SMART CITIES AND THE MEASUREMENT OF URBAN ECONOMY AND ENTREPRENEURIAL INDICATORS: THE CASE OF PASSO FUNDO/RS

CIDADES INTELIGENTES E A MENSURAÇÃO DE INDICADORES URBANOS DE ECONOMIA E EMPREENDEDORISMO: O CASO DE PASSO FUNDO/RS

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ABSTRACT

Purpose - The intense urbanization process has transformed the urban dynamics. Such phenomenon is the cause of some of the main problems of contemporary cities, in social, environmental, and economic dimensions. Therefore, planning and managing cities have been a challenge for public managers. The concept of Smart Cities is an initiative that seeks to assist in this process, using Information and Communication Technology (ICTs) as agents of transformation in the urban environment. One tool used by Smart Cities is the measurement through indicators, serving as a basis for decision making. The objective of this article is to analyze the urban indicators of Economy and Entrepreneurship of Passo Fundo / RS.

Design/ methodology/approach - In the methodology, the indicators of the Connected Smart Cities Ranking were used as a reference, adopting a regional cut of medium-sized cities, located in the South Region, classified among the first 20 in the Ranking. Multimethod research, collection, and data collection procedures were applied.

Findings - The results show that the majority of the Passo Fundo indices are lower than those of the cities analyzed, as well as the indices related to employability and the growth of companies. However, the city has satisfactory rates, such as the workforce in the Education and R&D sector, and the creation of technology centers and incubators in the municipality.

Originality/value - From this analysis, the results obtained may serve as subsidies for public management in the formulation of more assertive strategies for Passo Fundo / RS in the quest to become a more intelligent and sustainable city.

Keywords: Smart Cities; Urban indicators; Economy; Entrepreneurship; Ranking Connected Smart Cities.

RESUMO

Objetivo - O intenso processo de urbanização tem transformado a dinâmica urbana. Tal fenômeno ocasiona algumas das principais problemáticas das cidades contemporâneas, nas dimensões social, ambiental e econômica. Por conseguinte, planejar e gerir as cidades têm sido um desafio aos gestores públicos. Uma iniciativa que busca auxiliar neste processo é o conceito de Cidades Inteligentes, que utiliza as Tecnologias da Informação e Comunicação (TICs) como agentes de transformação no meio urbano. Uma ferramenta utilizada pelas Cidades Inteligentes é a mensuração por meio de indicadores, que servem como subsídio na tomada de decisões. O objetivo deste artigo é analisar os indicadores urbanos de Economia e Empreendedorismo de Passo Fundo/RS.
Metodologia - Na metodologia, utilizou-se como referência os indicadores do Ranking Connected Smart Cities, adotando-se um recorte regional das cidades de médio porte, localizadas na Região Sul, classificadas entre as 20 primeiras do Ranking. Foram aplicados procedimentos multimétodos de pesquisa, coleta e levantamento de dados.
Resultados - Os resultados demonstram que a maioria dos índices de Passo Fundo, são inferiores àqueles das cidades analisadas, como os índices relacionados à empregabilidade e ao crescimento de empresas. Entretanto, a cidade apresenta índices satisfatórios, como a força de trabalho no setor de Educação e P&D, e a criação de pólos tecnológicos e incubadoras no município.
Originalidade - A partir desta análise, os resultados obtidos poderão servir como subsídios para a gestão pública na formulação de estratégias mais assertivas para Passo Fundo/RS na busca por tornar-se uma cidade mais inteligente e sustentável.

Palavras-chave: Cidades Inteligentes; Indicadores urbanos; Economia; Empreendedorismo; Ranking Connected Smart Cities.

1 INTRODUCTION

Unplanned urbanization has shaped contemporary cities. The phenomenon of population growth, particularly in urban areas, is not similar to any other social phenomenon that has already been observed. This demographic saturation of geographic space has resulted in numerous challenges for public management.

The well-known urban problems related to safety, health, education, basic sanitation, housing, and the economy, currently encompass new demands such as mobility, sustainability, and resilience. In this sense, planning and managing cities have been a great challenge for public managers.

Initiatives and alternatives that seek to help on mitigating the main problems and demands of cities have emerged prominently. One of these alternatives is the concept of Smart Cities, characterized by using Information and Communication Technology (ICT) as a tool for transformation in cities, in order to optimize urban dynamics.

The implementation of initiatives coming from Smart Cities has been able to transform the reality and conception of cities and urban policies. The applicability of the technology provides greater performance competence for urban systems, thus providing a more effective urban management. It is in this context that the role of urban indicators comes into play.

