A look at the city of Fortaleza from the perspective of NBR ISO 37120:2017

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Abstract
This article presents, for the city of Fortaleza, the result of the indicators of five of the seventeen sections of the standard NBR ISO 37120:2017 - "Sustainable Development of Communities - Indicators for urban services and quality of life" which establishes an international standard of key indicators and encourages communities to become more proactive, ensuring that stakeholders develop and implement a management system suited to the needs of each region. This standard, launched in 2014, defines the methodology for a set of 100 indicators, divided into 17 sections, which address social, environmental and economic aspects of cities. The five sections chosen for this work were: education, health, security, shelter and transport, since they are key areas for the development of any city. Fortaleza's results, in each of these sections, are discussed and compared with those of 58 other cities available through the World Council on City Data (WCCD) database. It is, therefore, an unprecedented study, since there is no related work in the literature for the chosen city. As a result, it can be seen that, of the 31 indicators evaluated in this work, Fortaleza was below the average of the cities certified by the WCCD in 19 indicators, above the average in 7 indicators and it was not possible to calculate another 5 indicators. It is also evident that in all the sections studied there are critical points that must be evaluated by the public power for the treatment and consequent improvement of urban services and quality of life of the population of Fortaleza.

Keywords: ISO 37120. Fortaleza. Sustainability. Indicators.

1. Introduction

The growing environmental awareness and concern, urbanization and technological development have resulted in an urgent need and opportunity to rethink the way we build and manage our cities [1]. To get an idea, data from the United Nations (UN) indicate that the next decades will bring profound changes in the size and distribution of the global population. Continued urbanization and general population growth will cause 2.5 billion

new people to live in urban areas by 2050, which will thus comprise more than 6 billion inhabitants of the 9.6 billion planned for that date [2].

People move to urban areas in the hope of finding better employment opportunities and a better standard of living. However, the growing number of people who migrate to these urban areas leads to complex issues such as congestion, increased demand for a limited set of natural resources, including energy, water, sanitation, education and health services, among others [3,4]. Thus, the management of urban areas becomes one of the most important development challenges of the 21st century. The information and data generated by the municipalities are vital for setting political priorities in order to promote inclusive, equitable and sustainable development [5].

As cities grow, the importance of data-driven decision making is critical to global comparison. Many cities are making urban data publicly available, free of charge, as a way to enhance transparency and facilitate new uses and applications of the data. These recent initiatives have the potential to transform citizen involvement and commitment in city governance. The growing flow of open urban data over the past few years suggests that this trend will continue [6,7]. However, developing city metrics also faces many challenges. The first challenge is the selection and definition of metrics. The second challenge is the adoption and use of these metrics by a large number of cities [8]. In this sense, the convergence of global standards for city indicators and open city data provides a unique opportunity for cities and researchers to analyse and compare city performance [9]. To help with these major challenges, city assessment tools can be used to support decision-making in urban development [10]. In this context, where the global convergence of standards for urban indicators, open city data, and the internet provides a unique opportunity for municipalities and researchers to analyze and compare performance across cities [11], the International Organization for Standardization (ISO) provides a standard that can help throughout this evaluation process. ISO 37120 Sustainable Development of Communities – Indicators for City Services and Quality of Life sets a global standard of key indicators that encourage communities to become more proactive, ensuring that stakeholders develop and implement a management system that is appropriate, needs of each region [12]. This standard, made available to the entire community in mid-2014, underwent a translation into Portuguese in 2017 and was launched by Brazilian Association of Technical Standards (ABNT) for the Brazilian public under the title NBR ISO 37120:2017: “Sustainable Development of Communities - Indicators for urban services and quality of life". NBR is the abbreviation for the Brazilian version of the ISO standard, basically the translation into Portuguese, as well as the inclusion of some information to facilitate the understanding of the standard.

The NBR ISO 37120:2017 establishes a set of 100 indicators divided into 17 sections. These indicators provide the potential for a clearer and more holistic understanding by society of urbanization and related sustainability topics. Thus, this work aims to present and discuss the results for the city of Fortaleza, in the state of Ceará, of the essential and support indicators established by the NBR ISO 37120:2017 standard in five of its seventeen sections, namely: education, health, safety, shelter and transport.

