INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

INDICATORS FOR SUSTAINABLE URBAN MOBILITY: 2030 AGENDA AND THE SDGS IN EVIDENCE

Clara Natália Steigleder[1], Marc François Richter[2], Raquel da Fonseca Holz[3], Andrea Lopes Pandolfo[4], Andreia de Bem Machado[5]

Abstract: The aim of this study was to identify, through the bibliometric research method, the sustainability indicators built and/or applied in several parts of the world, as a way to monitor and evaluate public policies in the area of Urban Mobility and Transportation and be able to outline future researches establishing comparisons between the researched countries. For selection of the analyzed papers, the parameters established by the 2030 Agenda were used, by means of its 17 SDGs and the indicators constructed by IPEA for Brazil. As a result of the search, 15 papers were identified, written by 58 authors, linked to 53 institutions from 14 different countries. When analyzing the 7 countries with the highest number of citations in the area, it can be noticed that Germany stands out with 38% of the total citations, followed by Spain with 30%. It was concluded that the indicators used in the analysed studies indicate that good urban mobility is important not only to improve people's life quality, but also to increase the economic and environmental efficiency of cities. In addition, it helps to promote social equality by allowing people to easily commute to their daily needs, be they work, school, health or leisure.

Keywords: Sustainability, Urban space, public management, circulation.

Resumo: O objetivo deste estudo foi identificar, através do método bibliométrico de pesquisa, os Indicadores de Sustentabilidade construídos e/ou aplicados em diversas partes do mundo, como forma de acompanhar e avaliar as políticas públicas na área de Mobilidade Urbana e Transportes e poder traçar futuras pesquisas estabelecendo comparações entre os países pesquisados. Para a seleção dos trabalhos analisados, utilizou-se os parâmetros estabelecidos pela Agenda 2030, através dos seus 17 ODS e os indicadores construídos pelo IPEA para o Brasil. Como resultado da coleta identificou-se que os 15 trabalhos selecionados na busca foram escritos por 58 autores, vinculados a 53 instituições provenientes de 14 países distintos. Ao se analisar os 7 países com maior número de citações na área pode-se perceber que a Alemanha se destaca com 38% das citações totais, seguido pela a Espanha com 30%. Concluiu-se que os indicadores utilizados nos estudos analisados apontam que a boa mobilidade urbana é importante não apenas para melhorar a qualidade de vida das pessoas, mas também para aumentar a eficiência econômica e ambiental das cidades. Além disso, ajuda a promover a igualdade social, permitindo que as pessoas se desloquem facilmente às suas necessidades diárias, sejam elas trabalho, escola, saúde ou lazer.

[1] Clara Natália Steigleder, Professora do curso de Tecnologia em Transporte Terrestre, Universidade Federal de Pelotas (UFPel), Eldorado do Sul/RS, Brasil. E-mail: nataliasteigleder@gmail.com
[2] Marc François Richter, Professor do Programa de Pós-Graduação em Ambiente e Sustentabilidade (PPGAS), Universidade Estadual do Rio Grande do Sul (Uergs), São Francisco de Paula/RS, Brasil. E-mail: marc-richter@uergs.edu.br
[3] Raquel da Fonseca Holz, Professora dos cursos de Transporte e Hotelaria/ Centro de Integração do Mercosul, Universidade Federal de Pelotas (UFPel), Pelotas/RS, Brasil. E-mail: raquel.holz@ufpel.edu.br
[4] Andrea Lopes Pandolfo, Académica do Programa de Pós-Graduação em Ambiente e Sustentabilidade (PPGAS), Universidade Estadual do Rio Grande do Sul (Uergs), São Francisco de Paula/RS, Brasil. E-mail: andrea-pandolfo@uergs.edu.br
[5] Andreia de Bem Machado, Professora colaboradora da Faculdade Municipal de Palhoça, Professora e Coordenadora do Curso de Pedagogia da Faculdade Anasps, Faculdade Anasps, Palhoça/SC, Brasil. E-mail: andreiadebem@gmail.com

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

Palavras-chave: Sustentabilidade, Espaço urbano, Gestão Pública, Circulação.

Addressing the main challenges of the 2030 Agenda first implies the commitment of the signatory countries to the 17 Sustainable Development Goals (SDGs) and 169 targets. For this purpose, the nationalization and subsequent localization of targets and indicators becomes a fundamental task (Annesi et al., 2021). However, more than seven years after its adoption, this continues to be one of the greatest challenges of the Agenda, especially for developing countries, whose structural, social and economic difficulties make the task even more complex. The integration of environmental principles in the public decision-making process needs to be, increasingly, a priority of public policies at municipal, state and federal levels.

The difficulties in the generation and treatment of information by the poorest countries is one of the points that must be addressed. Without reliable, disaggregated and up-to-date data, the follow-up and monitoring of goals and indicators is unfeasible and, therefore, there is little possibility of progress in the eradication of problems (United Nations, 2015), since one of the great advantages of the system of goals and indicators provided for in the Agenda is precisely to allow the creation and monitoring of public policies to be based on concrete data. Such measure would allow for course adjustments, in case of undesirable results.

Another point to be addressed, is the structural, financial and technical capacity for municipalities to effectively adopt the Agenda. The effort to implement the 2030 Agenda for sustainable development is great and involves the commitment of many actors. Especially when it comes to the municipal level, one must keep in mind the differences in the capacity of different municipalities to deal with the issue. These differences range from population, geographic, economic, social and political issues, to issues related to the capacity of the technical staff and the managers' sensitivity/awareness to the theme (Neto, 2021).

As a result, there is a strong need for coordination of the work at the federal level, which should act as a guideline for the municipalities, defining priorities, key actions, training and support for the federation entities, allowing problems to be "attacked" in a coordinated manner and results obtained at local level to be translated at the national level, also as a way to ensure that achievements and challenges can be assessed at the global level. In Brazil, however, it is evident the very low involvement and mobilization of the federal government towards the 2030 Agenda, especially after 2019 with the extinction of the “Comissão Nacional para os Objetivos de Desenvolvimento Sustentável” (CNODS) in Portuguese, or National Commission for Sustainable Development Goals (CNODS), in English (CNODS, 2018). Currently, to a large extent, the implementation of the 2030 Agenda seems to be conducted by civil society through isolated initiatives (Moura, 2020), which generate very disparate results and are not able to represent a national scenario.