Urban indicators are important tools that serve as a subsidy to measure, analyze and understand the context of cities. They provide a thorough understanding of the local reality, aiming to make more assertive decisions and outline future strategies. Therefore, it is through the diagnosis of the indicators that a "reading" of the city can be carried out in the most varied spheres.

In Brazil, since 2015, Urban Systems has annually released the Connected Smart Cities Index (RCSC, 2020), which ranks the 100 smartest cities in the country. The ranking takes place according to the analysis of 11 main areas or axes, which are composed of a total of 70 indicators. These

indicators corroborate the 2030 Agenda (UN, 2015), which includes 17 Sustainable Development Goals (SDGs) in the economic, social and environmental dimensions.

Given this scenario, the questions that guided the development of this article arose: What is the context of smart city indicators in medium-sized cities? And in a second moment, taking the Connected Smart Cities Index (RCSC) as a reference, the following question was asked: What is the context of the urban indicators of Economy and Entrepreneurship in Passo Fundo/RS?

In this sense, from the point of view of Smart Cities, this research aims to carry out an analysis of the Economic and Entrepreneurship indicators of the city of Passo Fundo/RS using the most recent (2020) indicators of the best classified medium-sized cities in the Connected Smart Cities Index (RCSC) as reference. In addition, we sought to carry out a critical analysis of the collected data, identifying both positive and to-improve points in the scope of the Entrepreneurship and Economics axes analyzed in the city of Passo Fundo.

2 THEORETICAL FRAMEWORK

Human history has been permeated by a multitude of changes in all its dimensions. This evolution includes different types of organization, construction, and appropriation of space, ranging from the first tribes of hunters to the current configuration of cities. The urban space has been shaped by different patterns, forms of production, commerce, interactions and collaborations, and has been adapting to emerging models and demands (LEITE & AWAD, 2012; WEISS, 2017).

Contemporary cities are characterized by economic development and population increase, in addition, they are products of the spatial organization of the places where they are located, becoming unique, due to their distinct peculiarities and idiosyncrasies. In this sense, Castells (2009) states that the urban space is defined by the relationships of different instances of the social structure, with emphasis on the economic, political and ideological, and the conjuncture of social relations resulting from it.

The discussion arenas about the context and the future of cities have taken the agendas of governments, companies and the academia (GIFFINGER, FERTNER, KRAMAR, PICHLER-MILANO-VIC & MEIJERS, 2007). In this regard, Weiss (2017) observes that while cities grow in quantity and population, they are centrally positioned in the global scenario, and are shaped as vectors for the integration of information, knowledge and business flows.

The 21st century, with the progress of the Information Age, presents the emergence of a network society, in which advances in Information and Communication Technology (ICTs) generate important social impacts, including all that relates to cities (CASTELL, 1999). In this context, with the implementation of ICTs in the urban environment, Smart Cities have arisen.

The phrase *Smart City* was used in the early nineties to conceptualize the phenomenon of urban development dependent on technology, innovation and globalization, mainly focused on an economic perspective (GIBSON et al., 1992). In the 2000s, the concept acquired greater breadth in the scientific debate, being the object of discussions and reflections in various spheres of society (GIFFINGER et al., 2007; LEITE & AWAD, 2012).

Despite the various initiatives on the subject, it is worth emphasizing that the concept still lacks a single or consensual definition. In his conception Komninos (2002) addresses the city as a multidimensional agglomeration, making the interrelation of the various dimensions that compose and characterize it so that without the conjoined action of these actors there is no realization of a Smart City.

Giffinger et al. (2007) believe that the concept of Smart City is premised on the issue of

intelligence, with independent and aware citizens. The concept proposed by Batty, Axhausen and Giannotti (2012) places ICTs as the main characteristic of the concept, furthermore, it states that Smart Cities are instruments to improve community competitiveness.

This perspective is highlighted by Weiss (2017), who states that the presence of physical and network infrastructures are essential in Smart Cities, as they establish poles that connect and work together.

As it can be observed, the concepts discussed use some converging points such as intelligence and creativity, strategic planning and integration of all actors, the use of new technologies to optimize and manage the basic functions of the city; in addition to the need for the three main actors in this process to work collectively: civil society, private initiative and government (PALETTA, VASCONCELOS & GONÇALVES 2015).

Thus, *communication* can be listed as a keyword within the context of Smart Cities. This feature comprises the intercommunication of resources, energy, information systems, and management services, monitoring, and control systems (ZUBIZARRETA, SERAVALLI & ARRIZABALAGA, 2016).

