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Sustainable Mobility Challenges in the Latin American Context

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Abstract: Sustainable mobility and transport are topics that have been rising exponentially since the 2000s within the academic community and society. One of the main drivers for this is the intensification of the urbanization processes on a global scale, which leads to higher demand for services and transport systems, consequently bringing more severe concern regarding social, environmental, and economic issues. However, nations do not seem to advance at the same pace regarding the proposition of policies and the implementation of strategies to promote sustainable mobility and transport. Latin American countries have long been striving to improve and implement, on a larger scale, mobility solutions toward more sustainable human agglomerations. Therefore, this article analyzes the sustainable mobility challenges in the Latin American context through a systematic literature review process. The main results show that within the Latin American context, there is a significant focus on the social inequality of mobility in urban areas, which is developed in studies through mobility indicators and modeling, participatory and other qualitative approaches, and a critical analysis of public policies. However, there is a need to explore, through alternative methodologies, such as experimental and in-situ evaluations, the paths/routes of trips within the Latin American context at different scales to promote a better understanding and strategies to advance towards more sustainable cities and mobilities and deliver a better mobility experience for citizens, adding value to the mobility itself.

Keywords: sustainable mobility; sustainable transport; Latin American context; global context

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1. Introduction

Urbanization is a global process that has been occurring for centuries. In recent decades, it has accelerated to concerning levels. According to the United Nations, the world's urban population is expected to reach 68% by 2050 [1], and processes like industrialization, globalization, and rural-to-urban migration intensified this movement. Urbanization has also driven economic growth, as cities are centers of innovation, productivity, and entrepreneurship. Urban areas account for more than 80% of global GDP [2] and are the locus of a significant portion of the world's wealth generation. Urban concentration has also led to better access to healthcare, education, and sanitation services. In cities, people have better access to medical facilities, schools, and clean water, improving health outcomes and life expectancy. Additionally, urbanization has led to the development of

roads, bridges, and public transportation systems, facilitating the movement of goods and people and contributing to economic growth.

However, it has also led to numerous challenges related to environmental degradation, social inequality, and inadequate infrastructure that have become normal in any urban society. Rapid urbanization has increased greenhouse gas emissions, air pollution, and waste production, negatively impacting the environment and public health. It has been a driving force behind environmental degradation, as cities are centers of pollution, waste production, and deforestation. They account for more than 70% of global greenhouse gas emissions and generate a significant portion of the world's waste [3].

Among these challenges, mobility and environmental degradation are essential in urban society. In the modern world, mobility can assume many different shapes and expressions. It has firmly established itself as a form of entertainment and one of the primary engines of capital reproduction for service-based economies. Tourism, which involves people traveling to locations other than their usual place of residence, typically for leisure, is an example of how large flows of people could manifest themselves in contemporary society. Another aspect is freight transport, which has grown exponentially and plays an essential role in the urban economy, especially in urban centers, where there is a high intensity of the movement of goods.

In the effort to deliver an adequate quality level of mobility and attend to market demands, people and goods must transit through congested transportation networks. In this direction, the new paradigm of capitalism that arose after the 1970s is today most exemplified by the cyclical movements of trade and services, which also serve as the significant expression of flows and networks in the movement of modern cities. Around $16.7 trillion worth of financial transactions were placed globally in 2020, an increase of more than 300% since 1996. Currently, China ($2.65 T) is the world's top exporter, while the United States ($2.24 T) is the top importer [4].

However, the current state of urban mobility has many negative impacts on the cities. As cities grow, the number of vehicles on the road increases, leading to traffic congestion, a severe problem in many cities worldwide. It has serious negative impacts on the environment, public health, air pollution, noise pollution, and more. The effects of these acts have led to environmental deterioration and a decline in living standards in surrounding cities and towns. Planners, legislators, and other stakeholders have realized that reducing automotive traffic is vital to preserving the environment and quality of life. Today, it is possible to observe an increasing effort to implement sustainable mobility and transport strategies in some way to solve these problems, which may include green infrastructure building, renewable energy use, and, finally, actions to promote non-motorized mobility, such as parking restrictions, car use fees, and car-free zones in central areas.

In this direction, this article analyzes the challenges for sustainable mobility in the Latin American context through a systematic literature review process. However, it is important to highlight that this paper focuses on the challenges related to the mobility of people instead of freight. On a global scale, it is possible to evidence the concerns about the impact of mobility on the sustainability of nations through the existence, for example, of the Sustainable Development Goals of the United Nations. The United Nations has recognized, even if in a modest grade, the importance of sustainable urban mobility and has included it as a target in some of the Sustainable Development Goals (SDGs), including SDG 11, which aims to make cities and human settlements more inclusive, safe, resilient, and sustainable, and SDG 3, which recognizes its importance for public health while ensuring healthy lives and well-being for people of all ages.

This study aims to identify similarities and differences in terms of the development of sustainable mobility and transport studies between a global context and a Latin American context. This analysis is expected to offer insights into how Latin American studies have evolved and what paths could be explored to advance toward more sustainable mobility. As a practical implication, this article delivers a review of what has been done and new paths

that could be taken in future studies regarding the Latin American context, emphasizing the methodological and case study approaches.

According to Moscoso et al. [5], within the Latin American context, the emerging issues related to sustainable mobility and transport are equity, climate change, and health concerns. Moreover, the authors highlight that beyond the high levels of urbanization, it is the most unequal region in the world, from a social and transport infrastructure perspective, leading to significant levels of motorized mobility with a critical impact on congestion and air pollution, within a context in which the vulnerable population is socially and economically conditioned to public and active mobility.

Sustainable mobility has become a concept that addresses all of these issues by promoting environmentally friendly, socially equitable, and economically viable transportation. It involves a shift towards more sustainable modes of transportation, such as innovative public transit systems, electric vehicles, cycling, and walking, and the development of infrastructure supporting them. According to Banister [6], sustainable mobility relates to the effort to strengthen the link between land use and transport, aiming to reduce average trip distances adequate to walking and cycling and prioritizing the promotion of public transport to minimize the use of private vehicles (such as cars or motorcycles). In addition, the author points out that sustainable mobility is achieved through strategies that give people the choice between non-motorized mobility and public transport, without prohibitive policies related to car use and without decreasing the quality of the mobility experience.

Policies and practices that promote sustainable mobility are priorities for the future transformation of urban areas. The relationship between sustainable mobility and inhabitants' quality of life in large cities and urban agglomerations has been a leading research subject. It is about reducing the negative impacts of transportation, improving accessibility, and providing high-quality transportation through and within urban areas. However, to achieve it, one must consider the needs of all members of society, mainly those whose transportation systems have traditionally underserved their citizens. For this reason, it is essential to evaluate the research advancements within the Latin American context, composed of countries still struggling to implement mobility policies aligned with the SDGs.

Besides Section 1, this article is divided into five sections: Section 2 is dedicated to presenting previous reviews on the topic of sustainable mobility/transport and argues the importance of this article by differentiating this article from other reviews; Section 3 focuses on describing methods and materials used to perform the systematic literature review proposed; Section 4 develops the proposed methods with its respective analysis; Section 5 discusses the challenges for sustainable mobility in the Latin American context; and the last section is the presentation of conclusions and final considerations.

2. Previous Focus of Reviews on Sustainable Mobility

Before getting into the specifics of this paper, it is relevant to identify and understand previous review papers surrounding the topic of sustainable mobility and transport, with special attention to methodological aspects, in order to justify the methodological and conceptual frameworks of this study. This understanding sets this paper apart from others in terms of methodological approach and general results/conclusions. Using the following search criteria in the Web of Science database (search date: 4 July 2021), 31 review papers were found: title: ("sustainable mobility") or title: ("sustainable transport"); languages: (English); document types: (review); timespan: all years; and indexes: SCI-EXPANDED, SSCI, A&HCI, ESCI. However, of these 31, 5 are closely related to a general view of sustainable mobility or transport [7–11].

Cohen et al. [7] point out reasons for the lack of action regarding sustainable mobility, although there is existing evidence that tourism transport has a growing environmental impact. The key topics discussed in this paper are based on several findings presented at the Freiburg 2014 workshop: socio-technical factors; technology myths; and transport taboos. These topics are deepened by Cohen et al. [7], without a specific procedure for selecting references.

Dehghanmongabadi & Hoşkara [8] aims to point out critical determinative variables to promote active transportation modes and consequently contribute to sustainable mobility in communities. Using as key search terms "sustainable transportation", "sustainable mobility", and "active transportation", this review searched journal articles (SCI and SSCI), books, published conference papers, reports, and published research works. Based on the focus of the found material, the authors selected 40 papers to review, resulting in the recommendation of key variables to promote active mobility.

Holden et al. [9] develop a conceptual review of sustainable mobility through an extensive literature review. This review does not establish explicit criteria for selecting literature. However, it is guided by three key elements: strategies, responsible agents, and how sustainable mobility can be achieved. It is relevant to point out that the crossing of these elements in this study aims to identify contemporary interest regarding sustainable mobility. For example, Holden et al. [9], within the identified strategies, present the reduction strategies from the expert approach, which refers to the planning of compact cities with short distances of trips, under the perspective of developing a high-density built environment and mixed land use, with a focus on promoting higher use of public transport and active mobility.

Lanzini & Stocchetti [10] focus on identifying the principles' evolution for sustainable urban mobility between 1996 and 2018, with particular attention to planning and management. For this review, the authors considered journal articles and proceedings in the Web of Science and Scopus databases from 1996 to 2018. The searched terms by Lanzini & Stocchetti [10] were "urban mobility" and "urban transport". Additionally, this review focused on articles within the socio-economic areas, defined by the database of Web of Science and Scopus, such as management, business, economics, urban studies, public administration, and related disciplines. In other words, articles outside socio-economic areas were excluded. Furthermore, the authors focused on universally applicable articles that, according to the authors, refer to empirical studies with broadly applicable results and methods, which led to a manual process of excluding articles through the reading of the titles and abstracts, which brought the number of findings from 2691 to 237 articles, which were actually reviewed for the proposed purpose.