For this purpose, this article is organized into five sections. The next section addresses the characteristics and history of the ISO 37120 standard. The third section presents the methodological procedures for the development of this research and, in the fourth section; the research results for the city of Fortaleza are presented. The fifth section closes the work, with final considerations and proposals for future studies.

1.1. The ISO 37120 standard

In May 2014 the first international standard for urban indicators was launched by ISO: ISO 37120 - "Sustainable development of communities - Indicators for city services and quality of life". This standard, the result of a joint effort by several countries, presents a set of 100 indicators, divided into 17 sections, which address the social, environmental and economic aspects of cities. It is important to highlight that the standard, at no time, presents reference values for these indicators, nor targets to be followed, being applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, regardless of its size and location. The calculation method for each of the 100 indicators is described throughout the standard and these must be compiled or presented on an annual basis. The 17 sections of the ISO 37120:2014 standard can be seen in Fig. 1.

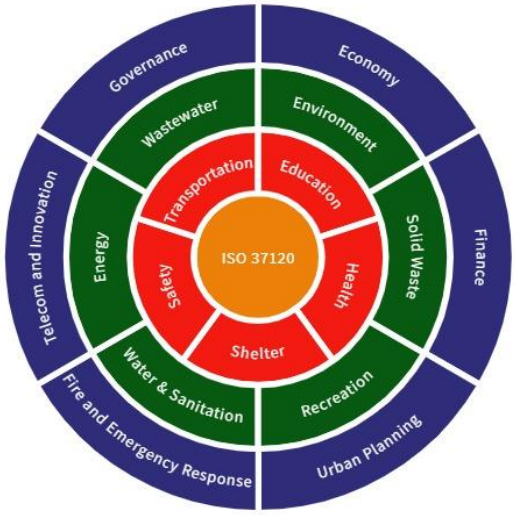

Fig. 1. Sections of ISO 37120:2014
Source: Authors 2022

Although all sections of the standard have the same importance, it was decided to present them in layers. In the first layer, the most central and in red, are the sections that are related to the basic rights of the citizen. These were the sections chosen to present the results in this work. In the second layer, the intermediate and in green, are the sections of the standard that have a closer relationship with the environment. And, finally, in the third layer, the most peripheral and in blue, are the sections that are more related to urban planning and the city's support services.

The indicators included in the ISO 37120 standard can help cities assess their performance and measure their progress gradually, with the ultimate goal of improving quality of life and sustainability. The standard's uniform approach allows cities to compare where they are in relation to other cities and this information can, in turn, be used to identify best practices thus creating a learning circle [13]. In the standard there are two main groups of indicators to demonstrate the performance of the provision of urban services and quality of life in cities:

- the essential: a set of 46 required or indispensable indicators that have a greater weight for the city's certification by the WCCD, and;
- the supporting ones: a set of 54 recommendable indicators that have a complementary weight for the city's certification by the WCCD.

In addition to these two groups, 39 other profile indicators are also described by the standard that can be used to provide basic statistics and information on the context of cities to help identify which ones are interesting for comparisons in pairs. These indicators are used as an informative reference and are listed in annex B of the standard. Differently from what happens with the essential and support indicators, the definitions and methodologies for these profile indicators are still being elaborated and, therefore, are not the object of this study. The great challenge of this standard is the location of city data to calculate each of the 100 indicators, especially in developing countries that do not have information systems or open data accessible to the community. Often the data even exist, but at a national or even regional level and not local or municipal as the norm demands. The distribution of indicators in each of the sections of the ISO 37120:2014 standard can be seen in Table 1.

Table 1. Indicators by section of ISO 37120:2014, Source: Authors 2022

Standard sections	Number of Indicators		
	Full	Support	Essentials
Economy	3	4	7
Education	4	3	7
Energy	4	3	7
Environment	3	5	8
Finance	1	3	4
Fire and Emergency Responses	3	3	6
Governance	2	4	6
Health	4	3	7
Recreation	0	2	2
Safety	2	3	5
Shelter	1	2	3
Solid Waste	3	7	10
Telecommunications and innovation	2	1	3
Transportation	4	5	9
Urban Planning	1	3	4
Wastewater	5	0	5
Water and Sanitation	4	3	7
TOTAL	**46**	**54**	**100**