In this sense, the management of a Smart City can be the main driving force for the transformation of services and innovations in this city, significantly changing the management principles of the urban environment (USTUGOVA, PARYGIN, SADONIKOVA, YADAV & PRIKHODKOVA, 2017). The management tools coming from Smart Cities are evidenced mainly by indicators and rankings. According to Giffinger et al. (2007, p. 6) "the rankings have become a central instrument to assess the attractiveness of some urban regions", thus, the rankings are of great importance to verify the level of intelligence in which cities are found, generating competitiveness among them (PALETTA et al., 2015).

Thus, urban indicators should contemplate the diversity of contemporary urban problems and, at the same time, should allow for the incorporation of issues related to management, public policies and sustainability initiatives. It is necessary to give a lasting meaning to the city that appears, grows and transforms itself, establishing relationships between man and the environment as a whole (MARTINS & CÂNDIDO, 2015).

According to IBGE (2012) the objectives of urban indicators are: to identify variations, processes and trends, as they allow constant monitoring; to make comparisons; and assist the public's understanding of the topic (IBGE, 2012). In this way, the indicators serve as an aid for measuring and understanding the status quo of a portion of land (LEITE & AWAD, 2012). Along the same lines, Jacobs (2011) highlights that it is essential to understand the principles that underlie the behavior of cities, whose success lies in making the most of their assets, taking advantage of potential strengths, so as not to act in opposition to these principles.

Currently, there are several methods and programs that use urban indicators as a measurement and evaluation tool for urban management. Such indicators admit different formats, with different methodologies, which portray specific results, evaluating different variables.

Brazil has been experimenting with some Smart Cities initiatives, one of which is the Ranking Connected Smart Cities , which aims to map the cities with the greatest potential for development in Brazil, through indicators that portray the intelligence, connection and sustainability of cities (RCSC, 2020). The Ranking Connected Smart Cities , conceived by Urban Systems, is published annually, disclosing the ranking of the hundred smartest cities in the country, between the months of August and September.

The Connected Smart Cities Ranking comprises 11 main axes: Mobility and Accessibility, Urban Planning, Environment, Energy, Technology and Innovation, Economy, Education, Health, Safety, Entrepreneurship and Governance, which comprehends a total of 70 indicators. As of the 2019 edition, the RCSC began to be based on the NBR ISO 37120 and ISO 37122 indicators. These indicators

are a world reference, their metrologies serve as the basis for the composition of urban indicators.

In this research, the RCSC Economics and Entrepreneurship indicators were listed to carry out a more in-depth analysis of them. Such indicators seek innovation and flexibility as essential characteristics of the new production system (CASTELLS, 2009). Furthermore, they stand out in the construction of an innovative and dynamic economy, based on the relationship between technology, innovation, creativity and sustainability.

The current historical moment presents an economic structure of informational capitalism, in which capital, labor and the form of production and consumption are changed based on the management of information for development. Information that can lead to greater technological innovation, knowledge dissemination, and the improvement of democratic institutions with transparency and interactivity between citizens and government (REMEDIO & SILVA, 2017).
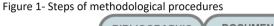
Hence, based on the theoretical framework, the next section addresses the methodological processes, presenting the steps, procedures and methods used in carrying out this research. In addition, an overview of the object of study was carried out.
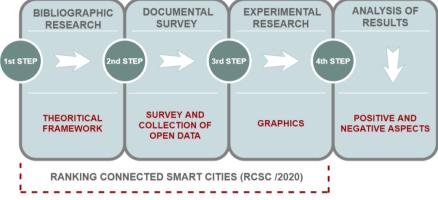
3 METHODOLOGICAL PROCEDURES

The The development of this work was based on a case study, considering that it seeks to analyze the context of the Economics and Entrepreneurship indicators of Passo Fundo/RS using the Ranking Connected Smart Cities (RCSC, 2020) as a reference. From the main objective proposed in this research, compliance with specific procedures was adopted, resulting in four main steps, as shown in Figure 1.

Figure 1- Steps of methodological procedures

Source: Prepared by the authors (2021).

As shown in Figure 1, the research consisted of four distinct steps respectively:

1. *Bibliographic Research:* carried out in order to understand the context of contemporary cities, the concept and initiatives of Smart Cities, and the use of indicators as a management tool. Furthermore, the bibliographical research served as a theoretical framework for the argumentation process presented in the article.

2. *Documentary Research*: consisted of surveying and collecting open data for each indicator from the institutions responsible for measuring it.

3. *Experimental Research*: consisted of representing the collected data through graphs, making comparisons of the case study data (Passo Fundo/RS) with the data of cities taken as a reference within the context of Smart Cities of the RCSC 2020.

4. *Analysis of Results:* in this stage, we sought to analyze the data resulting from the collection and crossings of the previous stages, analyzing under a critical perspective the main information raised, both positive points and deficient issues.