Especially regarding the goals of the SDG 11, this scenario is quite concerning, since it is an SDG directly linked to the local sphere, requiring data and information that eventually can only be generated at local level (Koch & Krellenberg, 2018). This change of "scale" for small and medium-sized municipalities can be quite challenging, requiring both financial investments and training, often facing internal resistance from local public managers (Neto, 2021).

More specifically in relation to the mobility issue (Goal 11.2), small and medium-sized municipalities face challenges in the management of public transport and other actions related to

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

mobility. An example is that not all municipalities have the so-called Urban Mobility Plans, an essential public policy when discussing the subject at the municipal level. Without a comprehensive planning, the municipalities are stuck to isolated actions, which do not result in effective returns for the local society regarding the expansion of urban mobility conditions.

More specifically in relation to the issue of urban mobility (target 11.2 of SDG 11), this is configured as one of the main challenges currently faced by urban centres, bringing damage to health, economy and environment. In this context, the expansion of urban areas (which has increased the distances to be covered by the population in order to carry out their daily activities) and the inefficiency of the public authorities to enable public transport on a large scale have contributed to the massification of individual transport – especially in developing countries (Locatelli, 2020). Today, although it is considered one of the most inefficient means of transport from the point of view of sustainability, cars are the main responsible for the daily trips made in most cities in the world. As a result of this practice, several negative effects on the life quality of the population are observed, including: air quality, increased emissions of greenhouse gases (GHG), a greater number of traffic jams, an increase in the number of automobile accidents, including transport costs (both at public and individual level) and travel times (Jiménez, 2020). Furthermore, small and medium-sized municipalities also suffer from an additional problem: the absence of public policies focused on the mobility area. An example of this is that not all cities have so-called Urban Mobility Plans, important for the development of cities, and an essential policy when discussing the issue at the municipal level. Without comprehensive planning, municipalities are stuck with isolated actions, which do not result in effective returns for the local society, regarding the expansion and/or improvement of the conditions and quality of urban mobility (Barbarossa, 2020).

For an effective planning, it is necessary to build indicators that allow measuring whether the efforts made by the public power are in line with the goals set by the UN and their adaptation by Instituto de Pesquisa Econômica Aplicada (Ipea), or Institute for Applied Economic Research, in English. It is also important to outline medium and long-range public policies that contribute to a more sustainable society. The difficulty that public authorities often have to draw up indicators is well known. In this sense, the present study aims to contribute to this planning by conducting a bibliometric study of the indicators used worldwide on Sustainable Urban Mobility (IPEA, 2016).

The bibliographical study "Sustainable Indicators for Urban Mobility in Brazil – a bibliographical study" (Steigleder et al., 2022), analyzed nine scientific publications from 2012 to 2021, and the data pointed to the importance of deepening the analyses, as well as their expansion. The proposal of this new article on the subject is, therefore, to expand the research in order to consider experiences in other countries. Therefore, the purpose of this study was to analyze “Sustainability Indicators” that are being built in several parts of the world in as much as urban mobility and transportation are concerned.

This article is organized as follows: after this brief introduction, a short history of the origin of 2030 agenda and the SDGs and their adaptation to the Brazilian context will be presented, focusing on SDG 11, whose target 11.2 deals with urban mobility and access to public and collective transport, and target 11.3, which proposes to increase inclusive and sustainable urbanisation in Brazilian cities by 2030 (IPEA, 2018). Both targets, which deal with the planning of cities, mobility and transportation, shall be developed in the following section. Subsequently, it will be presented conceptually both what the indicators are and how they can be thought of for the planning of Sustainable Urban Mobility. In the methodology section, all procedures used in

DOI 10.34624/ilcj.v13i2.32090

the study are presented, then, in the next section, the analysis of these indicators is carried out and, finally, the final considerations are presented.

SUSTAINABLE DEVELOPMENT GOALS (SDG)

The 2030 Agenda is a global action plan consisting of 17 Sustainable Development Goals (SDGs), divided into 169 targets, and 232 indicators. There is also the Declaration, which brings together shared vision, principles and commitments. It was created with the intention of eradicating extreme poverty in the world and promoting, at the same time, dignified lives for all people, within the conditions that our planet offers and without compromising the quality of life of the next generations (Kronemberger, 2019). This plan was born from an agreement signed in 2015 by the 193 member states of the United Nations (UN), with the commitment to follow the measures recommended in the document "Transforming Our World: the 2030 Agenda for Sustainable Development" for the 15-year period between 2016 and 2030 (UNITED NATIONS, 2015).

This agenda is the result of efforts made since 2010 – ten years after the approval of the Millennium Development Goals (MDGs) and five years before the deadline for their achievement – when the MDG summit recommended to the UN Secretary-General the adoption of measures to define goals beyond 2015 (Oliveira, 2018). The process culminated with the approval, in the year 2015, of the Sustainable Development Goals on the occasion of the 70th United Nations General Assembly. Importantly, the goals and targets are integrated and cover the three dimensions of sustainable development - social, environmental and economic – and should be put into practice by governments at municipal, regional or national level, by the civil society, the private sector and by every citizen committed to future generations.

In Brazil, the implementation process of the 2030 Agenda is, as of 2019, linked to the Special Secretariat for Social Articulation (SEAS; Secretaria Especial de Articulação Social, in portuguese), which in turn is linked to the Government Secretariat of the Presidency of the Republic (SEGOV-PR). The Brazilian Institute of Geography and Statistics (IBGE; Instituto Brasileiro de Geografia e Estatística, in portuguese) continues to coordinate the process of production of SDG indicators at the national level. The Applied Economics Research Institute (IPEA) was responsible for producing a document adapting the 169 UN development goals to Brazil's priorities, considering national strategies, plans and programmes and the country's challenges to ensure sustainable development in the next decade (IPEA, 2018).

Among the SDGs, SDG 11 stands out for this analysis, whose official mission is to "Make cities inclusive, safe, resilient and sustainable". From the point of view of mobility and transport, two goals of this SDG should be considered. One of them is goal 11.2, which in the case of Brazil, focuses on the theme of sustainable urban mobility: "By 2030, improve road safety and access to the city through more sustainable, inclusive, efficient and fair urban mobility systems, prioritizing mass public transport and active transport, with special attention to the needs of people in vulnerable situations, such as those with disabilities and reduced mobility, women, children and elderly people." It was included in the drafting of this goal, in relation to the UN version, the prioritization of non-motorized and collective mass transport modes, following the guidelines of the National Policy on Urban Mobility (IPEA, 2018).