Parallel to the presentation of ISO 37120 in 2014, the World Council on City Data (WCCD) was launched, which, according to its own definition, is a council that leads the world in

the standardization of urban metrics and coordinates a data platform referring to sustainable development indicators. WCCD hosts a data network of cities that implement ISO 37120, for this it has developed a certification system based on the standard's indicators and the Global Cities Registry, which is the list of cities that have received such certification. The certificate awarded to each city does not take into account the performance observed, but the number of essential and supporting indicators made available in accordance with the standard. Thus, cities can be certified as:

- aspirant – presenting between 30 and 45 essential indicators;
- bronze – with between 46 and 59 indicators, 46 of which are essential and the others are supportive;
- silver – with between 60 and 75 indicators, 46 of which are essential and the others are supportive;
- gold – with between 76 and 90 indicators, 46 of which are essential and the others are supportive;
- platinum – with between 91 and 100 indicators, 46 of which are essential and the others are supportive.

Currently 84 cities are part of the Global Cities Registry, with 80% of these cities having platinum certification. However, taking South America as a base, only the cities of Buenos Aires in Argentina and Bogotá in Colombia have data available in the WCCD database.

In January 2017, the Special Study Committee on Sustainable Development in Communities (ABNT/CEE-268) translated and adapted ISO 37120:2014 to the Brazilian reality. Thus, NBR ISO 37120:2017 emerged: "Sustainable Development of Communities - Indicators for urban services and quality of life". In July 2018, there was the first revision of ISO 37120:2014, adding some more indicators and sections, but the "Brazilian" standard (NBR ISO 37120:2017), to date, has not yet been revised and adapted to this new revision. Thus, the current versions are: ISO 37120:2018 - Sustainable cities and communities - Indicators for city services and quality of life and NBR ISO 37120:2017, which is the object of this study for the city of Fortaleza.

2. Methodology

The methodology adopted in this article can be seen in Fig. 2.

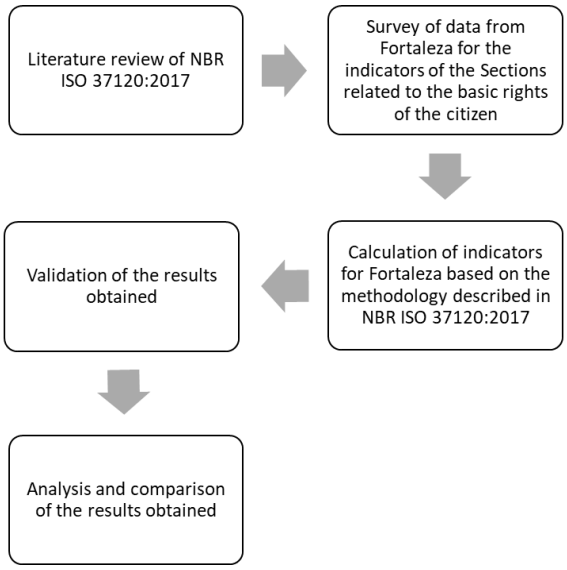

Fig. 2. Methodology block diagram
Source: Authors 2022

In the literature review, a detailed study was carried out to understand all 100 indicators of the standard and its 17 sections so that it was possible to divide them into the three layers shown in Fig. 1. After this review, a search process was conducted to obtain data from the city of Fortaleza to calculate the indicators of the sections of education, health, security, housing and transport. This search was carried out between January and May 2020 on the Brazilian government's internet portals, both at the federal, state and municipal levels, always focusing on specific data for the city of Fortaleza. The WCCD database for comparison with the results obtained for Fortaleza was obtained through the work "Urban Retrofit: an approach to support decision-making" [6], since during the writing process of this work the WCCD portal was under maintenance and with some features deactivated, including data from certified cities. This chosen database includes the result of 58 cities around the world and certified by the year 2018, therefore, it is very representative.

Then, the results obtained from the indicators for the city of Fortaleza were validated with the calculation methodology described in NBR ISO 37120. For this, each formula was verified to ensure that the result obtained in Fortaleza was in accordance with the methodology established in the standard.

Finally, there was an analysis, comparison and discussion of the results found for Fortaleza. It is noteworthy that some of the results found in this work are from 2010, since the last demographic census in the Brazilian territory took place that year. More recent data should

be available after the next census that should take place, according to information from the Brazilian Institute of Geography and Statistics (IBGE) only in 2021.