Zhao et al. [11] apply science mapping, with the support of CiteSpace software (version 6), to identify the research trends of sustainable transport studies between 2000 and 2019. This review gathered the documents to be analyzed from the Web of Science core collection database, using the following search terms in the title of the papers: "sustainable transport"; "sustainable transportation"; "green transport"; and "green transportation". It is relevant to highlight that Zhao et al. [11] excluded from the analysis all research that did not fall into the following research areas: engineering; building and construction; architecture; and sustainability. This study focused on statistical and graphical analysis of keyword co-occurrence analysis and document co-citation analysis without an in-depth analysis of the content of the papers because the authors analyzed the following information: authors, affiliations, and country/region; title; abstract; keywords; year of publication; source journal, and references.

To conclude, it is possible to observe that this present article seeks to fill a gap related to mapping and understanding the development of case studies within the Latin American context regarding sustainable mobility and transport and the differences in comparison to the global context on the topic. Moreover, focusing on the application of these perspectives on countries in these regions and seeking to identify the focus of studies in terms of their methodologies and general conclusions, which yet have not been explored from the proposed approach, is explained in detail in the following section.

3. Materials and Methods

3.1. Data Collection

This study used the Web of Science Core Collection (WoSCC) from Clarivate to collect publications' data. The date of search and retrieval of documents for the review was 4 July 2021. The search criteria were as follows:

- TITLE: ("sustainable mobility") OR TITLE: ("sustainable transport");
- Languages: (ENGLISH);
- Document types: (ARTICLE);
- Timespan: All years;
- Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCI.

Through pointed-out search criteria and considering the search date, 444 articles were found, of which 24 originate from Latin American countries, which means that at least one of the authors/co-authors of these is from this region. Searching the terms in titles is to ensure that all documents found deal with the reviewed topic. However, it is understood that other articles may develop studies on sustainable mobility and transport without explicitly using these terms in the title. On the other hand, there may be the use of these terms in studies that do not necessarily focus on the mobility of people, which is the focus of this review. For this reason, the used search terms and criteria are adequate to understand the evolution of this topic under a general view and how it has been dealt with in the Latin American context.

This section is divided into subheadings that provide a concise and precise description of the experimental results, their interpretation, and the experimental conclusions that can be drawn.

3.2. Analysis Methods

This study uses a combination of techniques to undertake the proposed review. Firstly, there is a stage of bibliometric analysis, using the data downloaded from the "analyze results" tool of the Web of Science database search system for statistical analysis of the search results (looking at publication years and countries) and undertaking a keyword co-occurrence analysis with the support of the VOSviewer software (version 1.6). Given that the approach is based on bibliometric analysis with the support of the VOSViewer open software [12], it is important to understand its applicability. This software was developed to enhance the graphical representation of large amounts of bibliometrically classified data. It has been used in other studies, such as Oliveira et al. [13] and Corrêa et al. [14], and based on them, this paper adopts similar procedures, implementing minor changes to guarantee the replicability of the methods. Among mobility-related research, we can also find similar and recent uses of the proposed procedure in Ao et al. [15] and Alidadi and Sharifi [16], however, without the in-depth analysis of papers. The use of these tools for bibliometric analysis may become more and more popular in systematic literature review papers since the amount of data can exceed the human capacity to analyze it in a limited period of time. The keyword co-occurrence analysis applied here is divided into four periods based on important global events. Each previous comment analysis allows an understanding of the publications' characteristics and the evolution of research topics.

The first period for the keyword co-occurrence analysis considers all articles until 2001, recognizing that the 1990s was important in terms of climate awareness with important events, such as the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. The second period analyzes articles published from 2002 to 2014, considering the importance of the UN's Millennium Development Goals (MDGs), which were to be achieved by 2015. Within the MDGs, there were eight goals, one of which regarded environmental sustainability. The third period of analysis was from 2015 to 2019, considering the emergence of the Sustainable Development Goals in 2015 by the UN, which expanded the 8 goals of the MDGs to 17 goals, most of them to be achieved by 2030 by the countries that seek to commit to these goals. The last period of analysis considers the years 2020 and 2021, because of the global pandemic.

Finally, we present the keyword co-occurrence map from the Latin American papers from all time, but with a filter that brings only the keywords that appear more than once to subsidize the comparison between this area and the rest of the world regarding sustainable mobility/transport research.

The next step is to undertake a co-citation and cluster analysis by authors with all articles (with the support of VOSviewer software) to identify the clusters and the main authors by clusters of co-citation. Within the found documents, the top two authors of each cluster are selected for in-depth analysis and will represent the review's general perspective. If an author is within the top two most cited articles in a cluster but is not within the articles, then the following most cited is selected. Moreover, it goes like this until the top cited authors of each cluster within the found documents are identified and selected, considering any position they may have in the order of authors, meaning that they can be authors or co-authors.

On the other hand, all articles originating from Latin America are selected to represent the in-depth analysis from this part of the globe. The articles selected will be downloaded in full version, and the sections that are equivalent to materials and methods and the conclusion of the articles will be extracted. Following this step is the in-depth analysis stage after this data screening and organization stage. The articles that originated from authors from Latin America that do not apply a case study or do not discuss the Latin American context will be excluded from the analysis representing this group.

The in-depth analysis involves reading and identifying key elements and information from the selected papers, with special attention to methodological aspects, case studies, and general conclusions. It is important to highlight that the analysis at this stage focuses on comparing the general and Latin American context. Finally, there is a general discussion about all the achieved results and analysis, emphasizing the barriers and opportunities for sustainable mobility studies in Latin America. Figure 1 gives an overview of the steps taken for this research.

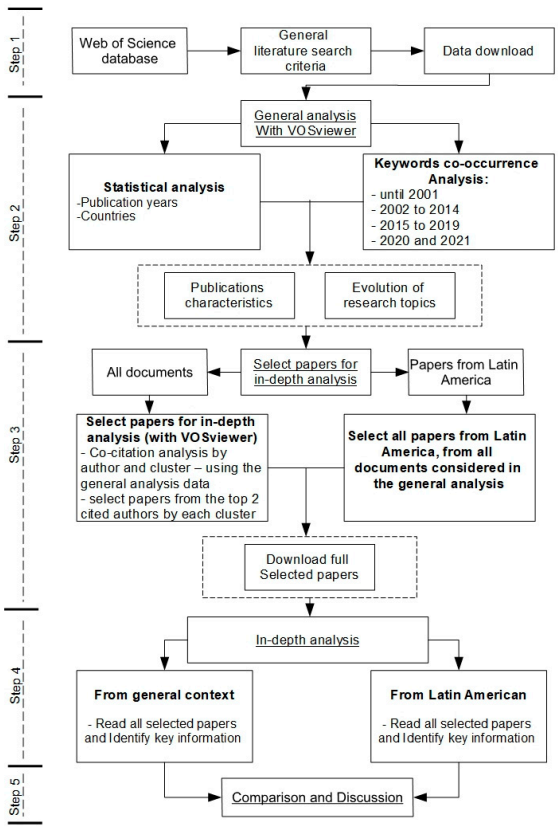

Figure 1. Outline research design.

4. Results

In this section, we conduct a quantitative analysis of the aggregated metrics of the 444 articles, including publications by year, WOS category distribution, percentage of papers published per journal, and percentage of papers published per country/region.

4.1. Publications' Characteristics

When observing the share of publications by year (Figure 2), it is possible to realize the growing importance of the theme, with a period of slight growth between 1994 and 2007, and after 2007 a considerable increase in the volume of publications. After 2013, the volume reached 20 publications per year and never returned to this line. Additionally, 2019 was the year with the highest number of publications, surpassing the mark of 50 publications. More than observing the higher peak of publication, it is significant to observe cyclical publication patterns with a general growth over the years, which could relate to the neo-Schumpeterian economic theory [17]. Therefore, it is possible to notice moments of peak, downfall, and growth, which can be related to the evolution of global concerns related to environmental, economic, and social development issues. In the 90s, there was growing discussion about the environmental impact of industrialization and urbanization, while between 2001 and 2014, there was the proposal of MDGs with an environmental, social, and health focus. In 2015, the United Nations presented the SDGs, increasing the dimension of sustainable development concerns, including a higher diversity of goals. In addition, the downfall of data in 2020 is possibly due to the emergence of the COVID-19 pandemic, shifting slightly the focus of academics' concerns.

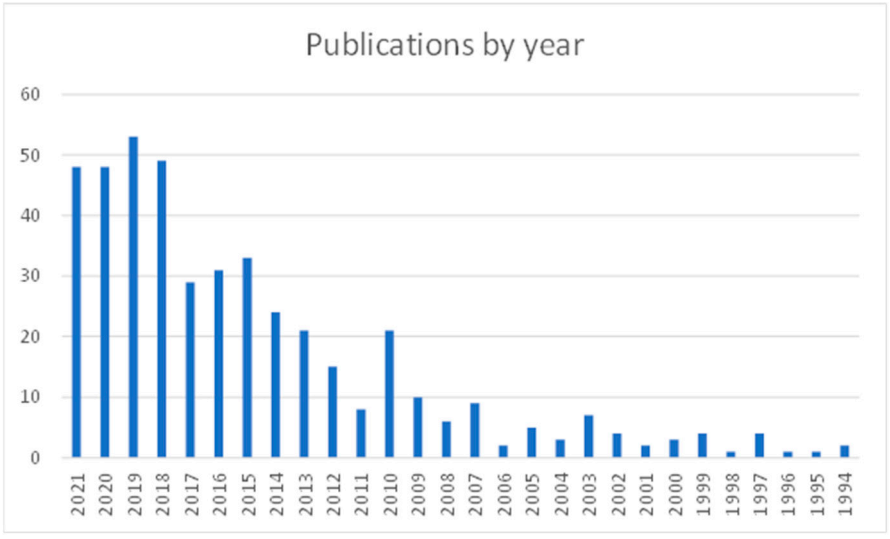

Figure 2. Publications by year.

When looking at the distribution of papers published by country (Figure 3), England and the USA are the leaders, gathering more than a quarter of all the publications. This could be attributed to the search criteria that filter only English-language papers. Among the next five, Sweden and Denmark, both Scandinavian countries, hold more than 15% of the publications together, demonstrating the historical concern of the region with the theme since the Conference of Stockholm in 1978. In the third and fourth positions, we can see Italy and Germany, both countries with solid automobile industries, followed by Spain, one of the countries most affected by climate change because of its Mediterranean climate.