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

The other goal is goal 11.3, which states that by 2030, all units of the federation should "increase inclusive and sustainable urbanization, enhance capacities for planning, for social control and for participatory, integrated and sustainable management of human settlements" (IPEA, 2018). This goal is important due to the associations it enables, since planning should be integrated and contemplate different areas of public power, such as environmental policies, land use and housing, all three of which are directly related to mobility and transport (Teklemariam, 2022).

SUSTAINABLE URBAN MOBILITY

The urban mobility pattern of most Brazilian cities has undergone changes mainly due to their growth and consequent increase in the distances covered in urban travel. Cities that offer a considerable territorial area, almost always expand horizontally, are called "sprawling cities". According to Riera (2014), the quality of life is compromised mainly in urban areas, where residents of peripheral areas need to travel long distances to access the centre, usually the place where the commercial and services area of cities is located.

These modifications have led to the preference, by a considerable part of the population, for the use of individual motor vehicles (IMVs) over the use of public transport and non-motorised vehicles. Furthermore, the social imaginary about the individual vehicle is associated with individual well-being, to which almost everyone aspires at some point in their lives. It is not by chance that many stories in books and films feature a car as a gift for the young person turning 18 (and coming of age). But this preferred use may cause negative externalities, such as traffic accidents, traffic jams, environmental pollution (physical, noise, air and soil), among others.

Traffic accidents have been one of the leading causes of mortality in the world, causing 20 to 50 million injuries and 1.2 million deaths every year (Zhu et al., 2016). According to Aquino et al. (2020) "public policies for accident prevention have not been as effective as market policies for increasing vehicle sales".

Thinking about sustainability in urban mobility implies valuing life in all its senses and potentials. This means, first of all, access to the city and everything it offers for life to be developed with quality and fullness. Hence the priority given by Law 12587/2012 (PNMU, 2012), which establishes the "National Policy on Urban Mobility ("Política Nacional de Mobilidade Urbana", in Portuguese), which should guide municipalities with over 20,000 inhabitants to create their Urban Mobility Plans considering the planning of accessible public spaces, the encouragement of active transport and public transport. Prioritizing these issues in municipal planning is crucial for the sustainable development of cities, in order to comply with SDG 11 and target 11.2. However, in order for this to be planned and implemented with quality, it is necessary to establish the right set of indicators. Next, it will be conceptualized what are Sustainable Indicators, their importance for the planning of Urban Mobility, and examples of them will be presented.

SUSTAINABLE INDICATORS

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

Indicators are tools made up of one or more variables that, associated through different forms, reveal broader meanings about the phenomena they refer to, that is: indicators are made up of the identification and analysis of attributes of a certain theme. Sustainable development indicators are essential tools to guide the action and subsidize the monitoring and evaluation of the progress achieved towards sustainable development (Giles-Corti, 2020). They should be seen as a means to achieve sustainable development and not as an end in themselves. They are worth more for what they point to than for their absolute value and are more useful when looked at as a whole rather than as individual indicators. Table 1 shows two important indicators for mobility (SDG targets: 11.2 and 11.3).

TABLE 1 – INDICATORS FOR TARGETS 11.2 AND 11.3

Target	Indicator
11.2	Percentage of trips made by public transport, walking and cycling.
	Burden on family budget with public transport
	Death rate in traffic accidents per 100 thousand inhabitants
	Percentage of the population living close (within 1 km) to medium and high capacity transport terminals and stations (total and by income bracket).
11.3	Percentage of municipalities with a participatory Master Plan.
	Percentage of municipalities with Municipal Councils and Sectoral Forums.
	Percentage of municipalities that carry out participatory budgets.

Source: IPEA (2018)

The indicators of target 11.2 are more specific to the area of Urban Mobility and Transport, however, the indicators of target 11.3 have a direct relationship with the first one. This is because the “National Policy on Urban Mobility” (PNMU, 2012), establishes that “Municipal Mobility Plans” should be thought and planned in line with the “Urban Development Master Plans”. In a planning order, first there is the planning of the territory, the uses and functions of the spaces, almost at the same time, the planning of access to the city and its spaces, macro and micro accessibility must be thought together with the function and uses of the territory. In the same way, following questions for a better transport system planning must be addressed: Which places are accessible by bicycle? Where should bicycle lanes be planned ? Which areas of the city are served by public transport using exclusive corridors ? Where are the fundamental facilities for life available, such as access to schools, hospitals, health clinics, cultural and leisure centers ?, among others. All these issues are directly related to urban space planning, as a sustainable city is one in which its

DOI 10.34624/ilcj.v13i2.32090

citizens have access to all its functions. And mobility to be sustainable must enable this to occur with quality, functionality, comfort, safety and respect for the environment (Gülgün et asl., 2014).

Seeking to account for this complexity of issues involving city planning and urban mobility was the main reason for conducting this bibliometric study, researching scientific papers published in different countries. To this end, based on the study produced in Brazil in 2022, it was found that the most important issues for the definition of urban sustainability indicators were: 1) sustainable construction and infrastructure, 2) governance and participatory planning, 3) urban mobility, 4) housing, 5) opportunities, 6) planning and land use, 7) environmental issues, 8) safety, and 9) services and facilities. Next, the methodological procedures used to analyze the sustainability indicators in urban mobility present in different parts of the world are presented.

METODOLOGICAL PROCEDURES

The integrative review contributes to the systematic visualization of the state of the art (de Bem Machado et al., 2020) on the subject in the research and its timeline to the level of production by area, avoiding minimization or repetition of studies, or even tending to bias when looking at a specific theme. For this analysis, the research was organized into five phases, namely: problem formulation, definition of research sources, article selection, screening evaluation and analytical synthesis of results.

The **first phase** is the research formulation of the problem that guides this study. This answered the question: What are the indicators for sustainable urban mobility in light of the SDGs? To answer this question, a database search was conducted that began and ended in the month of June 2022.

In the **second phase**, called the definition of research sources, some criteria for the selection of the research were defined, such as the delimitation of the research base. We chose to work with the electronic database Web of Science, considered quite relevant due to the number of abstracts and references indexed in the peer reviewed spaces, as well as its impact on the academic area in the interdisciplinary context, which is the study area of this research.

Considering the main problem question, the **third phase** was the selection of articles and conferences. Doing so implied in delimiting the search terms or expressions, as presented in Table 2.