The first three stages are based on the urban indicators of the Ranking Connected Smart Cities, within the scope of the Economy and Entrepreneurship axes that will be analyzed. Such indicators have intrinsic characteristics that will be detailed in the following subsection.

3.1 URBAN INDICATORS OF THE AXES OF ECONOMY AND ENTREPRENEURSHIP OF RCSC

For the application of the proposed methodology, the open data used were collected from official platforms and databases. Tables 1 and 2 present the indicators that make up the Economics and Entrepreneurship axes of the Connected Smart Cities Ranking (RCSC, 2020), as well as the unit of measure of each indicator, the source of open data where they are collected and the year of update.

Table 1 - Economy Axis Indicators

	INDICATORS	UNITY	SOURCE	LAST UPDATE
ECONOMY	Per Capita GDP growth	%	IBGE	2016-2017
	Average Income Formal Jobs	R$	RAIS	2018
	Business growth	%	RAIS	2018
	jobs growth	%	RAIS/ CAGED	2018
	Independent Public Sector Jobs	% jobs	RAIS	2017
	Employability (Jobs/PEA)	(Jobs/ PEA)	RAIS/ IBGE	2018
	Total Revenue not from Transfer	%	Siconfi	2018
	% Workforce in the ICT sector	%	RAIS	2018
	% Workforce occupied in Education and R&D	%	RAIS	2018
	Computers available per 1000 students	#/ 1000	INEP	2018

Source: Prepared by the authors (2021).

As shown in Table 1, the Economy axis is composed of ten indicators, which encompass issues related to the Gross Domestic Product (GDP), jobs and companies and, in addition, it analyzes aspects related to ICT.

The choice of the Economy axis is due to the fact of the horizontal relationship that Passo Fundo establishes with neighboring cities. Passo Fundo is the main city in the Northwest of Rio Grande do Sul, characterized by a high index of socioeconomic development (IDESE, 2015), occupying the 5th position in the state. According to more recent data, the municipality's GDP reached R$9.14 billion in 2018 (IBGE, 2020b). With a population of over 200,000 inhabitants (IBGE, 2020a), the city is characterized by offering services and being a regional hub that meets the various demands of the small municipalities located in its surroundings. The importance of the city in the urban dynamics that encompasses the northwestern Rio Grande do Sul is also noteworthy.

Table 2 presents the indicators related to the Entrepreneurship axis. This axis includes five indicators, which seek to portray issues related to the employment and development of technology, as well as the encouragement of research and innovation. The choice of this axis is due to the fact that it contemplates the practice of entrepreneurship, and its contribution to economic development, mainly induced by the innovation of products and processes (PORTER, 1992; BARROS; PEREIRA, 2008).

Table 2 – Entrepreneurship Axis Indicators

AXLE	INDICATORS	UNITY	SOURCE	LAST UPDATE
ENTREPRENEURSHIP	Technology Companies Growth	%	RAIS	2018
	Technologial Poles - Parks	#	Anprotec	2019
	Corporate Growth Creative Economy	%	RAIS	2018
	Incubators	#	Anprotec	2019
	MEI growth	%	Portal do Empreendedor	2018

Source: Prepared by the authors (2021).

All data (values) presented in Tables 1 and 2 were collected from open databases, in digital media, at the website of each institution responsible for measuring and disclosing this information (IBGE, RAIS, Siconfi, INEP, Anprotec, Portal of the Entrepreneur). The most recent data were collected, referring to the last survey carried out for each of the surveyed indicators.

Thus, this work seeks to better understand the context of Passo Fundo in these two areas, which encompass social and economic issues. In the next subsection, the object of the case study will be presented.

3.2 PASSO FUNDO/ RS

Located in the northern part of Rio Grande do Sul (RS), Passo Fundo is the main city in the Northwest of Rio Grande do Sul, characterized by a high level of socioeconomic development (Idese, 2015). Passo Fundo is a medium-sized city, recognized as an important economic, medical and educational center.

The Northwest region is characterized by being an urban network composed mostly of small municipalities, which seek, in larger municipalities, for access to goods and services unavailable in their small nuclei. In this sense, Passo Fundo becomes a regional reference, participating in the socioeconomic and population dynamics of nearby cities (FERRETO, 2012).

In this perspective, Santos (2010) highlights the concept of horizontality, which concerns a contiguous population, united by territory, and as a territory, governed by interaction. In this sense, horizontalities would be represented by the relationships that the city of Passo Fundo establishes with the region, characterized by the offer of commerce and health and education services.