We should highlight the position of China between the eight first positions, the most populated country in the world, and where industrialization and motorization have grown the fastest, at least for a decade, and that demonstrates an increasing concern over the sustainable transport issue.

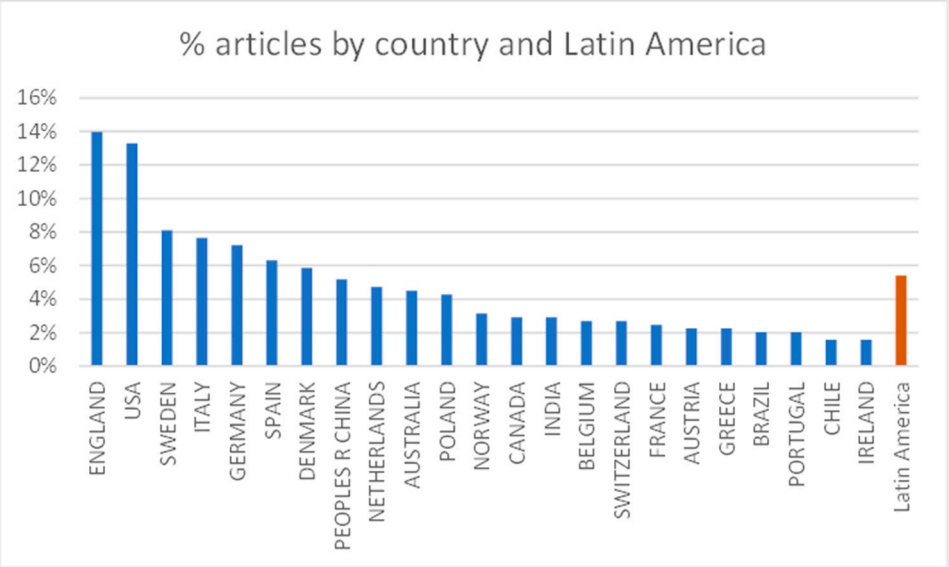

Figure 3. Percentage of papers published by country and Latin America.

Among the Latin Americans, Brazil and Chile are better positioned, with a 2% share of publications each. When aggregating all the countries from Latin America, the number reaches 5%, surpassing China and just behind Denmark. This could be partly explained by the effects of deglaciation in Scandinavia that make the impacts of climate change more visible, as well as the very high sociodemographic conditions in these countries that are much less concerned with social and urban inequalities.

4.2. Evolution of Research Topics

This section presents the results obtained using the VOSviewer software for the keyword co-occurrence data, separated by the predefined analysis periods.

In the first period, which goes until 2001 (Figure 4), we can see a significant co-occurrence of keywords related to "climate change"/"global warming" issues, as well as other environment threads related to transport such as "air pollution", "urban area pollution", and "health problems". "Environment protection" and "environment classification" suggest the path of action chosen by the authors in this period. Finally, it is relevant to highlight that the "sustainable transport system" at this stage shows a stronger relationship with "air pollution", "environmental classification", "urban area pollution", "climate change", "global warming" and "health problems".

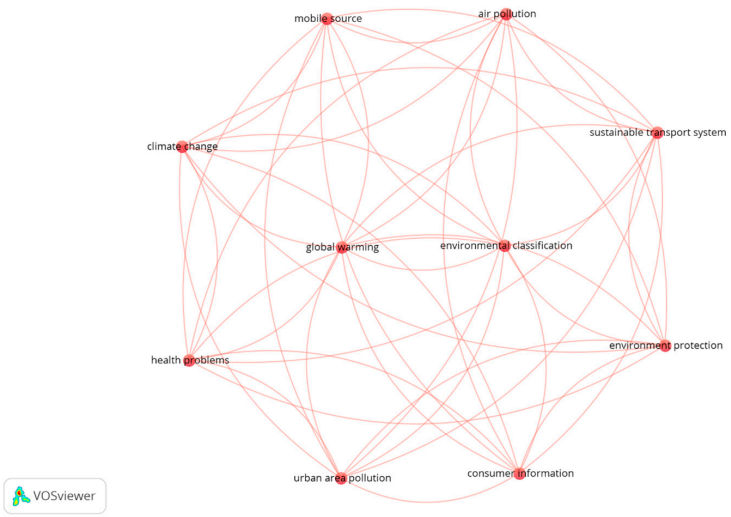

Figure 4. Co-occurrence of keywords of papers until 2001.

In the second period, which goes from 2002 to 2014 (Figure 5), the climate change/global warming issues are maintained, with the prevalence of the keyword "policy" related to "transport" and "emissions". In the green cluster, we can see a prevalence of energy issues, represented by the keywords "performance", "energy", "fuel", "systems" and "information", revealing concern over the necessity of better tools to improve performance and reduce energy waste. In the yellow and blue clusters, we can see the appearance of keywords that suggest more subject factors, such as "travel behavior", "behavior" and "attitudes" related to "transport policy" and "sustainability". The word "sustainability" is presented here no longer conjugated with other words, maybe suggesting a strengthening of the concept, mainly related to transport policies from a holistic perspective and issues related to other clusters, such as "climate change", "consumption" and "performance".

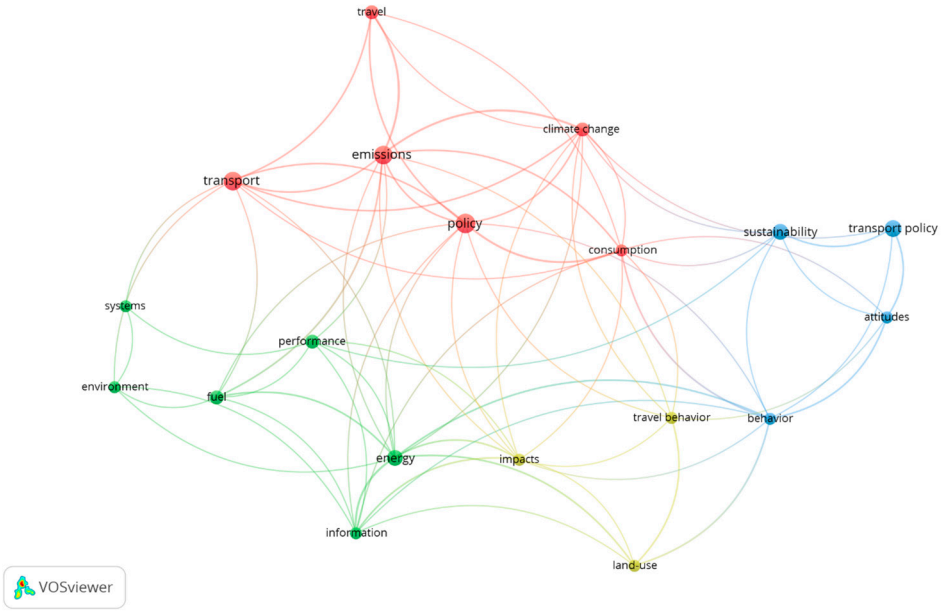

Figure 5. Co-occurrence of keywords of papers from 2002 to 2014.

In the 2015–2019 period (Figure 6), we notice a profusion of articles, demonstrating the rising importance of "sustainable transport" research. "Sustainability" and "transport" are sovereign in this chart, followed by "policy"/"policies", "cities", "transport" and the word "mobility", which appears here for the first time. We can also see the emergence of the words "governance", "planning" and "participation" in the green cluster, while the blue cluster presents the keywords "management", "transport planning" and "planning" alone. However, in the blue cluster, the words "system", "indicators", "framework", and "decision-making" suggest a path of action in this period. The purple cluster presents concerns over "car use" and the modal choice, regarding active and public modes of transport, represented by the words "cycling", "walking", "choice", "habit", "physical activity" and "planned behavior". The transition from purple to yellow cluster follows the issues of "travel behavior", "mode choice", "travel" and "car", changing gradually to spatial factors such as "land use" and "built environment", and socioeconomic factors such as "consumption" and "demand". The red cluster brings the words "determinants", "adoption", "model" and "design" which can also suggest a path of action, while "China", "emissions", and "electric vehicles" suggest new concerns over the transport pollution subject.

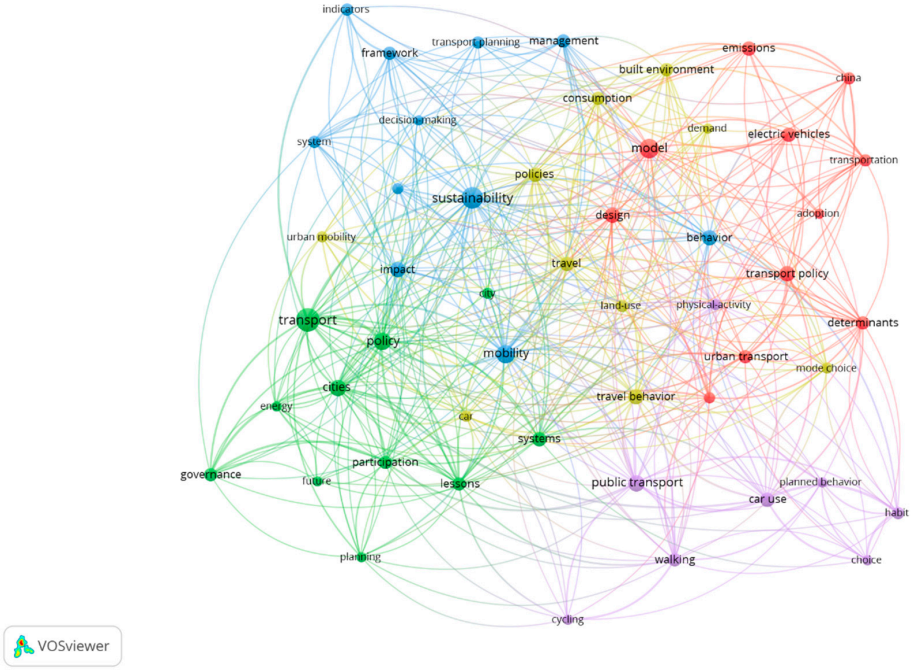

Figure 6. Co-occurrence of keywords of papers from 2015 to 2019.