Table 2 – SEARCH TERMS

Search terms	Total number of retrieved documents	Data base
"Urban mobility" and "sustainability"	559	Web of Science
"Urban mobility" and "indicators" and "sustainability"	70	Web of Science

DOI 10.34624/ilcj.v13i2.32090

“Urban mobility" and "Sustainable Development Goals"	15	Web of Science

Source: Prepared by the authors (2023).

The variations of the search terms adopted for the search were presented in a broader context, in the same proposal, as a concept depends on the context to which it is related and its historical trajectory and conceptual analysis. As a basic principle of the research, we chose to insert the terms and expressions in the "Title", "Abstract" and "Keyword" fields. No restrictions of time, language and area of knowledge or any other restrictions were allowed.

In the **fourth phase**, the evaluation of the selection, based on the criteria previously defined, led to a total number of 15 indexed documents, with a first record in 2016, until the latest publications in the year of 2022. Ten of the referred 15 documents were research articles in indexed journals, available on-line, without any reservation restriction for public domain. Also, it was identified that these 10 documents were written by 58 authors, linked to 53 institutions from 14 different countries. Also, a total of 119 keywords were used. Table 3 presents the results of this data collection in a general bibliometric analysis.

Table 3 – BIBLIOMETRIC DATA

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2016:2022
Documents obtained	15
Research articles obtained in indexed journals	10
Average citations per year	2,5
References	818
DOCUMENT CONTENTS	
Keywords	52
Additonal Author's keywords	119
AUTHORS	

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

Description	Results
Authors	58
Authors of single-authored documents	1
Authors of multi-authored documents	57
AUTHORS COLLABORATION	
Authors per Document	3,87

Source: Prepared by the authors (2023).

RESULTS AND DISCUSSION

The eligible articles in the Web of Science database were published in the period from 2016 to 2022. In the year 2016, there was 1 (one) publication. In the years 2017 and 2018 no publications were identified. In 2019, 5 (five) papers were published, and in 2020 we found 4 (four) publications. Finally, the year 2021 pointed out 2 (two) articles, with 3 (três) publications for 2022, as shown in Figure 1.

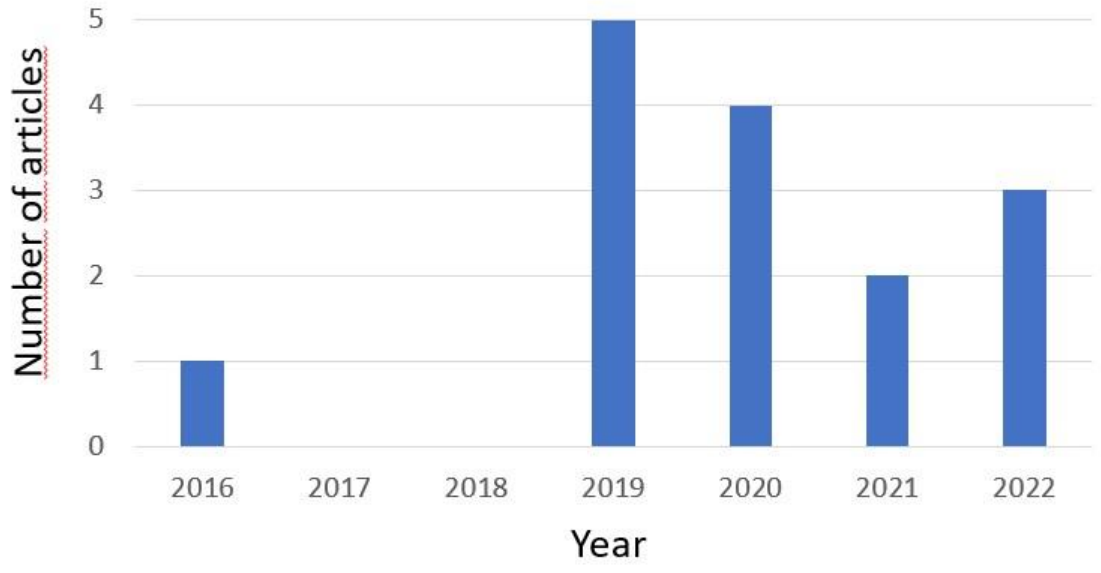

FIGURE 1 – NUMBER OF PUBLICATIONS PER YEAR;

Source: authors (2023)

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

In the 15 papers mentioned, a wide list of authors, institutions and 14 countries that stand out in research on urban mobility and sustainable development goals can be identified. When analyzing the 7 (seven) countries with articles that have been cited by others, the citations in the referred area, it can be seen that Germany stands out with an average of 38% (53) of total citations. In second place, Spain stands out with 30% (41) of the citations, as shown in Figure 2.

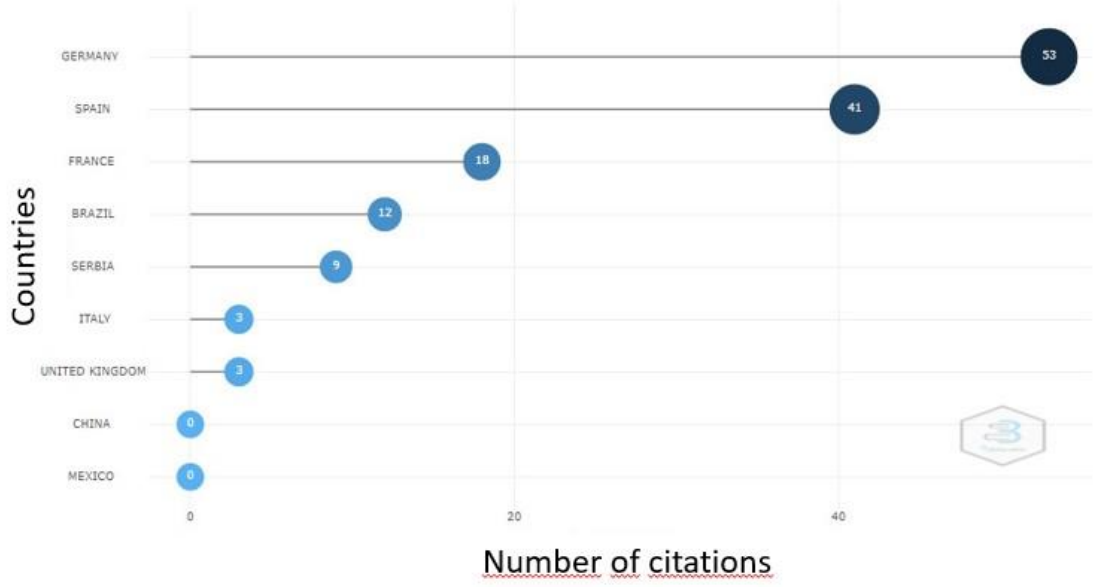

FIGURE 2 – DISTRIBUTION OF CITATIONS BY COUNTRY

Source: authors (2023)