The proposal to use Passo Fundo as the object of the case study was made with the aim of verifying at what level the city is in relation to some of the main Smart Cities in the country, according to the Ranking Connected Smart Cities. For this purpose the medium-sized cities located in the South region best classified in the 2020 ranking were selected. Table 3 presents the selected cities, as well as their number of inhabitants, and their classification in the RCSC 2020.

Table 3 - Midsize Cities in the South Region best ranked in the RCSC 2020

	CITY	NUMBER OF INHABITANTS	RCSC 2020 POSITION
RCSC 2020	Florianópolis - SC	492.977	2°
	Balneário Camboriú – SC	352.460	16°
	Itajaí - SC	215.895	18°
	Blumenau - SC	138.792	19°
	Passo Fundo - RS	201.767	-----

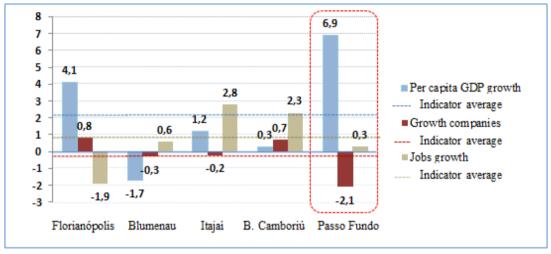Source: Prepared by the authors (2021).

As shown in Table 3, the comparison of the object of study (Passo Fundo) was carried out with four other cities in the South region, which are located in the state of Santa Catarina. This regional cut allowed for analyzes and comparisons with cities classified with the same size as Passo Fundo, medium-sized cities. Such cities are taken as a reference in their mesoregions so that the population of smaller cities located in their surroundings seeks access to products and services that are not found in their small centers.

After studying the Economics and Entrepreneurship indicators of the Ranking Connected Smart Cities to be used in the research, and the selection of cities to be compared, the 2nd stage of the research was carried out, which consisted of collecting and surveying open data from these cities. Subsequently, these data were compared (3rd stage of the research) as shown in the Results section below.

4 RESULTS AND DISCUSSIONS

The application of the methodology allowed the collection of comparative data that were represented through graphics. The economics and entrepreneurship indicators analyzed were grouped by subject area. Thus, initially, the indicators related to the Economy axis were analyzed. The first analysis that was carried out addressed the growth of GDP, companies ,and jobs encompassing these three indicators, as shown in Graph 1.

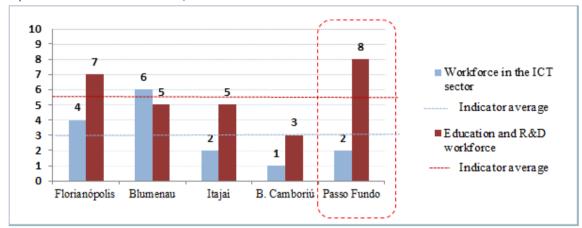Graph 1 – Growth of GDP Per Capita, Companies, and Jobs.
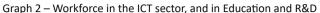

Source: Prepared by the authors (2021).

The results show that Passo Fundo had the highest GDP Per Capita growth rate of 6.9%, while for the average of the analyzed cities it was 2.16%, surpassing Florianópolis, capital of the state of Santa Catarina, an important tourist and educational center. As for the growth of companies, Passo Fundo registers a deficit which can be observed, to a lesser extent, also in Blumenau-SC and Itajaí-SC. This indicator showed an average of -0.22% in the analyzed cities, reaffirming the difficulty of opening new businesses. It is noteworthy that the companies located in Passo Fundo are mainly linked to the areas of health, education, the agricultural sector, and civil construction. The last indicator analyzed is directly linked to companies, as it seeks to measure job growth. In this item, Passo Fundo shows a small growth, driven mainly by the resumption of the civil construction sector after a period of stagnation. The average found in this indicator was 0.82%, indicating growth at the regional level.

As published in the newspaper Diário da Manhã (PERSPECTIVA, 2017), civil construction was the first sector to feel the effects of the 2016 economic crisis, laying off many workers. The sector was also the first to give a return through the generation of new jobs, mainly with the resumption of the constructions of the program Minha Casa, Minha Vida. It is also noteworthy that the sector has an inducing effect in relation to other sectors since it heats up the market through the search for products and services.

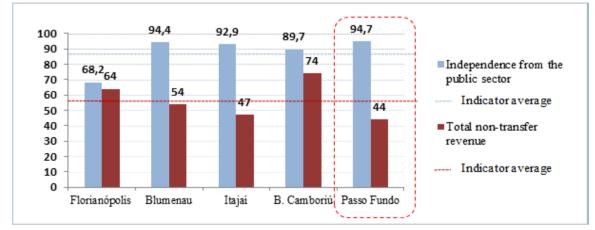Graph 2, presented below, shows the list of results linked to the workforce indicators.

