Ingeniería y Competitividad
Vol 27 (1) 2025 doi: 10.25100/iyc.v27i1.14497

Vol 27 (1)

ISSN
0123-3033
e- 2027-8284

Review Article

Decision-making in sustainable transportation management: bibliometric review of the literature

Toma de decisiones en la gestión sostenible del transporte: revisión bibliométrica de la literatura

Juan C. Orobio[1] Daniel E. Guzmán[1] Jackeline Murillo-Hoyos [1] Ciro Jaramillo Molina[1]

[1]Universidad del Valle, Cali, Colombia.

How to cite?

Orobio, J., Guzmán, D., Murillo-Hoyos, J., Jaramillo, C. Decision-making in sustainable transportation management: bibliometric review of the literature . Ingeniería y Competitividad, 2025, 27(1) e-30114497

https://doi.org/10.25100/iyc.v27i1.14497

Recibido: 23-10-24
Evaluado: 5-11-24
Aceptado: 10-02-25
Online: 17-02-25

Correspondence
orobio.juan@correounivalle.edu.co

Abstract

Introduction: Traditionally, in transportation management, decisions have been made using cost-benefit analysis to compare different alternatives. However, this method was not designed to contemplate the dimensions of sustainability. In light of this, sustainability indexes and multi-criteria decision analysis have been used as alternatives in recent years.
Objective: This paper aims to identify global trends in decision-making processes in sustainable transportation management through a bibliometric review of scientific production.
Methodology: This article was developed following five methodological steps: i) literature search, ii) screening for inclusion, iii) data extraction, iv) data source selection, and v) data analysis.
Results: The results reveal a significant dynamic in the search for appropriate tools to implement sustainable development concepts in decision-making. Specifically, the findings highlight the importance of considering the specific context of cities, the spatial distribution of effects, and the involvement of stakeholders.
Conclusions: The study underscores the need to integrate sustainability dimensions into decision-making frameworks in transportation management, with a focus on context-specific factors and stakeholder considerations to effectively implement sustainable practices.

Keywords: Project evaluation, transportation, sustainable development, decision-making.

