applied nature (Eco, 1997) on the same theme. In this way, in principle, it can be highlighted as possible theoretical contributions of this study: (i) identification of the universe of objective variables adopted in the literature and which of these have availability of data at municipal level in Brazil; and (ii) the theoretical construct of municipal competitiveness interrelating all the variables mentioned in the literature, aiming to obtain a model of analysis that is as robust as possible. As a result of this initial theoretical study and for the continuity of the research, it is proposed the development of the data analysis, adopting the Brazilian municipalities as a research population, according to the following sequential analysis phases of the data shown in figure 3.

FIGURE 2 THEORETICAL CONSTRUCT FOR ANALYSIS OF MUNICIPAL COMPETITIVENESS FACTORS



Source: Elaborated by the authors.

FIGURE 3 THEORETICAL CONSTRUCT FOR ANALYSIS OF MUNICIPAL COMPETITIVENESS FACTORS



Source: Elaborated by the authors.

In the first phase, the variables identified in the bibliometric review and available for analysis in Brazil will be operationalized according to the conceptual and standardized definitions in 100-point scales. In the second phase, all variables will be used to identify underlying factors and the exclusion of variables with low explanatory loads, as undertaken by several researches in the portfolio of analysis (Soares et al., 2003; Callois and Aubert, 2007; Mann and Erdin, 2007; Del Campo et al., 2008; Monastiriotis, 2009; Pinto and Guerreiro, 2010; Goletsis and Chletsos, 2011; Michalek and Zarnekow, 2012; Ohlan, 2013).

In the third phase, Brazilian municipalities will be classified into clusters to bring together municipalities into groups that share common characteristics, regardless of size. The bases are the previous factors to be identified. Otherwise, clusters can be interpreted as cities that meet common conditions of greater or lesser competitiveness. In addition, the relationship between the factors identified for proposing a theoretical-empirical model of analysis for the Brazilian municipalities will be established.

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