In the last period, from 2020 to 2021 (Figure 7), we see the centrality of "sustainability" and "transport", followed by "mobility" and the composite keyword "sustainable urban mobility", which conjugates important previous ones. Notwithstanding, the word "COVID-19" appears in the red cluster and "innovation", which could suggest the growing concern over a paradigm-breaking necessity preceded by the pandemic. In the blue cluster, "urban transport", "accessibility", "framework" and "city" are relevant. In contrast, in the green cluster, we can see the prevalence of transport behavior-related words, such as "cycling", "impact", and "behavior" and transport planning issues, such as "public transport", and "infrastructure".

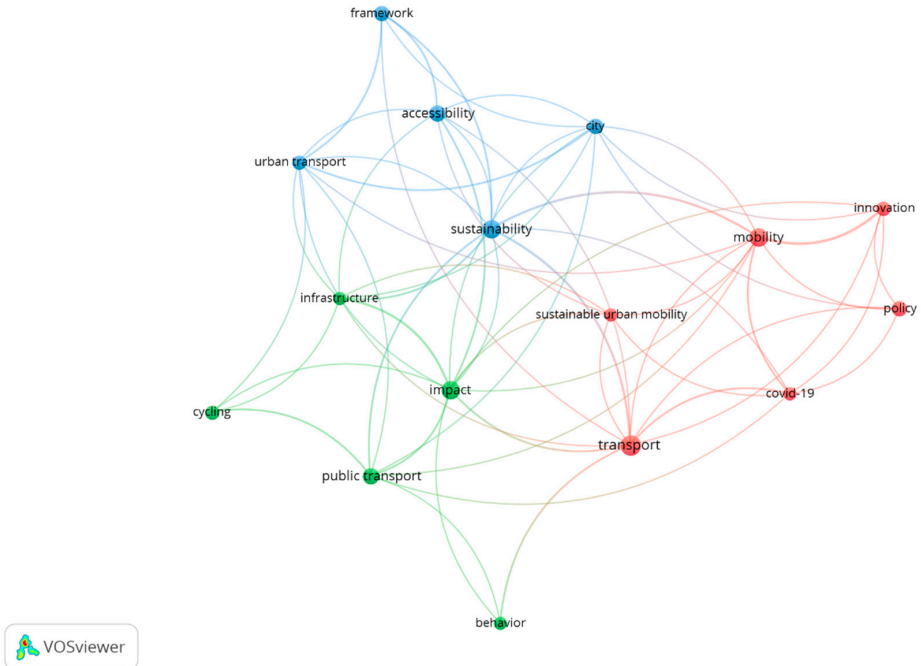

Figure 7. Co-occurrence of keywords of papers from 2020 to 2021.

Figure 8 presents the co-occurrence of keywords from the selected papers from Latin America regarding all time. Here, we can outline the keywords "sustainability", "participation", "transport", and "public transport" as the major ones. The conjugated keywords "sustainable transport" and "sustainable mobility" also play an essential role in their clusters. Regarding public transport, "cycling" appears sovereign as the unique modal mentioned. Therefore, other words are presented here that we do not see in the general charts: "developing countries", "santiago", "curitiba", which represent the case studies undertaken; but also "social exclusion", "work", and "intervention", that are main issues in Latin America transport landscape. Other words that have recurrence here are: "system", "framework", "cities", "urban transport", "congestion", and "emissions". It is interesting to notice that the word "politics" differs from the previous "policy" or "policies", which can suggest the complexity of the political environment in Latin America, which is certainly a challenge in all the papers analyzed. It is interesting to observe that participation is a key term that connects all clusters, with strong links, for example, to "public transport", "planning", "sustainability", "governance", "developing countries". It could be seen as a precondition to developing, for example, better planning and public transport with more public acceptability, leading to sustainable mobility, closer to the definition of Banister [6].

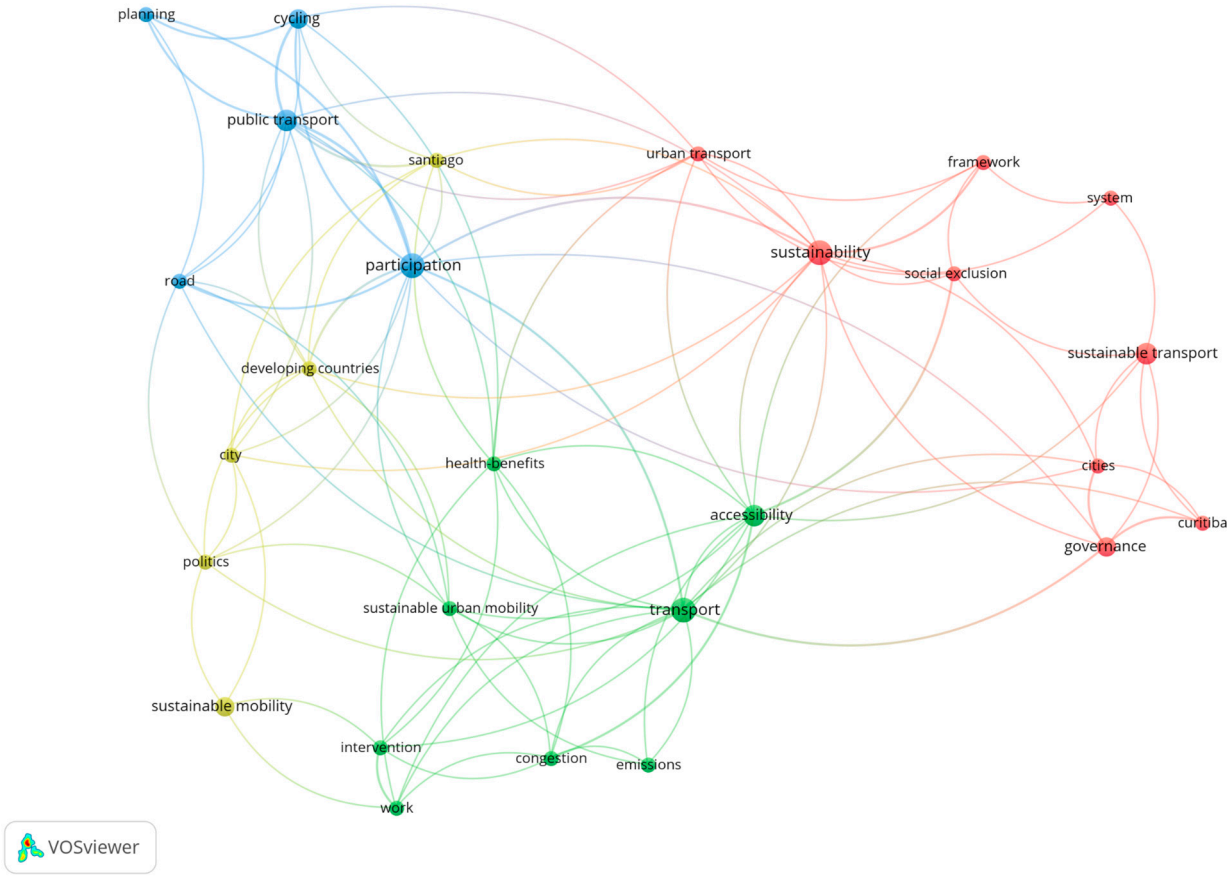

Figure 8. Co-occurrence of keywords of papers from Latin America all-time.

4.3. In-Depth Analysis of Selected Papers

In the following section, we show the results of the paper selection procedure and the in-depth analysis of papers that will be performed both for the general and Latin American literature contexts, aiming to identify, mainly, focus, methodological aspects, and general conclusions.

4.3.1. Papers' Selection

Figure 9, produced with the VOSviewer software with citation data from all 444 articles, shows that Banister is the author with a more robust connection among the conjunct. It demonstrates the global reach of their publications. Although the second-most cited author, Litman, has a stronger connection with the blue and purple clusters and weaker with the green and yellow ones. Pucher is the third most cited. Although Pucher has no strong links with red and blue clusters, this author was selected in the yellow cluster for the in-depth review, and so was Litman for the red cluster and Buehler for the same yellow cluster.

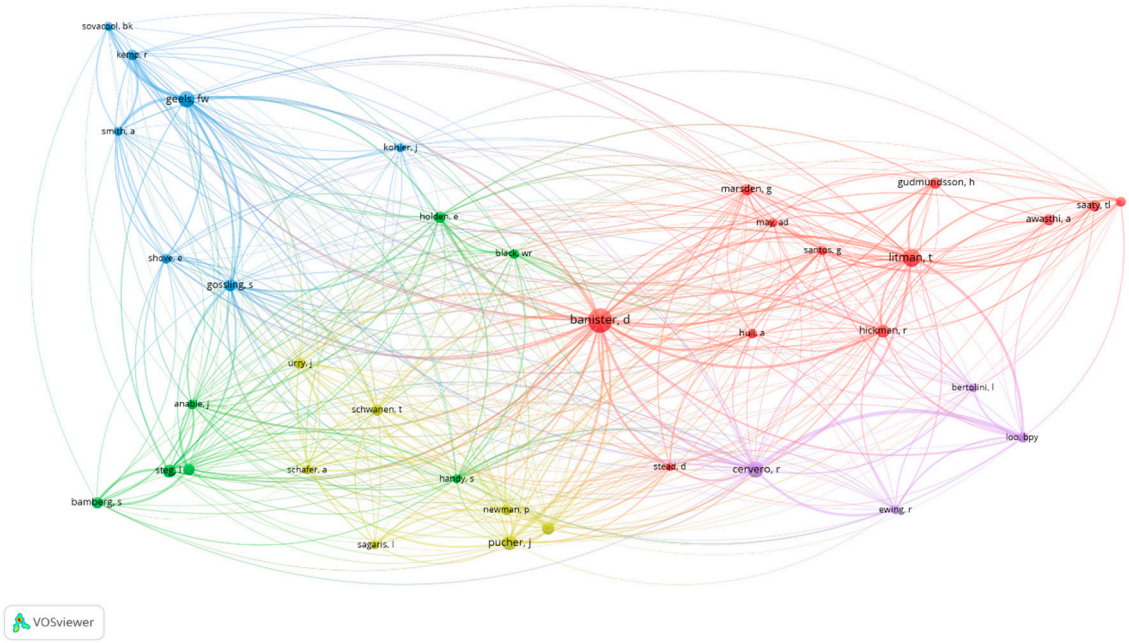

Figure 9. Co-citation analysis by author and cluster Map.