Graph 2 – Workforce in the ICT sector, and in Education and R&D

Observing Graph 2, it can be seen that the percentage of workers in the Information and Communication Technology (ICT) sector reaches 2% in Passo Fundo, and the average of this indicator in the cities analyzed was 3%. Despite being a relatively small index, perspectives point to a growing expansion in this sector, driven by the installation of a Technology Park in the city (UPFPARQUE, 2020). The average of this indicator with the analyzed cities was 3%. It is the very implantation of this Technological Park, added to the large number of educational institutions in Passo Fundo, that has raised the workforce indicator in Education, Research and Development rate higher than that of the other compared cities, reaching an index of 8%. While the average of the cities analyzed in the sample was 5.6%, reiterating the importance of the educational sector for the region.

In this sense, about R&D Paludo projects (2019) states that agreements between educational institutions and companies aim to appropriately allocate human and financial resources in projects that demonstrate originality, relevance and economic feasibility in their uses and processes.

Graph 3 presents the indicators related to Public Management issues: Public Sector Independence and Total Revenue not arising from Transfers.
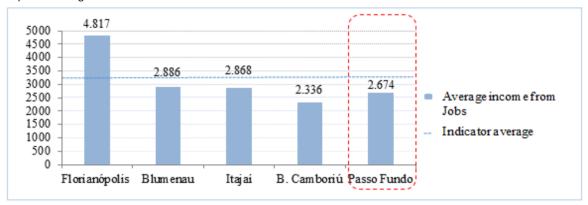
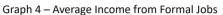Graph 3 – Indicators related to Public Management

As for the indicators related to public management, Passo Fundo is the city that presents the highest index of independence in the Public Sector, reaching the level of 94.7%, while the lowest index was presented by Florianópolis with 68.2%. The average of the analyzed cities was 87.98%. On the other hand, the city of Florianópolis has the lowest percentage of total revenue not originating from transfers, with an index of 44%, which is below the general average of 56.6%.

Graph 4 presents the results of the indicator of Average Income from Formal Jobs in the compared cities.
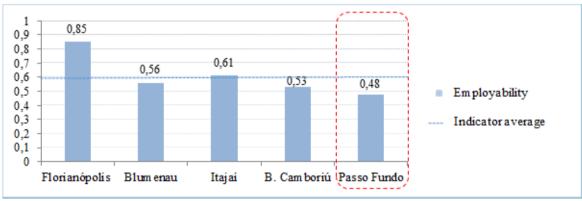
Graph 4 – Average Income from Formal Jobs
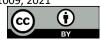

Source: Prepared by the authors (2021).

As for the average income from formal jobs, Passo Fundo has an average of R$2,674.00 per worker, this value corresponds to 2.5 minimum wages. The value presented by the city is similar to the values of other medium-sized cities, with the exception of the city of Florianópolis, which presents an index well above the average salary of the cities compared, which is R$3,116. This higher income from the capital of Santa Catarina reflects on the cost of living, consumption, and services, higher when compared to other cities.

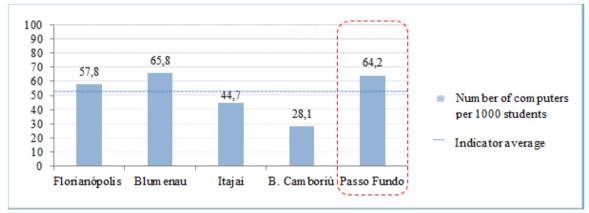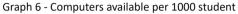Graph 5, presented below, shows the indicators related to employability indices

Graph 5 - Employability Indicator

Source: Prepared by the authors (2021).

The employability indicator is related to the ability to obtain and remain in a job. This indicator is related to numerous variables such as qualification, experience, flexibility and skills. As shown in Graph 5, the city of Passo Fundo has the lowest index, not reaching the level of 0.5 points. While, at the other end, we have the city of Florianópolis with an index of 0.85 points, being a reference indicator for the other cities. The average of this indicator in the analyzed cities was 0.6 points.

Graph 6 presented below is related to the axes of Economy and Education.

Graph 6 - Computers available per 1000 student

Source: Prepared by the authors (2021).

The indicator represented in Graph 6 integrates the economic system with the educational sector, as it seeks to bring the list of computers available in the public network to every 1000 students. In this indicator Passo Fundo stands out, reaching one of the highest rates with 64.2 computers available for every 1000 students. The city with the highest index in this indicator is Blumenau, with 65.8 computers, while the average in the analyzed cities was 52.12 computers per 1000 students.