The highlight in relation to these countries may be related to socioeconomic and cultural issues. Spain has a tradition in valuing public space, and although private vehicles have enjoyed a progressive occupation, its cities seek to negotiate the public space, from the point of view of this culture of expanded use of space. These are developed cities, whose circulation is designed to integrate the various modes of transport and travel, making cities pleasant for human encounters, an ideal that meets SDG 11 "Make cities and human settlements inclusive, safe, resilient and sustainable". Regarding Germany, it is important to consider that the country has invested a lot in qualifying its mobility, incorporating sustainability in urban planning. Bremen, for example, won the European Union Sustainable Urban Mobility Award in 2014. Among the actions that value sustainability in mobility, are educational actions aimed at creating a culture of sustainable mobility even in primary schools, when students are encouraged and trained to use bicycles. As a result, 25% of the residents' commutes are made by bicycle. The public authorities, in turn, invest in infrastructure, such as bicycle parking facilities. This stimulus has existed since 1999, when it was established by law that every new building built should have bicycle parking spaces, extending this obligation to all types of establishments (supermarkets, offices, public agencies, among others).

From the bibliometric analysis, based on the set of retrieved documents, 119 keywords indicated by the authors were identified. According to Figure 3, the keyword "Sustainability" stood

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

out for having been the most cited in the 15 documents mentioned. The keywords "urban mobility" and "sustainable mobility" are also highlighted in the set of keywords. These terms/words are indicated by the author during the manuscript submission process, requested by the on-line submission systems, and that are important for the article indexation along with the chosen journal, in order to facilitate searches by researchers within the knowledge area in question.

FIGURE 3 – TAG CLOUD

Source: authors (2023)

In the **fifth phase** of the present research comes the formulation of the problem that guides this study. This answers the main question: What are the indicators for sustainable urban mobility, in light of the SDGs? Of the 15 documents, after reading and analyzing the title and abstract, 5 (five) documents were excluded for not being research articles, but book chapters. Of the resulting 10 (ten) articles, only 7 (seven) of them were full-text available. All 7 (seven) articles had full adherence to the main question issue of the present research, which are presented with a schematic summary in Table 4.

TABLE 4 – SCHEMATIC SUMMARY

Ano	Author	Título	Resumo
2016	Ahmad; Puppim de Oliveira	Determinants of urban mobility in India: lessons for promoting sustainable and inclusive urban transportation in developing countries.	The research shows that public and non-motorised transport infrastructure will provide sustainable and inclusive development, besides other cobenefits such as energy security. Based on these findings, several policy recommendations are proposed to improve the sustainability and inclusiveness of urban mobility in Indian cities

DOI 10.34624/ilcj.v13i2.32090

2019	Sechilariu, Molines,Richard, Martell-Flores, Locment, Baert	Electromobility framework study: infrastructure e urban planning for EV charging station empowered by PV-based microgrid.	The study provides key elements to encourage stakeholders to develop smart infrastructure dedicated to electric vehicles (EV) charging within societal expectations, urban planning and in adequacy with UN sustainable development goals.
2019	Caroleo; Morelli; Lissandrello; Vesco; Di Dio; Mauro	Measuring the change towards more sustainable Mobility: MUV impact evaluation approach.	This paper describes a critical validation method, an impact evaluation of the experimental Mobility Urban Values range in several pilot cities in order to represent a proof for future global urban strategies. This methodological approach is based on an evaluation structured on impact and process indicators suitable for urban contexts.
2019	Ramirez-Rubio; Daher;Fanjul; Gascon; Mueller; Pajín; Plasènsncia; Rojas-Rueda; Thondoo; Nieuwebhuijsen	Urban health an example of a “health in all policies” approach in the context of SDGs implementation.	The study spells out policies that promote cycling, walking, public transport, zero and low emission modes of transport, and the provision of urban green spaces or healthy public open spaces in Barcelona (e.g. Urban Mobility, Green Infrastructure and Biodiversity Plans, or the Superblocks model).
2020	Locatelli, Bernardinis, Moraes	An approach between public policies on urban mobility and the sustainable development goals in Curitiba-PR.	The article explains that there is a correlation between the content of the policies analysed and SDG 11. The highest levels of interrelationship were in the categories of road safety and sustainability, while the lowest were public transport and accessibility.
2020	Soto Canales; Dávila	Gobernanza y mobilidad urbana hacia la sustenabilidad. Comunidad edicativa en Monterrey, México	It is necessary to boost the urban governance structure, establish support frameworks and favour urban development planning to align with the commitments of the New Urban Agenda and UN-Habitat's SDGs. Although there is a good coverage of the urban transport network and the community has access to it, this network is wasted because its routes do not respond to criteria of efficiency, safety or economy for students and, therefore, the proximity between housing and educational space, rather than being considered a positive locational attribute, is a factor of differentiation and social inequality.
2020	Jiménez; María-Dolores; Beltrán	An Integrative and Sustainable Workplace Mobility Plan: The Case Study of Navantia-Cartagena (Spain).	The paper explains the Sustainable Workplace Mobility Plan motivated by SDG 11 (Sustainable Cities and Communities), focussing on the Navantia facilities in Cartagena/Spain, which are based on three sets of measurements: (i) improved access measures; (ii) management of parking areas; and (iii) soft measures, in order to transform the city into a place with a better life quality.

Source: Prepared by the authors (2023).

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

Finally, in search of a qualitative analysis, it was observed that this debate involves urban planning issues as instruments for strategic management in cities. However, in a qualitative analysis one notices that this debate involves public policies that address and focuss on sustainable urban mobility.