3. Discussion of research results

Fortaleza is the fifth largest city in Brazil, has a strategic geographic position for the country, as it is the closest Brazilian capital to Europe and is just over 5,500 km from Miami, in the United States. It has an area of 312 km2 and approximately 2.6 million inhabitants, accounting for a Gross Domestic Product (GDP) of around R$ 61 billion/year [14]. The Human Development Index (HDI) in 2010 was 0.754, considered high according to the criteria of the United Nations Development Program [15,16], and the population's life expectancy is 74 years.

3.1. Education portrait in Fortaleza according to NBR ISO 37120:2017 indicators

Education is the second section presented by the standard. It consists of seven indicators, four of which are classified as essential and three are classified as support. In this section, the standard defines primary education as education that is considered the first stage of basic education. Primary education typically comprises six years of full-time schooling, with the legal entry age typically not less than 5 years and not more than 7; and typically lasts until the age of 10 to 12, so it refers to children with age between 5 and 12 years or elementary school up to 5 or 6 years, as defined by local education systems. It also defines secondary education as education that is considered the second stage of basic education and marks the end of compulsory education where it exists. Students generally join between the ages of 10 and 13 (12 years being the most common). Secondary education usually ends 12 or 13 years after the start of primary education (or approximately 18 years); however, systems may vary, ending between 11 or 14 years after the start of primary education (or approximately 17 to 20 years of age). Secondary education also refers to grade 6 (or 7th) through grade 12 as defined by local education systems.

In Brazil, according to the Common National Curriculum Base [17], there are 3 stages of basic education: the Early Childhood Education stage that serves the age group from zero to 5 years old and which is not the object of study of the standard, the stage of Elementary Education comprising 9 years, being divided into initial years (the first 5 of the 9 years and which correspond to primary education in the definition of the standard) and final years (the following 4 years of the 9) and, finally, the High School stage that comprises another 3 years of teaching. Together, the final years of elementary school (4 years) and the years of high school (3 years) correspond to the definition of secondary education made by the standard. Thus, the calculation of the indicators in the Education section considered as primary education the initial years of Brazilian primary education and as secondary education the final years of primary education and Brazilian secondary education.
All indicators in this section were calculated, including the support ones, based on the indicators available at the Brazilian Institute of Geography and Statistics (IBGE) and at the National Institute of Educational Studies and Research Anísio Teixeira (INEP) [18,19]. The results of the Fortaleza education indicators, as well as those of cities certified in the WCCD database, are presented in Table 2.

Table 2. Education indicators, Source: Authors 2022

Indicators	Type of indicator	Results					Reference year for Fortaleza
		Fortaleza	Base WCCD (2018)			Fortaleza's position average	
			Best	Average	Worst		
Percentage of school-age female population enrolled in schools	Essential	93%	100%	96%	40%	Below average	2010
Percentage of students with complete primary education: survival rate	Essential	99%	108%	100%	67%	Below average	2018
Percentage of students with complete secondary education: survival rate	Essential	82%	103%	88%	45%	Below average	2018
Student/teacher relationship in primary education	Essential	24	11	18	66	Below average	2019
Percentage of school-age male population enrolled in schools	Supporting	92%	100%	94,78%	52,72%	Below average	2010
Percentage of school-age population enrolled in schools	Supporting	93%	100%	95,15%	55,71%	Below average	2010
Number of individuals with complete higher education per 100,000 inhabitants	Supporting	8.443	40.034	27.858	464	Below average	2010

In relation to the education section, of the seven indicators, Fortaleza was below the average of cities certified by WCCD in all of them. Some results from the city of Fortaleza stand out in this section and deserve to be highlighted: first, the number of individuals with complete higher education per 100,000 inhabitants, which is 3.3 times lower than the average value. This can have direct social consequences, mainly related to the employability of the population. A second important point is the ratio of students per teacher in primary education, which, in Fortaleza, is more than double the number of cities with the best results. Although there is currently no national legislation that determines the maximum number of students per class in basic education, Ordinance CNE/CP No. 10, of August 6, 2009 [20], stipulates that there must be a maximum of 25 students per class for primary education, teaching in the early years and 30 students per teacher in the final years. For high school, this same ordinance stipulates up to 35 students per teacher. This text is, however, a guideline and not a law.