We can perceive that the co-citation and cluster analysis privileged authors with stronger connections with the most cited in different clusters, even if they are not the most cited in their clusters. This is particularly clear when we analyze the case of Cervero and Geels, who were not selected for the in-depth review despite having strong connections and appearing big on the map. Among the Blue clusters, Gossling and Smith were selected. Although Smith and Sovacool have the same number of citations, Smith has stronger links with Gossling, Steg, and Holden (the most cited within the green cluster), which was the selection criteria.

Completing the selection, the most cited and selected author in the purple cluster was the female geographer, Becky Loo. A highlight should be made to the presence of Lake Sagaris in the leading network of shared connections, the only Latin American author in this group.

Table 1 shows descriptive information from the co-citation analysis, which, as described in the Section 3, was used to select authors and their articles to perform in-depth analysis from a general perspective. For the Latin American context, it is important to emphasize that all papers were selected, considering the filters explained in Section 3.

Table 1. Result of co-citation analysis by author and cluster for in-depth review.

Author	In-Depth Review Selection Situation	Citations	Total Link Strength	Cluster	Number of Articles in the List
Banister, D	selected	149	871	1 (red)	5
Litman, T	selected	84	476		1
Hickman, R	discarded	43	217		1
Gudmundsson, H	discarded	36	145		5
Awasthi, A	discarded	34	68		3
Hull, A	discarded	27	120		1
Macharis, C	discarded	24	102		3
Stead, D	discarded	23	131		1
Steg, L	selected	45	262	2 (green)	1
Holden, E	selected	32	317		2
Black, Wr	discarded	24	188		1
Gossling, S	selected	40	329	3 (blue)	4
Smith, A	selected	21	183		1
Sovacool, Bk	discarded	21	166		4
Pucher, J	selected	57	321	4 (yellow)	2
Buehler, R	selected	37	235		4
Schwanen, T	discarded	32	205		1
Newman, P	discarded	30	190		1
Sagaris, L	discarded	23	88		5
Loo, Bpy	selected	29	335	5 (purple)	3

In the following subsection, we perform an in-depth analysis and review of the selected articles.

4.3.2. General Context (GC)

Steg and Tertoolen [18] evaluate strategies for changing social behavior concerning the daily mobility choices of citizens and reducing car use. This article highlights the behavioral factors that explain the use of cars, which can be divided into three categories [18]: (1) available infrastructure, location of places of interest (such as job location, place of residence, etc.), and quality of public transport; (2) resources people have, such as money, time, and knowledge; and (3) motivational factors that can be physical, psychological, or other personal reasons. In order to motivate car users to shift to more sustainable modes of transport, Steg and Tertoolen [18] identify six strategies. The first involves physical and geographical changes in the possibilities of routes and directions regarding the use of cars to favor other modes to get to specific locations. The second strategy is related to technological innovations in order to reduce emissions from cars. However, the authors point out that this may have a marginal effect on the environment if car use keeps growing. The third one involves legal regulation accompanied by enforcement measures, meaning that violations regarding the use of cars could be punishable through fines, for example. The fourth strategy regards actions that offer the population financial and/or social payoffs for using more sustainable modes. The fifth strategy is related to increasing people's knowledge and awareness regarding sustainable mobility and its impact on society and the environment. The last strategy presented concerns social modeling and support, which relies on observing and understanding how behavior is related to certain social conditions that could be changed, such as norms and customs.

Litman [19] discusses and recommends a set of indicators that can support sustainable transport planning. The presented indicators are divided into three dimensions (economic, social, and environmental) and identify those that are considered most important (that should usually be used). Some of the most important indicators for the economic dimension are per capita mobility, model split, average commute travel time, and per capita congestion costs. In the social dimension, there are per capita traffic crashes and fatalities, affordability,

and overall satisfaction with transport systems. For the environmental dimension, the most important indicators are per capita energy consumption by mode of transport, per capita air pollution emissions by mode, and per capita land devoted to transport facilities.

Banister [20] highlights that transport decarbonization measures such as the implementation of new technologies, regulation, taxation, congestion charging, land use, development, and planning for sustainable transport should be implemented accompanied by strategies to gain public acceptability. In addition, it is argued that there is a need to implement a more participatory planning process to encourage higher commitment from all stakeholders to promote sustainable mobility.

Buehler [21] investigates influencing factors for individual car use through multivariate analysis and comparing Germany and the United States of America (USA). The highlighted influencing factor of the study is price. In the USA, the cost of driving a car can be more influential in choosing one than in Germany [21]. However, it is important to point out that this study indicated other factors influencing car travel in both countries, such as land use, and socioeconomic and demographic characteristics.

Buehler & Pucher [22] identify urban mobility policies that can promote sustainable mobility applied to the city of Freiburg, in Germany, that could be useful in other car-oriented countries. It is highlighted that, in the case of Freiburg, the integrated transport and land-use planning strategies that started in the 1970s and were improved in the years to come, which involved bettering the public transport, non-motorized transport systems, and infrastructure, and the conditions for multimodal mobility in a coherent way with the land-use distribution of the city.

Holden & Linnerud [23] investigate the effect of energy and CO_2 emissions policies on leisure travel. The policies evaluated are related to the development of compact cities, environmental awareness and attitudes, and the promotion of information and communication technologies (ICT). This topic arises in the context of the increasing use of private transportation for leisure travel and concerns the growth of environmental impacts related to leisure activities. It is pointed out that the compact cities approach may be questionable because traveling more or less can be related more to preference and behavioral issues than closeness to city centers, especially when regarding leisure trips, which may contradict the expectation of reducing CO_2 emissions even in a compact city environment. Additionally, the authors highlight cases where sustainable mobility promoted by awareness is applied to a specific type of trip, such as for work purposes. In contrast, other trips are maintained as non-sustainable, which is a challenge for awareness policies. At last, it is evidenced that promoting ICT reduces everyday travel but increases leisure travel [23].

With an environmental focus, Loo & Linna [24] identify the evolution in time and space of CO_2 emissions from passenger transport in China with distance and fuel-based methods. This study shows that road transport is the leading source of passenger transport carbon dioxide emissions in China, with the period 1980–2009 presenting a higher intensity of emissions growth due to the increasing use of private transportation and higher modal shift.

Hickman et al. [25] investigate the impact of urban and transport planning on sustainable mobility, emphasizing carbon dioxide emissions by the transport sector, through the examination of London and Oxfordshire in the UK. They evaluate four urban and transport planning scenarios based on the CO_2 emission of the studied areas. They conclude that all the scenarios may reduce emissions, but there are limitations to some strategies that may be better because of reduced funding and the implementation of practical solutions [25].

Based on a review of the papers presented at the Freiburg 2012 workshop, Highham et al. [26] seek to identify psychological and social factors that contribute to or can be barriers to sustainable tourist mobility. Through the review, the authors identify relevant issues, such as the little impact of climate change awareness on tourism consumption and that tourist travel decisions are strongly related to subjective factors, such as emotions, identity, time, and happiness, beyond others.

Through two case studies, Buehler et al. [27] seek to compare two best-practice examples, one in the USA (Washington, DC, USA) and another in Germany (Stuttgart, Germany), to demonstrate differences and similarities in terms of promoting sustainable transport. Firstly, the main difference is related to the transport planning approach from a historical perspective. While in Germany, since the 1970s, all levels of government have sought to implement policies to reduce the use of private vehicles and, at the same time, promote walking, cycling, and the use of public transport, in the USA, transport policies have given priority to private transport [27]. Secondly, as similarities, it was able to identify strategies that promoted an increase in sustainable transport patterns, such as mixed-use development around public transport stations, comprehensive long-term plans, higher participation in the planning process, and coordinated transport, housing, and economic development policies [27].

Based on an extensive review, Gössling & Cohen [28] address transport taboos that may be an obstacle to sustainable transport policies' success, with particular attention to the European Union climate policy. The identified transport taboos that challenge these policies are the highly unequal individual contribution to transport volumes and emissions, the social inequality of planned market-based measures, the role of lobbyism, and the various social and psychological functions of mobility [28].

Under the argument that space distribution is of key relevance for the sustainability of city transport systems, Gössling et al. [29] evaluate the relationship between space allocation for different transport modes and sustainable transport in Freiburg, Germany. In this study, it was found that in three of the four cities' quarters evaluated, most of the urban transport space is allocated to motorized individual transport, for roads and parking, although there is a high demand for bicycle lanes due to its elevated usage in Freiburg [29].

Using Hong Kong as a case study, Loo and du Verle [30] discuss the role of transit-oriented development (TOD) in contributing to sustainable mobility. In this study, it was discovered five types of TOD neighborhoods. This study finds that TOD areas tend to attract more people to use public transport and non-motorized modes, however, the authors also point out that there are still challenges to making a large-scale public acceptance of sustainable mobility. If this acceptance does not increase, strategies and policies for sustainable mobility will still tend to fail [30].

Buehler et al. [31] identify the most relevant strategies to promote sustainable mobility in Vienna, Austria, through 32 interviews with politicians, transport planners, and academics. As the most relevant strategies for the case of Vienna, they pointed out the expansion of the metro system car use restrictions and parking management strategies [31].

Banister [32] evaluates UK transport policy from 2010 to 2015, specifically looking at high speed in 2 cases and how it impacts the development of sustainable transport and identifying narratives that justify high investments in this project in the face of an inexistent national sustainable transport strategy (NSTS). In essence, the author perceives contradictions in the narrative, such as the high energy consumed for transport systems with higher speed, the increase in capacity to reach the demand of specific locations, limitations of connectivity to the train stations that are distant from one another, difficulty on measuring the economic benefits and at last the difficulty of improving the image of a rail network already perceived as out-of-date, crowded and unreliable [32].

From a different perspective, Hanna et al. [33] developed an extensive and critical review of role model advocacy and celebrity activism to promote environmental awareness and behavior. In particular, they are looking at the potential of applying these techniques to promote sustainable transport [33]. This study argues that there have been successful cases, for example, with celebrities endorsing ethical and green consumption [33].