Resumen

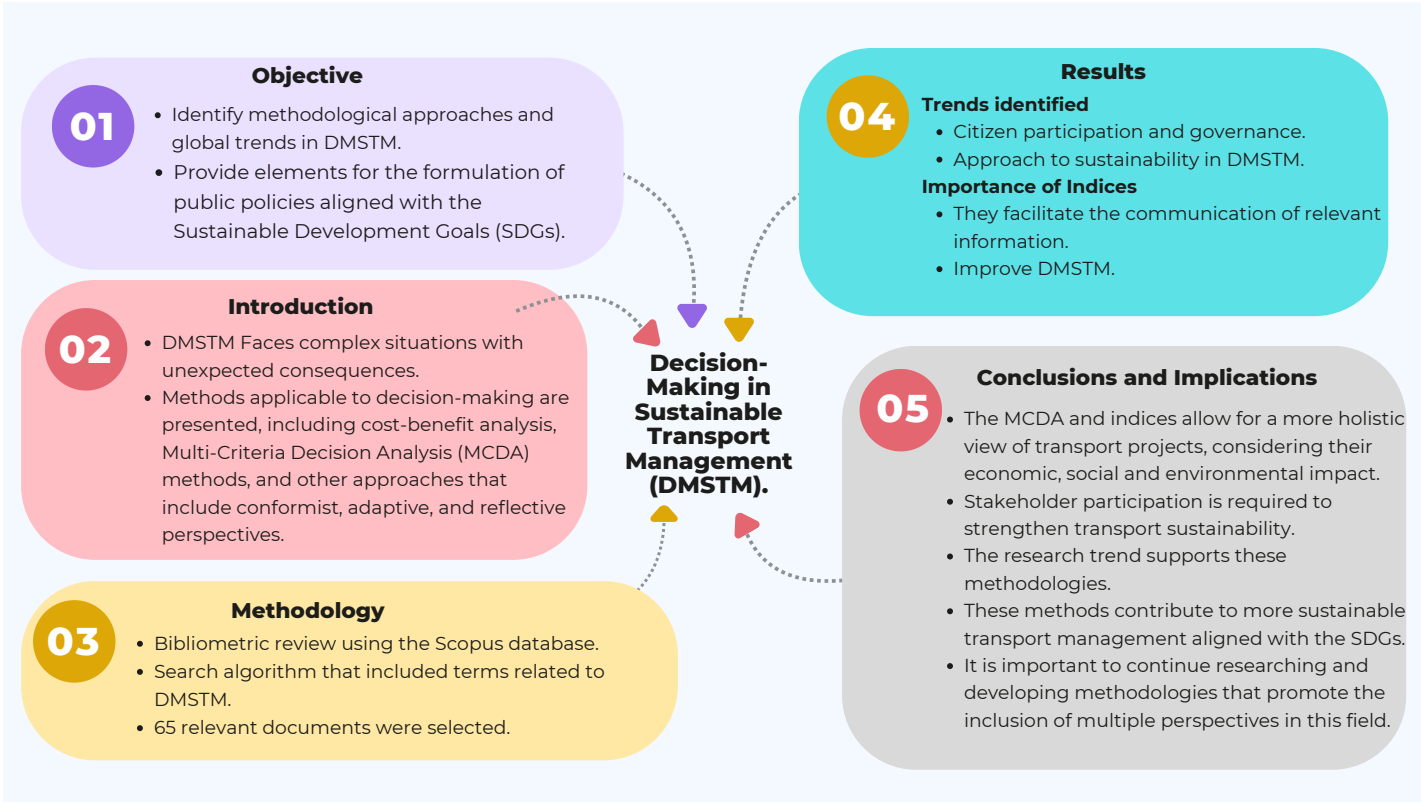
Introducción: Tradicionalmente, en la gestión del transporte, las decisiones se han tomado utilizando el análisis costo-beneficio para comparar diferentes alternativas. Sin embargo, este método no fue diseñado para contemplar las dimensiones de sostenibilidad. En este contexto, en los últimos años se han utilizado índices de sostenibilidad y el análisis multicriterio como alternativas.
Objetivo: Este artículo tiene como objetivo identificar las tendencias globales en los procesos de toma de decisiones en la gestión sostenible del transporte mediante una revisión bibliométrica de la producción científica.
Metodología: El artículo se desarrolló siguiendo cinco pasos metodológicos: i) búsqueda bibliográfica, ii) selección para inclusión, iii) extracción de datos, iv) selección de fuentes de datos y v) análisis de datos.
Resultados: Los resultados evidencian una dinámica significativa en la búsqueda de herramientas adecuadas para implementar los conceptos de desarrollo sostenible en la toma de decisiones, destacando especialmente la necesidad de considerar el contexto específico de las ciudades, la distribución espacial de los efectos y la participación de los actores involucrados.
Conclusiones: El estudio subraya la necesidad de integrar las dimensiones de sostenibilidad en los marcos de toma de decisiones en la gestión del transporte, con un enfoque en factores contextuales específicos y en la consideración de los actores involucrados para implementar de manera efectiva prácticas sostenibles.

Palabras clave: Evaluación de proyectos, transporte, desarrollo sustentable, toma de decisiones.

Contribution to the literature

Why was it done?
The article corresponds to the bibliometric review of the thesis called “Territorial Index for Decision Making in Sustainable Transport Management” prepared to opt for the title of Doctor in Urban Management and the territory granted by the Faculty of Integrated Arts of the University of the University of the University of the Valley.

What were the most relevant results? What do these results provide?
The literature review allowed to identify a void in the literature against the use of space accessibility measures, geographic information systems, equity analysis and simulation models as a help tools in decision -making in the management of Sustainable transport.The need to have frameworks to help the decision -making processes that allow to include environmental, economic, social and spatial dimensions, as well as facilitate the participation of interested actors, so that transport management contributes to sustainable development.Multicriterium decisions analysis are an instrument of help in decision making with the potential to include sustainability dimensions in sustainable transport management.



doi: 10.25100/iyc.v27i1.14497

Introduction

According to Meinard & Tsoukiàs (1), decision-makers must decide whether their acts are legitimate or valid. In relation to this, Merleau Donáis et al (2) state that the consideration of a good decision depends on the rationality pursued, and therefore, from a philosophical standpoint, the concept of validity of the decision model is linked to the four claims of validity that form a complete rationality of Habermas: truth, normative rightness, sincerity and intelligibility.