It is observed, therefore, that the result found in Fortaleza is very close to the limit stipulated by the aforementioned decree (23.5 of 25 students per teacher). It is important to analyze and, if necessary, act preventively in order to prevent this condition from having a negative impact on the quality of education, on student performance and, what would be worse, on the increase in the dropout rate.

Regarding the percentage of school-age population enrolled in schools, Fortaleza presents a result of 92.75% for the year 2010. This result includes the rates of elementary education (early and final years) and high school. However, looking at each stage of education differently, we have that 96.16% of the population aged 6 to 14 is enrolled in elementary school and only 83.94% of the population aged 15 to 17 is enrolled in secondary education [21]. These numbers are repeated when looking at Brazil as a whole. According to the Brazilian Yearbook of Basic Education [22], which presents federal and regional

indicators, in Brazil the percentage of school-age population enrolled in schools (which the yearbook calls net enrollment rate) in primary education was 98.00% in 2018 and in high school only 68.70%. These numbers are even lower if we observe only the Northeast region: 97.70% in elementary education and 60.40% in secondary education. Thus, the need for action on the population aged 15 to 17 is evident to improve this indicator.

3.2. Health portrait in Fortaleza according to NBR ISO 37120:2017 indicators

Health is the eighth section presented by the standard. It is also composed of seven indicators, four of which are classified as essential and three are classified as support. All indicators in this section were calculated, including the support ones, based on the indicators available at the Ministry of Health, at the Brazilian Institute of Geography and Statistics (IBGE), at the United Nations Development Program (UNDP), in the Institute for Applied Economic Research (Ipea) and the National Register of Health Establishments (CNES) [23]. The results of health indicators for Fortaleza, as well as those for cities certified in the WCCD database, are presented in Table 3.

Regarding the health section, of the seven indicators, Fortaleza was below the average of cities certified by WCCD in four and above the average in the other three indicators. Some results for the city of Fortaleza deserve discussion in this section: the first, and positively, is the number of physicians per 100,000 inhabitants, which is higher than the average for cities certified by WCCD, but well below the best result found. According to data from the Medical Demography in Brazil [24] study, there are huge inequalities in the distribution of doctors across the Brazilian territory. While across the country there are 218 doctors per 100,000 inhabitants, there are capitals with more than 1,200 physicians per 100,000 inhabitants – such as Vitória, Espírito Santo – and regions in the interior of the Northeast with values below 100 physicians per 100,000 inhabitants. It is also worth noting that the World Health Organization (WHO) and the Pan American Health Organization (PAHO) do not recommend or establish rates of physicians per inhabitant as a reference, as this depends on regional, socioeconomic, cultural and epidemiological factors. These bodies emphasize that it is not valid to establish a generalized “optimal rate” for all countries.

Table 3. Health indicators, Source: Authors 2022

Indicators	Type	Results					Reference year for Fortaleza
		Fortaleza	Base WCCD (2018)			Fortaleza's position average	
			Best	Average	Worst		
Average life expectancy (years)	Essential	74	86	80	54	Below average	2010
Number of hospital beds per 100,000 inhabitants	Essential	377	998	302	0	Above average	2019
Number of doctors per 100,000 inhabitants	Essential	295	2.540	279	12	Above average	2019
Mortality rate of children under five for every 1,000 live births	Essential	15	0	5	121	Below average	2017
Number of nursing and midwifery staff per 100,000 inhabitants	Supporting	1795	5.538	622	20	Below average	2019
Number of mental health professionals per 100,000 inhabitants	Supporting	6	3.214	31	0	Below average	2019
Suicide rate per 100,000 population	Supporting	6	0	8	42	Above average	2018

The number of nursing and midwifery team professionals and mental health professionals per 100,000 inhabitants in the city of Fortaleza, on the other hand, was much lower than the average for cities certified in WCCD, especially in relation to mental health professionals, which reaches 5, 5 times lower than the average and up to 564 times lower than the best result found.

Another important point is the suicide rate per 100,000 population. Even with a better result than the average of cities certified in WCCD, according to the Mortality Information System (SIM) of the Ministry of Health [25], in 2018 and in absolute numbers, with 170 cases, Fortaleza was the fifth Brazilian city with the highest number of suicides, second only to Rio de Janeiro with 306 cases, São Paulo with 215 cases, Brasília with 196 cases and Belo Horizonte with 176 cases. Even more worrying is to correlate the low number of mental health professionals in Fortaleza with this high suicide rate.