Loo and Tsoi [34] develop an in-depth discussion supported by empirical evidence about the "Five Transformations" trategy and its potential for promoting sustainable transport from a more holistic perspective. These five transformations involve city, economic, vehicle, modal-split, and lifestyle transformations [34]. The city transformation relates to strategies that involve building a transit-oriented development through land-use mix

planning in harmony with transport planning. The economic transformation involves incrementing industries with high-added value and improving freight transport network distribution and urban logistics. Vehicle transformation relates to developing and using new and more efficient transport technologies in terms of the potential impact on the environment and fuel consumption. The modal-split strategy focuses on promoting public transport and non-motorized mobility to reduce the negative impacts of extensive automobile use. The lifestyle strategy deals with changing behavior towards a more sustainable mobility pattern. For Loo and Tsoi [34], understanding the practical applications of these strategies may support the generation of more holistic policies toward promoting and increasing sustainable mobility patterns in urban areas.

Based on a case study, Smith et al. [35] analyze the implementation of sustainable travel strategies in a rural tourism context through visitor surveys, interviews, and observations, with particular attention to the New Forest National Park in the UK. This study identifies that the implemented strategies meet the needs of some visitors because there is still a lack of understanding of the visitors' practices in rural tourism [35].

Through a literature review, Holden et al. [36] seek to understand the evolution of the concept of sustainable mobility under six dimensions: research and policy, transport impacts and categories, scientific disciplines, methodological approach, and research questions. The results show that there are four generations of studies [36]: (1) techno-centric and environmental perspective, from 1992 to 1993; (2) increasing concern with the quality of life and integration of a sociological perspective, from 1993 to 2000; (3) increasing concerns with equity, accessibility, economic impacts with more qualitative approaches, from 2000 to 2010; (4) studies with an integrative view of sustainable mobility looking at all its dimensions and concerns with decarbonization and innovation, from 2010 to 2018.

4.3.3. Latin American Context (LA)

From the 24 articles initially selected through the applied search criteria, 5 were discarded for being considered out of the Latin America-specific context. These were: Chatziioannou, et al. [37] and Paula & Marins [38], who considered sustainable mobility just in general without conducting any case study in Latin America; García-Melero et al. [39], who conducted their case study in Santander (Spain); González, et al. [40], who conducted their case study in Tenerife (Spain); and Lönnqvist et al. [41], who conducted their case study in Stockholm (Sweden). Below, we start the in-depth analysis of the other 19 articles chronologically.

Campos et al. [42] apply a Sustainable Mobility Index (SMI) in the Belo Horizonte—MG, Brazil case study by combining urban transport and land-use planning aspects. They believe that these two aspects can contribute to the improvement of accessibility and the use of space, the increase in the contribution of environment-friendly modes (public transport, cycling, walking), traffic congestion reduction, safety improvement, and air pollution, noise, and visual nuisance reduction while maintaining a wealthy and healthy urban economy and ensuring social equity and transport opportunities for all community sectors. They conclude that the region with lower income has a higher frequency of better SMI per Census area, mainly due to more public transport options (subway and buses) and fewer car trips to the center.

Sagaris [43] explores the functioning of the Living City institution, presenting how it works over its "circles of participation" [43] and focusing on the pro-cycling initiatives carried out by the group together with the Dutch NGO Interface for Cycling Expertise (I-CE), the Metropolitan Santiago Regional's Government (GORE), and other autonomous citizens' actors. This initiative, which first generated a manual for cycling policies in Chile, later evolved into the Government-Citizens Roundtable for a Cycling-Friendly Culture, the central result of this three-year process for the author. The primary outcomes from the Living City project are related to the main achievements of the civil organization: the co-published report about the participatory process's proposals that were integrated into the Santiago Master Plan, the four chapters contribution by the Urban Design Manual

Working Group to the Revision of the Chilean road design manual (REDEVU); and the beginners' course for women who had never cycled. The above-mentioned participatory process in the Santiago Master Plan included an "emblematic" participatory mapping and evaluation process carried out by cyclists, although the Santiago Master Plan Commission undertook it.

Meanwhile, Sagaris [44] resulted in a more general presentation, emphasizing how small groups, more participatory and deliberative forums, and informal spaces could promote better engagement and new consensuses favoring cycling-inclusive urban planning and achieving more sustainable transport systems. Therefore, the "sustainable" term in the article refers mainly to social sustainability, focusing on its importance to social justice, human flourishing, and liveability rather than its environmental dimension.

Mercier et al. [45] studied the successful case city of Curitiba—PR (Brazil), which achieved international recognition by undertaking a series of more centralized/direct policy tools in public transport initiated by the urbanist Mayor Jaime Lerner in the 1970s. The study investigates whether Curitiba has advanced toward a participative approach through qualitative methods, such as interviews. As a result, they concluded that Curitiba policies are still very proactive and direct, even more so than those of other American cities such as Toronto, Seattle, Chicago, or Montréal, although it is possible to notice a slight rise of more indirect policy tools: a process that may be incipient at the time.

Warren et al. [46] present research relative to the unique case of Havana, Cuba. As the main objective, the authors seek to identify the possibilities and priorities for a long-term strategy for reaching equitable and sustainable mobility through workshops, which resulted in a SWOT matrix about the status of the transport system in Havana. As a result, they conclude that there is a strong consensus that public transport should be prioritized—despite explicit social acclaim for the car market deregulation. As strengths, they point out the actual low levels of motorization and the high coherence of the ongoing transport policies with the emerging sustainable necessities, and as main threats, a change in the policy-making framework and economic shocks (both recession and rapid growth).

Mercier et al. [47] present a comparative analysis between Seattle, Montreal, and Curitiba and how they deal with the challenges of achieving sustainable mobility through public policy tools in the face of metropolization and the rise of motorization, evaluated through qualitative methods. The study results show that Seattle has higher levels of interactive/governance instruments. On the other hand, Curitiba presents the oldest tradition in sustainable urban transport projects between the three cities, conjugating land use planning with infrastructure projects, such as the BRT, but also presenting higher levels of proactive participatory instruments. Finally, Montreal is the more balanced in terms of policy mix tools. However, its number of institutional players with competing mandates led the respondents to classify it as "chaotic" or "messy" in planning sustainable mobility.

Steurer and Bonilla [48] address the main issues in the Mexico City Metropolitan Area (MCMA) mobility: high CO_2 emissions, local air pollution, rising car ownership, laissez-faire urban planning and growth, and a fragmented public transport system. In order to build the paths to a more sustainable mobility future in MCMA, they apply semi-structured interviews to make four plausible exploratory scenarios based on stakeholders' perspectives on MCMA transport. They conclude that the major concerns of the stakeholders (even governmental and private ones) are the political integration between the Federal District of Mexico City and the State of Mexico (SoM) and the success of the negotiations among local stakeholders, such as mini-bus autonomous drivers.

In this article from Sagaris and Arora [49], the sustainability concept is rediscussed from more socially and equitable perspectives. They advocate for intermodal sustainable transport planning, prioritizing specific modes according to trip lengths and purposes and even adapting land use to them. Particular emphasis is given to walking and cycling and its possible arrangements with public transport, such as buses with cycle racks, cycles on trains, bike-sharing, and cycle parks near public transport stations. The authors define their study as a conceptual exploration using practical examples from many cities, mainly

Delhi (India) and Santiago (Chile). They also use literature review, field observation, and hands-on experience. The outcomes of this study are related to the proposal of criteria to integrate and promote sustainable modes of transport, such as adequate cycling distance, land use planning, equity, and safety, among others.

Stein and Silva [50] undertook a survey applying 2260 questionnaires out of 8857 estimated regular users in the University of São Paulo (USP) campus in São Carlos (Brazil) to identify barriers, motivators, and strategies to promote sustainable mobility locally. The survey confirms that one of the most significant barriers to promoting behavior change to more active and sustainable modes of transport is the ownership of cars. Furthermore, 13.6% of users of other modes of transport do want to move to cars, which is concerning. One of the appointed motivators for car use is the presence of parking places reserved for faculty employees, data that could ensure the development of strategies to limit its use and promote more sustainable modes of transport among USP campus regular users.

Sosa-López & Montero [51] discuss the tensions around sustainable mobility policy-making in Latin America, mainly from participant observation during planning forums, meetings, and public events and leading semi-structured interviews with policy actors in Mexico City and Guadalajara from 2012 to 2015. The authors conclude that active stakeholders have reassembled the politics of urban transport in Mexico, aligning contingent interests from multiple scales and orienting solutions in sustainable mobility policy among multiple actors, discourses, and technologies.

Sagaris [52] uses the participatory action research method to analyze the outcomes from two participatory planning experiences conducted by The Laboratory for Social Change in Chile within the context of transport projects. Despite the differences between both experiences, regarding their time duration, the author concludes that both initiatives present innovative aspects regarding participatory methods and strategies to enhance shifts toward greater sustainability of urban and transport systems and reveal barriers and opportunities to break with the distrust between institutional actors and citizens.

Defining as reference the principles and strategies from the TOD (Transport Oriented Development) planning approaches and the issue of sustainable urban mobility, Barbosa and Galves [53] perform a qualitative analysis of the Master Plans of three Brazilian cities in the State of Sâo Paulo. As a result, they conclude that besides all the plans incorporate strategies following many TOD planning principles, such as prioritizing non-motorized and public transport over motorized individual ones, mixing land use, and reappropriating empty public spaces to leisure activities, their guidelines are too general and do not advance on "how" to implement them. None of the plans proposed citizen participation in transport policy planning specifically, despite it being a core principle presented in all of them.

Scheffer et al. [54] take the University of Passo Fundo (UPF) Campus I as a case study elaborating and implementing a Sustainable Mobility Plan. They focus on the initial steps of the plan elaboration: qualitative survey, questionnaire application, bibliographical review, and traffic counting. As a result, they recognize the users' preference for cars and the need to build crosswalks in the Campus area.

Alba-Martínez et al. [55] start from the premise that equitable accessibility to higher education favors social fairness in economic opportunities. From this perspective, they perform an empirical study in the Guadalajara Metropolitan Area (GMA) based on statistical and spatial analysis. Finally, the authors conclude that university students are under-represented in transport planning and that transport-related social exclusion persists. Moreover, they point out that conventional buses offer low-quality service.