The study by Ahmad & de Oliveira (2016) aims to quantify the influence of the city through socio-economic and socio-cultural characteristics and variables, on mobility patterns, to attempt to identify some policy interventions that can promote more inclusive and sustainable transport. The methodology uses a representative household survey of the 98 largest Indian cities. The authors disclose, as an analysis, that densification in Indian cities reduces the amount of transport as well as increases the likelihood of using public transport; they also specify that small and medium-sized cities predominantly use private transport, while large cities prefer public transport but lack non-motorised transport. Moreover, income is the most important determinant of the amount of transport and the use of motorised and private transport. Meanwhile, the results show that public and non-motorised transport infrastructure will provide sustainable and inclusive development and other co-benefits, such as energy security.

According to the European Platform for Transport Management (EPOMM, 2013), the concern of local governments to make urban mobility more sustainable has gradually increased and that this is mainly due to people's increased interest in improving the quality of life of the population. According to this point of view, one notes the importance of road safety, accessibility, sustainability and encouraging the use of public transport to ensure that all residents have efficient access to goods and services, improving the living standards of the current generation without endangering future generations. Results showed that, in terms of discourse, primary public policies on urban mobility in the municipality of Curitiba-PR are, to a lesser or greater degree, in line with the general principles of the Sustainable Development Goals (LOCATELLI et al., 2020).

The study by Soto Canales & Gómez Dávila (2020), on the other hand, shows an urban transport network and, although the community has access to it, this network is being wasted because its routes do not respond to criteria of efficiency, safety or economy for students and, consequently, the proximity between housing and educational space, instead of being considered a positive location attribute, is a factor of differentiation and social inequality.

Caroleo et al. (2019) investigate whether gamification-based experiential applications can help create more environmentally friendly urban environments using an impact assessment technique that ignores personal preferences in the context of urban mobility. This study is being conducted as part of the Mobility Urban Values (MUV) project. This European Union initiative seeks to promote more environmentally friendly urban mobility in six pilot cities in order to serve as evidence for upcoming urban policies. The methodology is built on impact indicators and processes that are appropriate for different urban settings. The overall evaluation framework accounts for both impact and process evaluation, thus leading to a qualitative and quantitative evaluation that attempts to capture the quantification of outcomes (e.g. reduction of urban vehicle traffic) as well as understandings related to the implementation of the solution (e.g. how supporting activities could affect MUV outcomes). In addition, the relationships between MUV objectives and impact areas (Society-People, Society-Governance, Economy and Environment) are used as a guiding principle to define the impact indicators. This results in a set of indicators that are meaningful for urban contexts to measure experimental gamification issues and appropriate measures on effects that are selected to be relevant. As the evaluation approach is

INTERNET LATENT CORPUS JOURNAL
vol. 13 – n .2
(2023) ISSN 1647-7308

DOI 10.34624/ilcj.v13i2.32090

scalable and replicable, several other European cities have already been chosen to join the MUV initiative.

The measures presented in the article by Jiménez et al. (2020) propose reducing the use of private vehicles as the main means of transport, providing suitable areas for pedestrians and safety on bicycle paths, in order to achieve balance and appropriate coexistence between the different existing sustainable means of transport. These steps, together with other soft measures that the company, contracted by the municipality, could implement, will facilitate the reduction of private vehicle traffic and increase the number of sustainable transport users, which should result in a reduction of more than 200,000 kg of CO_2 emitted into the atmosphere, annually. The study increases scientific knowledge on workplace mobility plans by applying the spanish guidelines of the Institute for Diversification and Energy Saving (MTE, 2019). Results show the potential of cross-cutting measures to promote sustainable mobility even in consolidated areas with little space available for building new infrastructure. The promotion of sustainable mobility implies energy savings and less congestion, considering not only employees but also inhabitants will benefit.

According to Sechilariu et al. (2019), the growth of the electric vehicle (EV) market is an important step towards achieving carbon-free urban mobility. Coupling with renewable energy production according to an optimised energy management model within an urban microgrid meets tomorrow's challenges of smart grids and cities. The study aims at defining a intelligent infrastructure dedicated to the recharge of EVs (IIREVs) in an urban area as a charging station enabled by a photovoltaic micro-grid, able to interact with the public power distribution grid, and thus with electric car users. Presented as a multidisciplinary electromobility framework, this study provides key elements for the development of IIREVs, and gives the starting points concerning the design and its control structure. The study also highlights the need for a systemic approach to remain focused on users' needs and habits, to assess the efficiency at various scales of IIRVEs, associated services and the energy grid. By using a multidisciplinary framework leading to a technical-economic-environmental assessment methodology for IIREVs, the main outcome of this study focuses on the requirements and feasibility of IIREVs within the most suitable urban areas, within the expectations of society, urban planning, as well as suitability and sustainability of the urban analysis.

While health and well-being are explicitly addressed in SDG 3, health is also present as a precondition for SDG 11, which aims at inclusive, safe, resilient and sustainable cities. Ramirez-Rubio et al. (2019) highlight the so-called Health in All Policies (HiAP); this is a public policy approach across sectors that systematically takes into account the health implications of decisions, seeks synergies and avoids harmful health impacts in order to improve population health and health equity. According to the authors, HiAP is critical for local decision-making processes in the context of urban policies to promote public health interventions aimed at achieving SDGs targets. Quantitative assessments can provide powerful data such as: 1) estimates of avoidable annual morbidity under compliance with international exposure recommendations for physical activity, exposure to air pollution, noise, heat and access to green spaces; 2) the associated economic impacts on health care costs per year; and 3) the number of avoidable premature deaths when improvements in urban and transport planning are implemented. This information has been used to support the design of policies that promote cycling, walking, public, zero and low emission modes of transport, and the provision of urban green spaces or healthy public open spaces in Barcelona (e.g. Urban Mobility, Green Infrastructure and Biodiversity Plans, in addition to Bus Rapid Transit and Open Streets initiatives

DOI 10.34624/ilcj.v13i2.32090

in several Latin American cities). The availability of data, taking into account equity issues, strengthening communication between experts and citizens, interdisciplinary and interagency collaboration and the involvement of all key stakeholders are crucial elements in a HiAP approach to the implementation of the SDGs.

In order to have a sustainable urban mobility, it is necessary that the projects of urban spaces and circulation are increasingly safer and more humanized, with improvements focused on people and not vehicles, entering in evidence the Urban Planning of our cities. In this vision, the responsibility for safe mobility is not only the user, but also the designers, planners and operators of the road system, and this makes the improvements in mobility to be seen differently and somehow more sustainable, especially by the Public Management.