3.3. Security portrait in Fortaleza according to NBR ISO 37120:2017 indicators

Security is the tenth section presented by the standard. It comprises five indicators, two of which are classified as essential and three are classified as support. In this section, only 3 of the 5 indicators were calculated, since data referring to the number of official police officers and the response time of the police from the first call were not available until the end of this work. For the calculation of other indicators, the Brazilian Institute of Geography and Statistics (IBGE) and the Secretariat of Public Security and Social Defense (SSPDS) [26] were used as data sources. The results of safety indicators for Fortaleza, as well as those for cities certified in the WCCD database [27], are presented in Table 4.

Table 4. Security indicators, Source: Authors 2022

Indicators	Type	Results					Reference year for Fortaleza
		Fortaleza	Base WCCD (2018)			Fortaleza's position average	
			Best	Average	Worst		
Number of police officers per 100,000 inhabitants	Essential	Not available	1.162	197	9	Not available	-
Number of homicides per 100,000 inhabitants	Essential	24.84	0	2	63	Below average	2019
Crimes against property per 100,000 inhabitants	Supporting	1.171	0	1.290	4.664	Above average	2019
Police response time from first call	Supporting	Not available	0	8	94	Not available	-
Violent crime rate per 100,000 inhabitants	Supporting	1,273	8	382	3.973	Below average	2019

Regarding the safety section, of the five indicators, Fortaleza was below the average of cities certified in the WCCD in two, above the average in only one indicator and it was not possible to reach the result in the two other indicators in this section, including one of them essential, which in a way would already limit the WCCD certification of Fortaleza to the aspirant level.

Security, in fact, is a much debated topic in Fortaleza, mainly due to the high levels of violence reported in recent years. The results found in this section really point in that direction. For comparison purposes, according to the latest Atlas of Violence published in 2019 by the Institute for Applied Economic Research (Ipea), with data from the base year 2017, and which brings a picture of homicides in Brazilian municipalities, comparing the 27 capitals, Fortaleza appears as the most violent with 87.9 homicides per 100,000 inhabitants (which would be the worst result considering the cities certified by WCCD), followed by Rio Branco in Acre with 85.3 and Belém in Pará with 74.3. Even improving its result in 2019, the number of homicides in Fortaleza per 100,000 inhabitants is up to 12 times higher than the average result found in cities certified by WCCD. Likewise, comparing the violent crime rate indicator, Fortaleza presents an index 150 times higher than the best result found. No less worrying are crimes against property, which, even with a slightly better result than the average for WCCD cities, is still far from the best result found and, since it is theft, where there is no violence or serious threat, there may be cases not reported by the population.

In this section, the difficulty in obtaining important data for the population's knowledge is noteworthy, such as the number of police officers per population and the response time of the police from the first call. Even performing an exhaustive search in the media at the federal, state and municipal levels, it was not possible to locate the data for calculating these indicators. Thus, information was requested through the "Portal Ceará Transparente", under the prerogative of the Access to Information Law [27], however, until the closing of this work, these data were not yet available.

Thus, the importance of effective political action on the issue of security in the city of Fortaleza is evident, since this is an area that has a direct impact on the quality of life, health and physical and mental well-being of the population and can, even interfering in the attraction of new businesses and in the city's development. Increasing public safety is one of the quickest methods to produce quantifiable results and shape public opinion and [29], as suggested by the study Atlas of Violence: portraits of Brazilian municipalities [30], the solution to improve security in cities would combine three fundamental pillars: first - the planning of intersectorial actions, aimed at social prevention and child-juvenile development, in vulnerable families; second - the qualification of police work with more intelligence and effective investigation; and, third - the reorganization of the criminal policy and the reorganization of the penal execution system, in order to guarantee the control of prisons by the State.

3.4. Shelter portrait in Fortaleza according to NBR ISO 37120:2017 indicators

Shelter is the eleventh section presented by the standard. It consists of three indicators, one classified as essential and two classified as support. In this section, only 2 of the 3 indicators were calculated, since data referring to the number of existing homes without legal property registration were not available until the end of this work. For the calculation of other indicators, the Brazilian Institute of Geography and Statistics (IBGE) and the Public Ministry of the State of Ceará (MPCE) [31] were used as data sources. The results of the shelter indicators for Fortaleza, as well as those for cities certified in the WCCD database, are presented in Table 5.