Meinard & Tsoukiàs (1) defined four approaches to aid decision-making based on Habermas' concept of communicative action, i) Objectivist Approach: where rationality is strategically configured and accepts that there are unquestionable formulations of problems and solutions, e.g. cost-benefit analysis (CBA), multi-criteria decision analysis methods (MCDM), decision trees, decision matrices, life cycle analysis (LCA), etc. ii) Conformist Approach: where rationality is derived from the observation of stakeholders to build an empirical behavioral model, e.g. consensus methods, consultation processes, benchmarking, voting decisions, social risk analysis, design thinking, etc. iii) Adaptive Approach: where rationality is unique to a particular context according to stakeholder needs, preferences and values, e.g. agile methods, prototyping and pilot testing, results analysis and continuous feedback, scenario analysis, risk and opportunity analysis, etc. and iv) Reflective Approach: where rationality is a learning process to build a new rationality without an authoritative conception, without behavioral expectations and without internal decision preferences, e.g. mind mapping techniques, visualization of results, case studies, Delphi methods, etc.

Managing transportation problems entails dealing with complex situations and unexpected consequences, and given that possible solutions come in many forms, such as soft interventions (taxes, regulation of land use, technologies, energy or gas emissions, etc.) or hard interventions (development of infrastructure for private vehicles, implementation or improvement of public transport systems, construction of bicycle and pedestrian facilities, etc.), decision makers must assess the trade-offs between the required investments, the potential to achieve the desired outcomes, and the different impacts on society. The evaluation of alternatives in transportation management aims to provide relevant information for decision-making, considering the problems and characteristics of the different options available.

Sustainability assessment should ensure that plans and activities contribute to sustainable development (3). According to the United Nations Human Settlements Programme (UN-Habitat), achieving sustainable development goals requires addressing four dimensions of sustainability i) social, ii) economic, iii) environmental and iv) spatial (4). However, despite the inclusion of sustainability objectives in transportation management, a gap persists between decision processes that could be consistent with sustainable development and those that still promote unsustainable infrastructures and policies (2), which is why transportation management requires appropriate approaches to include sustainability in decision-making (5).

Marleau Donais et al. (2) state that CBA [Cost-Benefit Analysis] has long been employed as a technique for evaluating options in transportation management decision-making. By monetizing each alternative's socioeconomic costs (negative effects) and benefits (positive effects) throughout

doi: 10.25100/iyc.v27i1.14497

the course of the project, this method seeks to determine the solution that maximizes social welfare. But this approach is predicated on the 'winners' having more losses than the losers (6). This presumption frequently overlooks or undervalues distributional concerns, particularly when the losing stakeholders—who typically have interests in the social and environmental domains—are not sufficiently taken into account (2).

Mitigating the negative impacts of automobile use requires a shift to more sustainable practices such as the use of public transport, cycling and walking. This increases the complexity of transportation management due to its multidisciplinary nature and the diversity of stakeholders involved (2). For this reason, transportation management should focus on assessing whether alternatives contribute to economic development and meet mobility needs in a way that is compatible with environmental protection, thus ensuring a comprehensive and inclusive decision-making process (5).

Multi Criteria Decision Analysis [MCDA] can facilitate consensus building around a common value structure by integrating multidimensional aspects and stakeholders (7). However, these methods have been used mainly for the selection of alternatives rather than for evaluating transportation policies or projects (8). In the MCDAs, each of the sustainability pillars must be manifested and explained through a set of relevant indicators (9), which are usually summarized in a composite indicator, which allows condensing a large amount of information in simple and easy-to-understand formats, becoming a reference and communication tool for all stakeholders (9,10). Since indicators have different units of measurement, it is necessary to normalize, weight and aggregate them for the creation of indexes (9). This process entails selecting particular methods that call for consideration, care and a deep comprehension of how they are used in different contexts.