Meira et al. [56] bring an innovative approach to the sustainable mobility transport policy evaluation applied to the Metropolitan Region of Recife—PE (Brazil). They introduce the concepts of effective speed and socially effective speed per mode of transport as an alternative to cost-benefit and multicriterial analysis. The authors conclude that motorized modes had a lower effective speed than non-motorized ones, confirming the initial hypothesis. The socially effective speed costs represented 50% of the total costs for cycling users and only 7% for public transport users. In comparison, 23% of the total

socially effective speed costs came from private cars alone. Surprisingly, public transport's socially effective speed was the lowest, which could be attributed to the low value of the "average daily distance" traveled by the population and the lack of public transport offered in the metropolitan region studied.

Guzmán et al. [57] studied, through survey data and statistical modeling, the implementation of mobility plans in public and private organizations since 43% of the trips generated in the city are work trips. The results show that private transport is preferred, and walking is the last option. The statistical model indicates, for example, that parking management measures could promote modal choice change towards sustainable modes. Additionally, a case study in Bogotá, Oviedo, and Guzmán [58] explores the dimension of non-mandatory trips, which are also essential for an individual, to measure inequalities in accessibility and their implications for sustainability. The authors calculate a potential accessibility index that estimates the opportunities in a zone compared to all the others. As a result, they find, for example, that non-motorized trips are relevant to non-work activities, while slow modes such as walking and bicycling are particularly relevant to "take/pick up someone" and "shopping" activities, and they also point out the differences in accessibility between socioeconomic groups.

Sagaris et al. [59] conducted their research in Santiago and Temuco-Padre las Casas, having as the main objective to create a community-oriented evidence-based periodical report on Transport Justice, called Balance de Transporte Justo (BTJ), grounded in the hypothesis that providing citizens and advocacy planners with easy-to-use evidence to better frame demands could make more effective action possible on promoting more car-free living neighborhoods and cities. The research concludes that the residents of the 2 Chilean cities perceive their transport system as extremely unjust and that citizen participation must contemplate diversity in age, gender, income, ethnic origins, and capabilities.

The last paper selected for this review is from Valenzuéla-Levi et al. [60], which addresses the context of "post-COVID-19" mobility and the learnings that came from the pandemic experience. As major concerns, they point out the higher vulnerability suffered by the citizens within the low socioeconomic levels during the pandemic, due to inadequate overcrowded housing and public motorized transport dependence. For them, an integrated housing and transport policy to locate subsidized housing within cycling distance (7 km for Santiago) from areas that concentrate jobs for the poor could contribute simultaneously to disaster resilience, reduction of carbon emissions, and social equity. In order to prove so, they take as a case study the metropolis of Santiago (Chile) and undertake a household and trip distribution gravitation model with measures of impedance and generalized travel cost for each zone. They conclude that low-income people prefer to live in overcrowded areas but closer to their jobs. This leads to the implication that a short-term bike lane investment program could have a direct and immediate impact on the mobility patterns of the population since the most relevant factors that enable new cyclists are shortening trip distances together with an adequate cycling infrastructure network.

5. Comparison and Discussion: Sustainable Mobility Challenges in the Latin American Context

It is always a huge challenge to compare Latin America with the rest of the world in all aspects. The geohistorical differences that led to their differential development, their colonized past, the culture of its people, and their relative position among the hegemonized world in the actual framework of global financial capitalism are specific processes that cause not only inequality but also led to different challenges in sustainable transport and mobility. Notwithstanding, all these differences are reflected in the interests and focuses of the articles brought to analysis.

Within the Latin American context, one focus has been sustainable mobility indexes, modeling, and spatial indicators. In this direction, there are some similarities among the approaches of Campos et al. [42], Alba-Martínez et al. [55], Meira et al. [56], Oviedo and Guzmán [58] and Valenzuela-Levi et al. [60]. They ground their research on quantitative

methods such as multicriterial analysis, transport costs, and constraints analysis, or housing location analysis based on mobility indicators. This approach has the advantage of putting the evidence on objective grounds with rigorous quantitative methods. However, it has drawbacks, such as the difference in methodology and final results and the difficult comparability of data from the same period and scale.

Another interesting approach relates to participatory planning processes to promote sustainable mobility, which is aligned with the studies of Lake Sagaris [43,44,52], Sagaris et al. [59], and Sosa-López and Monteiro [51]. It is relevant to highlight that, within the Chilean context, Sagaris plays a major role in the political emancipation of Chilean communities in terms of achieving a more sustainable transport landscape, mainly through active modes of mobility, such as cycling. These papers focus on the experiences that Sagaris had while conducting participatory activities. The Chilean socioeconomic landscape may be similar to other LA countries such as Brazil, Mexico, and Bolivia, which makes it important to learn and seek to replicate these studies in other neighboring countries. With the same approach, Sosa-López and Monteiro [51] analyze the role of the "expert citizens" in Mexico, which also relies on understanding stakeholders/political agents' interests and searching for consensus. This approach is rich in terms of describing the crude and naked reality of Latin American countries' political bureaucracy, which lies in a complex political background of fragile post-dictatorial democracies. Thus, this is often the major challenge in public policy implementation. The efforts of the researchers in organizing and promoting participatory planning environments are remarkable and should inspire other similar initiatives. As possible drawbacks, we can cite the high subjectivity of the participative methods, which cannot be made into a general rule (and it doesn't even intend to) and hardly the results can be applied in different places and cases.

Furthermore, there are studies that undertake mobility survey and their analysis., such as Stein and Silva [50], Scheffer et al. [54], and Guzman et al. [57]. The two first mentioned conducted their study in Universities, through the application of questionnaires, and they sought to understand the high preference of users for the car when commuting to study. The latter uses a rigorous methodology to choose the companies with chosen survey participants and apply a state preference choice analysis to understand the willingness to change from passive to active modes of travel. This type of article has a major strength going into the roots of the problem when better understanding the population's preference for the use of cars in many situations (work and study) and what could be done to promote active modes of travel more effectively. Additionally, the University campuses act as a small laboratory for a city, since it is a more controlled urban environment but still carries major urban process vectors.

Different from other studies, within the Latin American context, some focus on collecting information through interviews [45], semi-structured interviews [48], workshops to generate a SWOT matrix [46], and documental analysis [47,53]. Interestingly, they focus on collecting lessons based on the policy approach and governance situations applied to different cities in Latin America. It is possible to observe that there is a constant effort to understand how the stakeholders' relationship affects the mobility of citizens. The methods used in these studies are focused on collecting local particularities concerning the referred topic and offers interesting methodological approaches related to focus group, workshops, and documentation analysis to advance toward a better comprehension of the governance surrounding the mobility policy.

When comparing the main issues emerging from the GC articles with the LA ones, we can observe a greater concern with climate change issues and the reduction of greenhouse gas emissions, mainly carbon. Thereby also concerns the increasing share of motorized travel modes, such as private vehicles. Moreover, more attention is given in GC to the goals of international treaties such as the Kyoto Protocol and the 2030 UN Agenda. The LA papers show a slight prevalence of transport issues related to urban inequalities, social movements, and governance.

Among the methods, both groups utilize more qualitative approaches to historical policy analysis and quantitative analysis based on indexes, especially multivariate analysis and building future scenarios. However, in LA we can notice a higher application of qualitative approaches directed to understanding mobility conditions and identifying barriers to moving toward sustainable mobility, in terms of social inequality, policy, and governance aspects. Possibly, this can be related to a lack of information to generate and outdated data in several cities of the region, which difficult the implementation of quantitative approaches, related to indicators and spatial analysis of mobility. On the other hand, in GC there is more discussion on the principles and relevant elements that represent sustainable mobility and transport towards questioning the coherence of policy, guidelines, and strategies related to promoting sustainable cities and mobility patterns.

In general, one can say that LA articles have a focus on urban/regional scale transport-related issues, often raising questions over the social dimension of sustainability, governance policy tools, and citizen democratic participation in the Global South, just barely questioning the roots of the environmental dimension of sustainability debate, while the GC ones are always facing this issue as its main problem to solve, recognized by the United Nations.

Comparing the themes approached, in GC we have a broader sort that includes urban space allocation with remote-sensing measurement method [29], TOD neighborhoods typologies definition [30], issues of rural tourism [35] and role-model advocacy to promote sustainable mobility [33]. Thus, the general context presents evident concerns with reducing carbon emissions by the transport sector. On the other hand, in LA, which has higher social concerns, there is an evident focus on public policy building and evaluation that includes citizen participation, the realization of workshops, and analysis of their outcomes (Warren et al., Sagaris [44,46]), identification of driving forces and stakeholders [48] and two policy tools classification schemes presented by Mercier, et al. [45,47]. Finally, in LA, it is observed concerns with sustainable mobility in university campuses, taken both as mini-city labs and trip generator places (Stein & Silva; Scheffer, et al.; Alba-Martínez, et al. [50,54,55]).

Both article categories give huge conceptual importance to behavioral and psychological theories. They focus on qualitative and quantitative analysis, from the oldest article observed by Steg and Tertoolen [18] to the latest, from Smith, et al. [35]. These analyses remain mainly on identifying behavioral travel trends that lead to car dependency and barriers for people to change to more active travel modes, such as cycling and walking. In this way, it is representative of the article from Guzman, et al. [57] that undertakes a state-preference survey to understand this behavior better.

In the practical arena, Sagaris plays a leading role among LA papers being the main representant of participative methods research-based conjugated with political, practical, and transformative action (Sagaris [43,44,52]; Sagaris & Arora [49]; Sagaris, et al. [59]). Meanwhile, in GC a leading role is played by Banister, who conceptualizes and reviews sustainable mobility/transport terms and sets research guidelines and political goals, from his 2008 paper—the most cited article among the selection—to the most recent in 2019, that undertakes a broad historical analysis from the research field (Banister [6,20,32]; Hickman, et al. [25]; Holden, et al. [36]). In this sense, the paper from Gössling & Cohen [28] addresses the role of "taboos" that undergoes the background of all the political debate.