Table 5. Shelter indicators, Source: Authors 2022

Indicators	Type	Results					Reference year for Fortaleza
		Fortaleza	Base WCCD (2018)			Fortaleza's position average	
			Best	Average	Worst		
Percentage of urban population living in slums	Essential	16%	0%	0,05%	40%	Below average	2019
Number of homeless per 100,000 inhabitants	Supporting	67	0	140	940	Above average	2014
Percentage of homes without registered title deeds	Supporting	Not available	0	0,2	70	Not available	-

In relation to the shelter section, it is noteworthy, in Fortaleza, the significant amount of the urban population living in slums or subnormal agglomerations, as the IBGE calls it. The occurrence of slums is a phenomenon that is widespread in cities of all sizes in Brazil, although it is more frequent in municipalities with a population above 500,000 inhabitants, where 97.3% of these municipalities have reported the occurrence of slums [21]. According to data from the Subnormal Clusters study [32], considering Brazilian cities with more than 750 thousand inhabitants, Fortaleza ranks fifth in relation to the percentage of households occupied in subnormal clusters, only behind the cities of Belém, Manaus, Salvador and São Luiz. These results are reflections of the development model adopted in the country, characterized by an unequal, environmentally disorderly and socially excluding urbanization process, marked by high levels of socio-spatial inequalities.

According to the definition of the IBGE [32], subnormal agglomerates are forms of irregular occupation of public or private land, characterized by an irregular urban pattern, lack of essential public services and location in areas that present restrictions to occupation. The populations of these communities live under socioeconomic, sanitation and precarious housing conditions. Therefore, it is important to adopt, in an integrated and proactive way, housing and social policies, allowing a more favorable insertion of the low-income population in the labor and housing markets, focusing mainly on preventing the formation of new slums without neglecting urbanization, regularization and integration of existing favelas to the rest of the city.

3.5. Transport portrait in Fortaleza according to NBR ISO 37120:2017 indicators

Transport is the fourteenth section presented by the standard. It consists of nine indicators, four classified as essential and five classified as support. In this section, only 7 of the 9 indicators were calculated, since the data referring to the annual number of trips in public transport and the percentage of passengers who travel to work as an alternative to the private car were not available until the closing of this work. For the calculation of the other indicators, the Brazilian Institute of Geography and Statistics (IBGE), the Metrofor (Metro of Fortaleza) [33], the National Traffic Department (DENATRAN) [34], the Municipality of Fortaleza and the Ministry of Health. The results of the transport indicators for Fortaleza, as well as those for cities certified in the WCCD database, are presented in Table 6.

The standard defines that high-capacity public transport may include subways, underground systems and commuter trains and that the medium-capacity public transport system may include light rail vehicles (LRT) and trams, buses, trolleybuses or other light transport service of passengers [13]. For the first indicator, number of kilometers of high-capacity public transport system, Fortaleza currently has 43.6 kilometers of network (southern line and west line of the metro), placing the city in sixth position among Brazilian capitals with the greatest extension of the network of high-capacity public transport. Comparing with the results of cities certified in WCCD, Fortaleza would be below average and far from the best result found. In relation to medium-capacity public transport, although Fortaleza presents a result above the average of cities certified by WCCD, practically the entire network is concentrated in the road modal, through urban buses.

Table 6. Transport indicators, Source: Authors 2022

Indicators	Type	Results					Reference year for Fortaleza
		Fortaleza	Base WCCD (2018)			Fortaleza's position average	
			Best	Average	Worst		
Kilometers of high-capacity public transport system per 100,000 population	Essential	1.63	187	4	0	Below average	2019
Kilometers of medium-capacity public transport system per 100,000 inhabitants	Essential	261.91	671	131	0,6	Above average	2019
Annual number of trips on public transport per capita	Essential	Not available	563	90	0,01	Not available	-
Number of private cars per capita	Essential	0.23	0,01	0,38	0,92	Above average	2019
Percentage of passengers commuting to work as an alternative to the private car	Supporting	Not available	11	46	88	Not available	-
Number of two-wheeled motor vehicles per capita	Supporting	0.12	0	0,03	0,68	Below average	2019
Kilometers of cycle lanes and cycle lanes per 100,000 inhabitants	Supporting	10.55	227	19	0	Below average	2019
Traffic mortality per 100,000 inhabitants	Supporting	16.19	0	6	41	Below average	2018
Air connectivity (number of non-stop commercial flight departures)	Supporting	24,336 nonstop flights per year	672.092	118.217	0	Below average	2020