Sustainable and safe urban mobility is addressed in SDG 3 and SDG 11. Goal 3 (Health and Well-being), in its target 3.6 states that it should "ensure healthy lives and promote well-being for all at all ages". The goal for the signatory countries is to halve the global deaths and injuries from traffic accidents, one of the major problems our cities are facing, especially when it comes to urban space and circulation. SDG 11 (Sustainable Cities and Communities) aims to "make cities and human settlements inclusive, safe, resilient and sustainable". In its Target 11.2, it presents as an objective, until 2030, to enable access to safe, accessible, sustainable and affordable transport systems for all, improving urban mobility through the expansion and qualification of public transport, with special attention to the needs of the most vulnerable users of the road system such as women, children, people with disabilities and the elderly.

FINAL CONSIDERATIONS

Urban mobility refers to the way people move around cities. This includes individual transport such as cars and bicycles, collective transport such as busses, subways, and walking. In this sense, the goal of urban mobility is to provide safe, affordable and, if possible, sustainable transport options for people to move around the city. But not only, and the indicators analysed in this study point to this, urban mobility is at the heart of access to the city, in the production and reproduction of material life, but also immaterial. And an accessible, inclusive and sustainable mobility enables the social, cultural and economic development of a locality and its people.

Currently, many cities face challenges in improving urban mobility, including congestion, pollutant emissions, lack of walking and cycling infrastructure and poor-quality public transport. To address these challenges, cities are seeking innovative solutions, such as the implementation of high-capacity public transport, the use of renewable fuels, bicycle paths, shared transport, intelligent traffic systems and data-driven urban mobility solutions. The major concern of the public authorities of cities that apply these innovative solutions in the area of sustainable urban mobility has been to "(re)build cities for people and not for vehicles". It is perceived, through researched studies, that increasingly welcoming, safe and sustainable cities improve the quality of life of the people who live there.

The main objective of this study was to identify, through the bibliometric research method, the Sustainability Indicators built and/or applied in various parts of the world, as a way to monitor and evaluate public policies in the area of Urban Mobility and Transport, and be able to outline future research by establishing comparisons between the studied countries. The study aimed to

DOI 10.34624/ilcj.v13i2.32090

answer the research question: Which are the indicators for sustainable urban mobility in the light of the SDG goals?

To answer the research question, all 15 scientific articles obtained in the bibliometric search were analyzed. These articles were published between January 2016 and December 2022. As a result of this research, it was identified that the 15 papers were written by 58 authors, linked to 53 institutions from 14 different countries. When analyzing the 7 countries with the highest number of citations in the area, it can be noticed that Germany stands out with an average of 38% of total citations, a total of 53 citations, and in second place, Spain stands out with 30% of citations, thus indicating a concern of these two countries with the theme of Sustainable Urban Mobility and the SDGs.

In relation to Brazil, it is concluded that some indicators for urban mobility in light of the SDGs are: 1) Percentage of trips made by public transport, on foot or by bicycle; 2) Burden of the family budget with public transport; 3) Rate of deaths in traffic accidents per 100 thousand inhabitants; 4) Percentage of the population living close (within a radius of 1 km) to terminals and medium and high capacity transport stations (total and by income bracket); 5) Percentage of municipalities with participatory Master Plan; 6) Percentage of municipalities with Municipal Councils and sectoral Forums and percentage of municipalities that make participatory budget.

Although the study answered the research question, there are some limitations that must be considered, since the documents analyzed had as scope articles published in journals indexed to the Web of Science. Although the Web of Science is the largest database, future studies may also include additional databases, such as: Scopus, EBSCO and ProQuest. For future work, it is aimed to make a study of the metrics of the indicators used in countries of the European continent, especially Germany and Spain, since they were the countries that presented the highest number of citations.

REFERÊNCIAS

Ahmad, S., & de Oliveira, J. A. P. (2016). Determinants of urban mobility in India: Lessons for promoting sustainable and inclusive urban transportation in developing countries. *Transport Policy*, *50*, 106-114. doi: https://doi.org/10.1016/j.tranpol.2016.04.014.

Annesi, N., Battaglia, M., Gragnani, P., & Iraldo, F. (2021). Integrating the 2030 Agenda at the municipal level: Multilevel pressures and institutional shift. *Land Use Policy*, *105*, 105424. doi: https://doi.org/10.1016/j.landusepol.2021.105424.

Aquino, E. C. D., Antunes, J. L. F., & Morais Neto, O. L. D. (2020). Mortality by road traffic injuries in Brazil (2000–2016): capital cities versus non-capital cities. *Revista de saude publica*, *54*. doi: https://doi.org/10.11606/s1518-8787.2020054001703.

Barbarossa, L. (2020). The post pandemic city: Challenges and opportunities for a non-motorized urban environment. An overview of Italian cases. *Sustainability*, *12*(17), 7172.

Caroleo, B., Morelli, N., Lissandrello, E., Vesco, A., Di Dio, S., & Mauro, S. (2019). Measuring the change towards more sustainable mobility: MUV impact evaluation approach. *Systems*, *7*(2), 30. doi: https://doi.org/10.3390/systems7020030.

De Bem Machado, A., & Richter, M. F. (2020). Sustentainability in times of pandemic: (Covid-19). *RECIMA21-Revista Científica Multidisciplinar-ISSN 2675-6218*, *1*(2), 264-279. doi: https://doi.org/10.47820/recima21.v1i2.25.

DOI 10.34624/ilcj.v13i2.32090

CNODS – Comissão Nacional para os ODS (2018). "Plano de Ação 2017-2019". Retrieved 29 December from: http://www4.planalto.gov.br/ods/publicacoes/plano-de-acao-da-cnods-2017-2019/view.

EPOMM – Plataforma Europeia para Gestão da Mobilidade (2013). Mobility Management: The Smart Way to Sustainable Mobility in European Countries, Regions and Cities: European Platform on Mobility Management.

Giles-Corti, B., Lowe, M., & Arundel, J. (2020). Achieving the SDGs: Evaluating indicators to be used to benchmark and monitor progress towards creating healthy and sustainable cities. *Health Policy*, *124*(6), 581-590. doi: https://doi.org/10.1016/j.healthpol.2019.03.001.

Gülgün, B., Güney, M. A., Aktaş, E., & Yazici, K. (2014). Role of the landscape architecture in interdisciplinary planning of sustainable cities. *Journal of Environmental Protection Ecology*, *15*(4), 1877-1880.