This value portrays the insertion of technology in public education as a tool that aims to democratize learning, encourage access to information, and stimulate research.
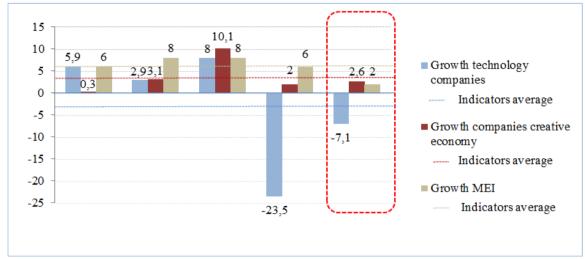
In this sense, the Passo Fundo City Hall has maintained the Hackers School Program since 2014, an institutional project that aims to provide a space for the development of skills in the area of computer programming and logical-mathematical reasoning for elementary school students in public schools municipal authorities (PMPF, 2020).

Making a general overview of the economic indicators, it can be noted that Passo Fundo presents some indicators that are much lower than those taken as a reference in the RCSC, as is the case of indicators related mainly to the theme of employability and the expansion of companies. On the other hand, Passo Fundo presents very positive indicators when it comes to aspects related to education and the insertion of Information and Communication Technology (ICTs), reaffirming that this new technology and innovation paradigm has come to transform cities.

In this second moment, the indicators of the Entrepreneurship axis will be analyzed, with 5 indicators being evaluated. Likewise, they were grouped by subject area. Graph 7 presents the analysis of three indicators related to company growth.
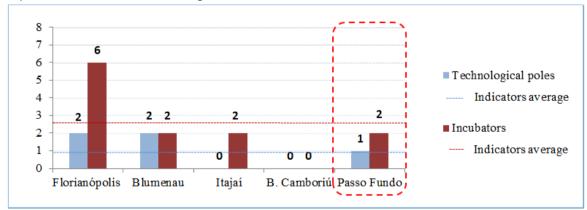
Graph 7 – Indicators related to Business Growth

The indicators shown in Graph 7 are related to the growth of Technology and Creative Economy companies and also to the growth of the Individual Micro Entrepreneur (MEI). As for the growth of technology companies, it can be observed that there was a retraction, with an index that reached - 7.1%, which is below the average of - 2.76 presented by the cities analyzed. As for the growth indicator of Creative Economy companies, Passo Fundo showed a timid growth, however, not so far from the other citiesin the study, with the exception of the city of Itajaí, which stood out in this indicator with 10.1% growth, while the average index of the analyzed cities reached the level of 3.62%. In addition, it is observed that individual Micro Entrepreneur (MEI) is still not a common practice in the municipality of Passo Fundo, which presented an index of 2%, which is below the average of the cities in the southern region analyzed that presented an index average of 6%. However, market perspectives show that entrepreneurship initiatives tend to grow in the municipality.

The next graph presented is Graph 8 in which indicators related to Technology Parks and Incubators will be presented.

Graph 8 – Indicators related to Technological Poles and Incubators

Graph 8 is composed of important indicators, which represent the implementation and application of technology in favor of knowledge, information, business, and entrepreneurship itself. Both the technological poles and the incubators are increasingly consolidating as practices and trends in the Digital Age. Passo Fundo has a Technological Pole, being in the average of the cities analyzed, and two Incubators, both inserted in Educational Institutions, the average in this indicator was 2.4. The city of Florianópolis stands out as it is known as the "Innovation Capital" due to its numerous entrepreneurship and technology initiatives.

Analyzing the Entrepreneurship indicators, it is possible to see that Passo Fundo is starting to advance in the analyzed themes, driven mainly by Education Institutions and private initiatives. Furthermore, the participation of the public power comes through as an encourager and facilitator in this process.

As a way of synthesizing the results presented in graphs 1 to 8 and what was discussed during the analyses, a table was created with the evaluated indicators and the position that each one of the cities occupies in relation to them. Table 1 presented below shows this relationship.

Table 1 – Synthesis of the classification of cities compared in each indicator analyzed

ECONOMY AXIS						
INDICATOR	**CITY CLASSIFICATION**					**GRÁPHIC**
	Florianópolis	Blumenau	Itajaí	B. Camboriú	Passo Fundo	
Per Capita GDP growth	2nd	5th	3rd	4th	1st	Graphic 1
Business growth	1st	4th	3rd	2nd	5th	Graphic 1
jobs growth	5th	3rd	1st	2nd	4th	Graphic 1
% Workforce in the ICT sector	2nd	1st	3rd	4th	3rd	Graphic 2
% Workforce occupied in Education and R&D	2nd	3rd	3rd	4th	1st	Graphic 2
Independent Public Sector Jobs	5th	2nd	3rd	4th	1st	Graphic 3
Total Revenue not from Transfer	2nd	3rd	4th	1st	5th	Graphic 3
Average Income Formal Jobs	1st	2nd	3rd	5th	4th	Graphic 4
Employability (Jobs/PEA)	1st	3rd	2nd	4th	5th	Graphic 5
Computers available per 1000 students	3rd	1st	4th	5th	2nd	Graphic 6