Although the network of bicycle paths and lanes in Fortaleza presents results below average, this is an indicator that has been improving year after year. According to the Integrated Cycling Master Plan of Fortaleza (PDCI) [35] in 2014, the extension of the cycling network was only 85.6 km. There are currently 281.6 km of cycle paths and cycle lanes in the city. The bicycle is a sustainable means of transport, alleviates mobility problems in large cities, provides improvements in the population's quality of life and also promotes inclusion in cities. For all these reasons, the World Bank encourages the use of bicycles as a means of transport in Latin American cities [36]. Its use has been greatly encouraged in Fortaleza, mainly through the municipal government's Bicycle project. Currently, this project already has 112 bike sharing stations spread across the city and the idea is to double this amount by the end of 2020 [37].

Another result that deserves attention is the traffic mortality rate per 100,000 inhabitants. Fortaleza presents a number practically 3 times higher than the average of cities certified by WCCD. According to the Annual Road Safety Report of Fortaleza [38], considering accidents with fatal victims, accidents with injured victims and accidents with material damage only and without victims, the estimated costs in Fortaleza with traffic accidents added up to the amount of BRL 506,817,352.89 in 2018, representing 0.8% of the city's Gross Domestic Product (GDP). The data used in this report are compiled by the Traffic Accident Information System of Fortaleza – SIAT, managed by the Municipal Traffic and Citizenship Authority of Fortaleza - AMC, since 2001 and show a relative difference with the data collected in the Information System on Mortality (SIM) of the Ministry of Health and which were used to calculate the aforementioned indicator. We chose to use SIM

numbers because this allows access to data, which was not possible through SIAT. It is important to mention that the Annual Report on Road Safety of Fortaleza is a very rich document, with a lot of information on the subject of road safety and, most importantly, with directions for improving this indicator.

As in the safety section, in this section it was not possible to obtain results for two of the indicators: annual number of trips in public transport per capita and percentage of passengers who travel to work as an alternative to the private car. Even performing an exhaustive search in the media at the federal, state and municipal levels, it was not possible to locate the data for calculating these indicators.

4. Conclusion

This article presents the result of the essential and support indicators established by the NBR ISO 37120:2017 standard in the sections of education, health, security, shelter and transport for the city of Fortaleza. It was possible to reach the result in 26 of the 31 selected indicators, since for the other 5 indicators, 2 essential and 3 support, it was not possible to locate the data to perform the calculations according to the methodologies established in NBR ISO 37120:2017. As the criterion for certification adopted by the WCCD does not take into account the performance observed, but the number of indicators made available in accordance with the standard, even if it presented results for all other indicators described in the sections of NBR ISO 37120:2017 not covered by this work, Fortaleza would obtain at most the aspirant certificate, since to be bronze, for example, at least all the essential indicators must be presented.

The results found for Fortaleza were then compared with those of 58 other cities from different continents with the aim of positioning it and also evaluating possible areas that deserve greater attention from the government. Thus, it can be seen that in 63% of the indicators the result of Fortaleza was lower than the average result of the cities certified by the WCCD, in 21% of the indicators the result of Fortaleza was higher than the average of these cities and in 16% of the indicators not it was possible to obtain the result for Fortaleza. Two sections evaluated in this work presented more worrying results: education and security. However, in all sections, it was possible to identify critical points that deserve attention from the Fortaleza public authorities. A second aspect of concern is the difficulty of finding some important data for the population. As this study showed, information for calculating the indicators of number of police officers and police response time, for example, was not found.

Future works may include comparative studies between Brazilian cities that present similar socioeconomic reality; studies of financial gains for cities with the implementation of the NBR ISO 37120 standard; studies relating the indicators of the NBR ISO 37120 standard with the Sustainable Development Goals (SDGs) and their goals for 2030; and a complementary study to the current one with the indicators of the recently launched ISO 37122: Sustainable cities and communities — Indicators for smart cities.

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