Last but not least, there is an overall consensus on the potential role of urban planning, land-use definition, and car-use restriction policies to promote sustainable mobility, which is commonly referred among the TOD principles (Loo & du Verle [30]; Loo & Tsoi [34]), such as the applied in Curitiba, Montreal, Portland (Mercier, et al. [45,47]) and Washington and Stuttgart (Buehler [21]; Buehler et al. [27]), and with the policy-mix of push and pull measures adopted in Freiburg, Vienna and other European cities (Buehler & Pucher [22]; Buehler et al. [31]). However, it is also consensus that car-use restriction measures must be accompanied by good public transport services, an issue already surpassed in TOD neighborhoods.

In conclusion, it is possible to observe that within the Latin American context, there is a valuable development of studies related to sustainable mobility and transport, however, there are some gaps that could be explored in order to support the development of policies at a more local scale towards more sustainable mobilities. Moreover, relating to Banister's [6] comprehension of sustainable mobility, it seems that there are opportunities to explore mobility patterns with a closer relationship to the built environment and infrastructure at smaller scales and also in different contexts, such as small and medium-sized cities and rural areas. LA research seems to focus strongly on behavior, mobility patterns, and purpose of trips, leaving aside how the surrounding and built environment may influence at a local scale the mobility experience, aiming to add value to the act of moving, instead of the destination activity, and being in touch with the landscapes, architecture, art, pollution, sounds, health, etc.

In the face of unequal urban environments, where vulnerable populations are not given the choice to use less contaminating modes of transport, but are conditioned to them for economic reasons, another area to develop research is how to add value and improve the mobility experience by understanding the impact of the built environment and land use distribution in Latin American cities in order to promote strategies and action plans that align with local context and needs. In this direction, one could recognize that social inequality is a chronic and complex issue in Latin American countries, which is related to multiple causes and requires long-term planning strategies. However in the short- and medium-term perspective the lack of "down to earth" prioritization of investments and policies´ development towards improving mobility conditions seems to relate to the scarcity of studies that explore more local cases, with emphasis on the impact of the quality of the paths/routes/built environment and places, that socially and physically vulnerable populations frequently take or are exposed to, on the mobility experience. Thus, this direction could shed some light on the reality of this region (and its cities) and not the sustainable mobility utopia, in which for everyone sustainable actions are a choice and not a conditioning context for the poor.

6. Conclusions and Final Considerations

In this bibliographical review article, we have analyzed, compared, and discussed 40 articles from the WoSCC that rely on the concept of "sustainable mobility" or "sustainable transport". Of these, 19 were based on LA themes or authors, and 21 were from what we called "General Literature". The papers were selected based on a consistent methodology, including a personalized search in the WoSCC, looking for papers that strictly had those terms/concepts in their titles.

The sustainable mobility/transport applications were discussed through the literature review. A periodization was undertaken based on key political and social events in the past decades about the theme. A quantitative analysis was performed, observing the metrics of the articles about their year of publication, scientific areas, and peer-reviewed journal of publication. Next, a co-occurrence analysis of the keywords was made, with the support of the VOSviewer software, for each determined period. The results were discussed, looking for differences in the evolution of the scientific debate. Meanwhile, among the LA papers, we run the co-occurrence analysis for all time, without periodization, due to the smaller number of articles.

After that, a co-citation and cluster analysis was performed with the GC articles and the VOSviewer's support to identify the most cited authors in each cluster without distinction between main authors and co-authors. Thereby, the top two authors of each cluster had their articles selected for the in-depth analysis. The LA-based papers were all selected for the in-depth review, except those with no case study applied to the Latin American context.

Towards the in-depth review, the articles had their main issues, themes, motivations, methodology, and outcomes systematized in tables and thus classified, supporting a deep comparison and discussion between the scientific debate on sustainable mobility/transport

going on LA and outwards. It is interesting to point out, within the LA context, the need to advance towards studies on sustainable mobility and transport applied to rural areas and small- and medium-sized cities, which receive low attention in Latin American countries and are even, in some cases, being depopulated for reasons related to quality of life and opportunities.

As a result, we conclude that GC has a major concern with climate change issues and decarbonization goals, while LA relies most on the social dimension of sustainability, injustice, inequalities, and the effort for change in the political arena within the urban scale. This could be explained in part because of the Western countries' relative political stability that comes from the postwar period, while LA countries have been dealing with much more challenging and complex political scenarios derived from fragile democracies with much less time for stabilization. This could be also endorsed by the cluster analysis in Section 4.2, wherein the words 'social exclusion', 'intervention', 'participation', and 'politics'—instead of 'policy'—appear.

Latin American research demonstrates that there are still areas of study to be explored that relate more to what Banister [6] defines as a sustainable mobility perspective, such as evaluating mobility at a more local scale, understanding the relationship of land use/built environment and mobility and evaluating travel as valued activity (not only as a derived demand). In this direction, most studies seem to focus on the destination of trips and how people get to them, while there is the need to explore through alternative methodologies, such as experimental and in-situ evaluations, the paths/routes of trips, within the Latin American context at different scales to promote a better understanding and strategies to advance towards more sustainable cities and mobilities.

The similarities remain in adopting push and pull measures to promote sustainable transport and reduce motorized private vehicle use in the present built environment while adopting TOD principles in developing new neighborhoods and future cities. Here we should notice that Western countries have much bigger shares of private car use and cars per habitant indicator than the LA ones, which have more concerns about the land-use pattern and distribution of trip generators activities/places and housing location. In this way, it is important to highlight that the spread of automobiles in LA countries—and thereby the car-oriented development paradigm—was promoted by those Western countries and their automotive industries since the sixties, when the productive restructuring arose and many fabrics were moved to LA countries. Regarding the methods utilized, we can conclude that there is some difference between GC and LA articles, mainly for the participative methods utilized in LA and the urban transport land-use measurement by remote sensing conducted only in GC.

Interesting approaches that could be conducted in LA in the future include the TOD-neighborhood classification [30], the carbon emission top-down and bottom-use measurement methods [24], the urban space allocation measurement [29], the policy tools undertook in Freiburg and Vienna (Buehler & Pucher [22]; Buehler, et al. [31]), the strategies for achieving sustainable mobility (Banister [6,20]; Hickman, et al. [25]), a better understand from the transport taboos in LA [29], to promote the role-model/celebrity activism [33], to understand the psychological behavior of car users and put up pull measures upon it [18].

While dealing with quantitative analysis, one can conclude that it should be kept as simple and smooth as possible because many variables and complex scenario building based on many estimated indexes and suppositions can obscure more than clarify the path. This is a problem due mainly to the lack of data on a detailed scale and methodological compatibility between the travel surveys that various countries have conducted. Indeed, a virtuous path is to make them comparable through international cooperation among their respective entities responsible for the survey conduction. Here, the appointments of Litman [19] on rigorously index selection procedure may be of high value.

Finally, sustainable transport should be seen in its totality, given that many measures that may reduce carbon emission in commuting travel can have side effects on the leisure/non-commuting travel patterns, even improving its volume and carbon emission.

As this article had a time reference deadline of 4 July 2021, we decided to conclude it with a brief perspective of what has been produced in the field in LA since it. Considering that, we repeated the search at WoSCC with the same criteria for the period from 4 July 2021 to 18 July 2023 (Figure 10). The search returned 12 articles from Brazil, Chile, Colombia, and Mexico, but one was discarded due to not being a study about LA. Next, we analyzed their keywords co-occurrence with the VOSviewer, which gave us the frame of the discussed topic in this period.

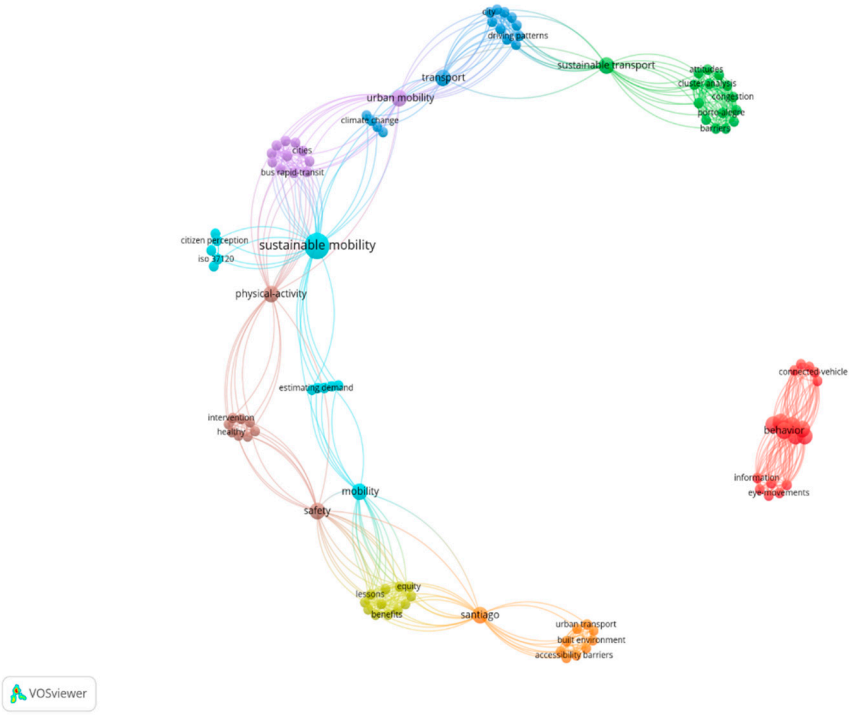

Figure 10. Keywords co-occurrence analysis for LA-based articles from 2021 to 2023.

Through so, we can assume that sustainable mobility in LA has gone deeper into new equity questions, such as gender inequality and transport safety. Additionally, emphasis has been given to active modes of travel and physical activity, which are highly connected with a more significant concern over public health equity and the city paradigm change brought about by the COVID-19 pandemic. In terms of study locations, Chile and Mexico sought to be the leading places of sustainable mobility research in LA for this period.

To finally conclude this paper, we point out from the volume of publications (Figure 3) that sustainable mobility and transport research in LA has a large gap to fill when compared to Global North countries. This seems to be particularly relevant when we notice, in Section 4.2, that all the countries from Latin America together have published less than much smaller Global North countries, such as Spain, Italy, and Denmark.

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