EIXO EMPREEDEDORISMO						
Technology Companies Growth	2nd	3rd	1st	4th	5th	Graphic 7
Corporate Growth Creative Economy	5th	2nd	1st	4th	3rd	Graphic 7
MEI growth	2nd	1st	1st	2nd	3rd	Graphic 7
Technologial Poles - Parks	1st	1st	--	--	2nd	Graphic 8
Incubators	1st	2nd	2nd	--	2nd	Graphic 8

Source: Prepared by the authors (2021).

As shown in Table 1, the five compared cities were ranked from 1st to 5th place, according to the indicator data collected and presented in Graphs 1 to 8. It is possible to observe that the city of Florianópolis most often appeared in the first and second position, in 11 of the 15 indicators analyzed, reaffirming the posit of being better classified in the RCSC among the compared cities. The city of Blumenau appeared eight times in the first positions, mainly in the entrepreneurship axis. The cities of Itajaí and Balneário Camboriú occupied, in most cases, intermediate positions such as 3rd and 4th place. And finally, the city of Passo Fundo showed variations, occupying 1st to 5th place, being among the first places (1st and 2nd) six times, having better indexes in the indicators of the Economy axis.

5 FINAL REMARKS

The challenges of implementing Smart Cities initiatives in Brazil are not small, especially when addressing social issues that require better solutions to face them. However, Brazil has experimented with some initiatives, such as the Ranking Connected Smart Cities (RCSC, 2020).

In this context, this article carried out an analysis of the urban indicators of Economy and Entrepreneurship in the city of Passo Fundo. The study used the indicators of the Connected Smart Cities as a reference, as well as the indexes of medium-sized cities in the South region, that were best classified in the Ranking. The analysis from the data collection was of fundamental importance for understanding the indicators. The results expressed in graphs brought the dimension of the studied context and the peculiarities of each city compared.

After this more in-depth analysis, it was possible to observe that Passo Fundo's indices are still a little lower than those of the medium-sized cities analyzed (Florianópolis-SC, Blumenau-SC, Itajaí-SC, Balneário Camboriú-SC), being far from the values needed to become a more sustainable and smart city.

The issue of employability can be highlighted as frailties in the axis of Economics, with an index that does not reach 0.5 out of a possible 1.0 point. It's important to keep in mind that this indicator assesses the expectations of getting a new job, or even keeping one. Another deficit indicator in the scope of the Economy is the retraction in the growth of companies, which reaches − 2.1%. This indicator is directly related to the issue of job offers, investment, and capital circulation in the municipality. Within the scope of Entrepreneurship indicators, the fragility in the growth of Technology companies is highlighted, with a retraction rate that reaches the level of -7.1%.

However, Passo Fundo also presented satisfactory indexes, in the Entrepreneurship axis, the numbers related to the implantation of technological poles and incubators. Currently, the city has a Technological Park and two Incubators, these initiatives are mainly promoted by higher education institutions in the municipality. In addition, it was observed that the encouragement and dissemination of the use of technologies have been used in Passo Fundo, from basic education, through access to computers, technological tools, and encouragement to programs such as the Hackers School. Today, the municipality has an average of 64 computers available in the Municipal network for every thousand students.

In the Economy axis, the highlight is the Per Capita GDP Growth, with an increase of 6.9% compared to the previous year. It is noteworthy that the Per Capita GDP is the indicator that represents the total wealth produced by each inhabitant, in this sense, the Per Capita income can be considered an indicator of the standard of living, as it is related to the HDI.

The analysis of the Economy and Entrepreneurship indicators allowed us to better understand the reality of Passo Fundo in these sectors. From the measurement of these indicators, it is

possible to have subsidies to draw specific strategies for each area, helping to make more assertive decisions, as reiterated by Leite and Awad (2012), Martins and Cândido (2015).

Therefore, the implementation of Smart Cities initiatives in medium-sized cities can be an important ally in building more sustainable and fluid planning. The attractiveness of these cities as regional economic and social centers must be in synergy with the implementation of innovation and new technologies to meet the demands of society.

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1. Definition of research problem	√	√
2. Development of hypotheses or research questions (empirical studies)	√	√
3. Development of theoretical propositions (theoretical work)	√	√
4. Theoretical foundation / Literature review	√	
5. Definition of methodological procedures	√	√
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7. Statistical analysis	√	
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