IPEA – Instituto de Pesquisa Econômica Aplicada (2016). ODS 11 – Cidades e Comunidades sustentáveis. Disponível em: https://www.ipea.gov.br/ods/ods11.html. Acesso em 18 de ago. 2022.

IPEA – Instituto de Pesquisa Econômica Aplicada (2018). AGENDA 2030 - ODS – Metas Nacionais dos Objetivos de Desenvolvimento Sustentável. Equipe técnica de coordenação: Enid Rocha Andrade da Silva, Anna Maria Peliano e José Valente Chaves/ Brasília, 2018.

Jiménez, P., María-Dolores, D., & Beltrán, S. (2020). An integrative and sustainable workplace mobility plan: The case study of Navantia-Cartagena (Spain). *Sustainability*, *12*(24), 10301. doi: https://doi.org/10.3390/su122410301.

Koch, F., & Krellenberg, K. (2018). How to contextualize SDG 11? Looking at indicators for sustainable urban development in Germany. *ISPRS International Journal of Geo-Information*, *7*(12), 464. doi: https://doi.org/10.3390/ijgi7120464.

Kronemberger, D. M. P. (2019). Os desafios da construção dos indicadores ODS globais. *Ciência e Cultura*, *71*(1), 40-45. doi: https://dx.doi.org/10.21800/2317-66602019000100012.

Locatelli, I. P. V., Bernardinis, M. D. A. P., & do Amaral Moraes, M. (2020). An approach between public policies on urban mobility and the sustainable development goals in Curitiba-PR. *Revista de Gestão Ambiental e Sustentabilidade*, *9*(1), 1-24. doi: https://doi.org/10.5585/geas.v9i1.16850.

Moura, J. M. de, Serafini, P. G., dos Santos Nobre, A. C., Nogueira, G. M. F., de Medeiros Júnior, E. L., & de Rezende, J. F. D. (2020). Diagnóstico da adesão aos ODS no Brasil: uma análise da incorporação da Agenda 2030 nos governos estaduais e em suas capitais. XXV Congreso Internacional del CLAD sobre la Reforma del Estado y de la Administración Pública, Lisboa, Portugal, 24-27 nov. Retrieved Februray 9 from: https://www.researchgate.net/profile/Jessica-De-Moura/publication/349811489_Diagnostico_da_adesao_aos_ODS_no_Brasil_uma_analise_da_incorporacao_da_Agenda_2030_nos_governos_estaduais_e_em_suas_capitais/links/60421d0a299bf1e07857236b/Diagnostico-da-adesao-aos-ODS-no-Brasil-uma-analise-da-incorporacao-da-Agenda-2030-nos-governos-estaduais-e-em-suas-capitais.pdf

MTE - Ministerio para la transición ecológica (2019). Guía IDAE 019: PTT: Planes de Transporte Al Trabajo. Muévete Con Un Plan. Madrid. Retrieved January 11 from: https://www.idae.es/publicaciones/guia-ptt-planes-de-transporte-al-trabajo.

Neto, J. M. da R. (2021). O desafio de implementar a agenda 2030/ODS frente ao déficit de capacidades estatais dos municípios brasileiros. GT 17-práticas e estratégias de gestão ambiental, social relato técnico VIII. Encontro Brasileiro de Administração Pública, Brasília/DF, 3 a 5 de novembro. Sociedade Brasileira de Administração Pública (SBAP) Instituto Brasileiro de Ensino, Desenvolvimento e Pesquisa (IDP) Brasil. Retrieved January 14 from: https://sbap.org.br/.

Oliveira, M. C. (2018). Global Goals and Urban Development: The Territorial Effects of Implementing the MDGs In Brazil. In: *The Globalisation of Urban Governance* (pp. 173-185). Routledge.

Ramirez-Rubio, O., Daher, C., Fanjul, G., Gascon, M., Mueller, N., Pajín, L., Plasencia, A., Rojas-Rueda, D., Thondoo, M., & Nieuwenhuijsen, M. J. (2019). Urban health: an example of a “health in all policies” approach in the context of SDGs implementation. *Globalization and Health*, *15*, 1-21. doi: https://doi.org/10.1186/s12992-019-0529-z.

DOI 10.34624/ilcj.v13i2.32090

Riera, A. (2014). Políticas de transporte no brasil: a construçao da mobilidade excludente. *Administración Pública y Sociedad (APyS)*, (3), 147-a.

Sechilariu, M., Molines, N., Richard, G., Martell-Flores, H., Locment, F., & Baert, J. (2019). Electromobility framework study: infrastructure and urban planning for EV charging station empowered by PV-based microgrid. *IET Electrical Systems in Transportation*, *9*(4), 176-185. doi: https://doi.org/10.1049/iet-est.2019.0032.

Soto Canales, K., & Dávila, J. A. G. (2020). Gobernanza y movilidad urbana hacia la sustentabilidad. Comunidad educativa en Monterrey, México. *Bitácora Urbano Territorial*, *30*(3), 95-107. doi: https://doi.org/10.15446/bitacora.v30n3.80196.

Steigleder, C. N., Richter, M. F.; Holz, R. F.; Silva, J. P., & Andreazza, R. C. L. (2022). Indicadores Sustentáveis para a Mobilidade Urbana no Brasil - um estudo bibliográfico In: Cidades e Sustentabilidade. Organizadores: Celmar Corrêa de Oliveira et al. Porto Alegre: UERGS. Retrieved January 14 from: https://drive.google.com/file/d/1vE2mN_ij1NVV4GwwygaJzQ-afSsPSpWw/view.

Teklemariam, N. (2022). Sustainable Development Goals and Equity in Urban Planning: A Comparative Analysis of Chicago, São Paulo, and Delhi. *Sustainability*, *14*(20), 13227. doi: https://doi.org/10.3390/su142013227.

United Nations. General Assembly (2015). Resolution 70/1, 25 september 2015. "Transforming our World: the 2030 Agenda for Sustainable Development". Retrieved January 22 from: http://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf.

Zhu, M., Cummings, P., Zhao, S., & Rice, T. (2016). The association between graduated driver licensing laws and travel behaviors among adolescents: an analysis of US National Household Travel Surveys. *BMC Public Health*, *16*(1), 1-6. doi: https://doi.org/10.1186/s12889-016-3206-7.

Submetido em: 03 / 05 / 2023

Aprovado em: 15/07/2023

Revisões requeridas: 04/06/2023

Publicado em: 31/07/2023