Bueno et al. (11) categorize the several decision aids for transportation management that are presented in the literature into three primary approaches: i) project evaluation methods for decision-making, ii) impact assessment techniques and iii) sustainability assessment methodologies. Tao & Hung (12) identified three categories of evaluation indicator models: i) composite index models, ii) multilevel index models, and iii) multidimensional matrix models. Suprayoga et al. (3) propose a set of criteria to determine whether approaches and indicators assess sustainability more adequately: i) socio-ecological system integrity, ii) livelihood sufficiency and opportunity, iii) intragenerational equity, iv) intergenerational equity, v) resource maintenance and efficiency, vi) socio-ecological, civic and democratic governance, vii) precaution and adaptation, and viii) immediate and long-term integration.

In general terms, the authors recognize the need to implement changes in transportation management processes to achieve sustainability (13), (14), (15), (16). Despite the wide variety of decision-support tools used to incorporate sustainability into transportation management, such as product-based Life Cycle Assessments [LCA], fleet-based Life Cycle Assessments [LCA], cost-benefit analysis [CBA], cost-effectiveness analysis [CEA], multi-criteria decision analysis [MCDA] based on ideal solutions, higher-order multi-criteria decision analysis [MCDA], and indicator-based assessments (5), the literature review reveals a lack of consensus on the most appropriate framework, indicators and method to evaluate alternatives in transport management in order to

doi: 10.25100/iyc.v27i1.14497

achieve sustainable development, this article seeks to identify the appropriate decision support approaches to achieve the transition of transport management towards sustainability, which would contribute to the formulation of public policies in line with the Sustainable Development Goals [SDGs].

The objective of this article is to conduct a bibliometric review of the literature to identify methodological aspects and global trends on decision-making processes related to sustainable transportation management in order to identify gaps in the related scientific production. Furthermore, it seeks to address the following questions: i) How has scientific research on decision-making processes for sustainable transportation management developed? ii) Which research and development centers and institutions are leading this field of decision-making processes in sustainable transportation management? iii) Which are the main journals for the publication of results in this field? iv) Which countries are at the forefront in research on decision-making processes in sustainable transportation management? v) Which are the most representative topics in research on decision-making processes in sustainable transportation management?

Methodology

In accordance with the methodology proposed by Templier and Paré (17) for literature reviews, this article was developed following five methodological steps i) literature search, ii) screening for inclusion, iii) data extraction, iv) data source selection, and v) data analysis, which are described below.

The purpose of the literature search is to identify possible sources of data that would allow the necessary analysis to answer the research questions. The global databases Web of Science [WoS] and Scopus were defined for this purpose. According to Zemigala (18), these databases are the most comprehensive in terms of their thematic coverage (they encompass all disciplines), contain aggregate data from other databases that are already highly profiled or regional in scope, and offer a wealth of information that includes management and economic sciences.

Screening for inclusion was developed using the search engines of the selected databases, for which a keyword algorithm was designed that contemplated decision-making and transportation. Additionally, the term decision-making was complemented with the terms indexes and indicators in order to include literature related to the design of these elements, given their importance as a support to decision-making. In order to design the search algorithm, the UNESCO Thesaurus list was used, which is a controlled and structured list of terms for thematic analysis. The algorithm used the complementarity (and) and substitution (or) connectors to ensure that the selected literature includes the relationship between transportation management and decision-making (or, alternatively, the construction of indexes or indicators). The search algorithm and its results can be found at Figure1.

Data extraction was carried out using the search engines of the WoS and Scopus databases, in which queries were performed using the previously defined algorithm. In order to be able to analyze the results of the queries, they were downloaded in .txt format in the WoS database and in .cvs format in the case of Scopus.

doi: 10.25100/iyc.v27i1.14497

The selection of the data source between the two possible sources, Scopus and WoS, was based on the comparison of the search results contained inTable1, where it can be seen that Scopus represents 72.54% of the publications, covering a longer period of time and with better coverage of the scientific literature, which is why it was decided to use this database as the main reference. This was done in order to maximize the scope and depth of the information analysis. Since the thematic approach of the algorithm used allowed us to obtain results concentrated on the research objective, no additional filters were applied for the bibliometric analysis.

The data analysis was carried out using the Bibliometrix package, which is a suitable tool for quantitative research in bibliometrics; this package has the advantage of being able to process the metadata of the previously selected Scopus database. For the synthesis of the study, a filtering process described inFigure1 was carried out, which made it possible to identify 65 documents that were reviewed in detail and whose results are described in the following chapter.

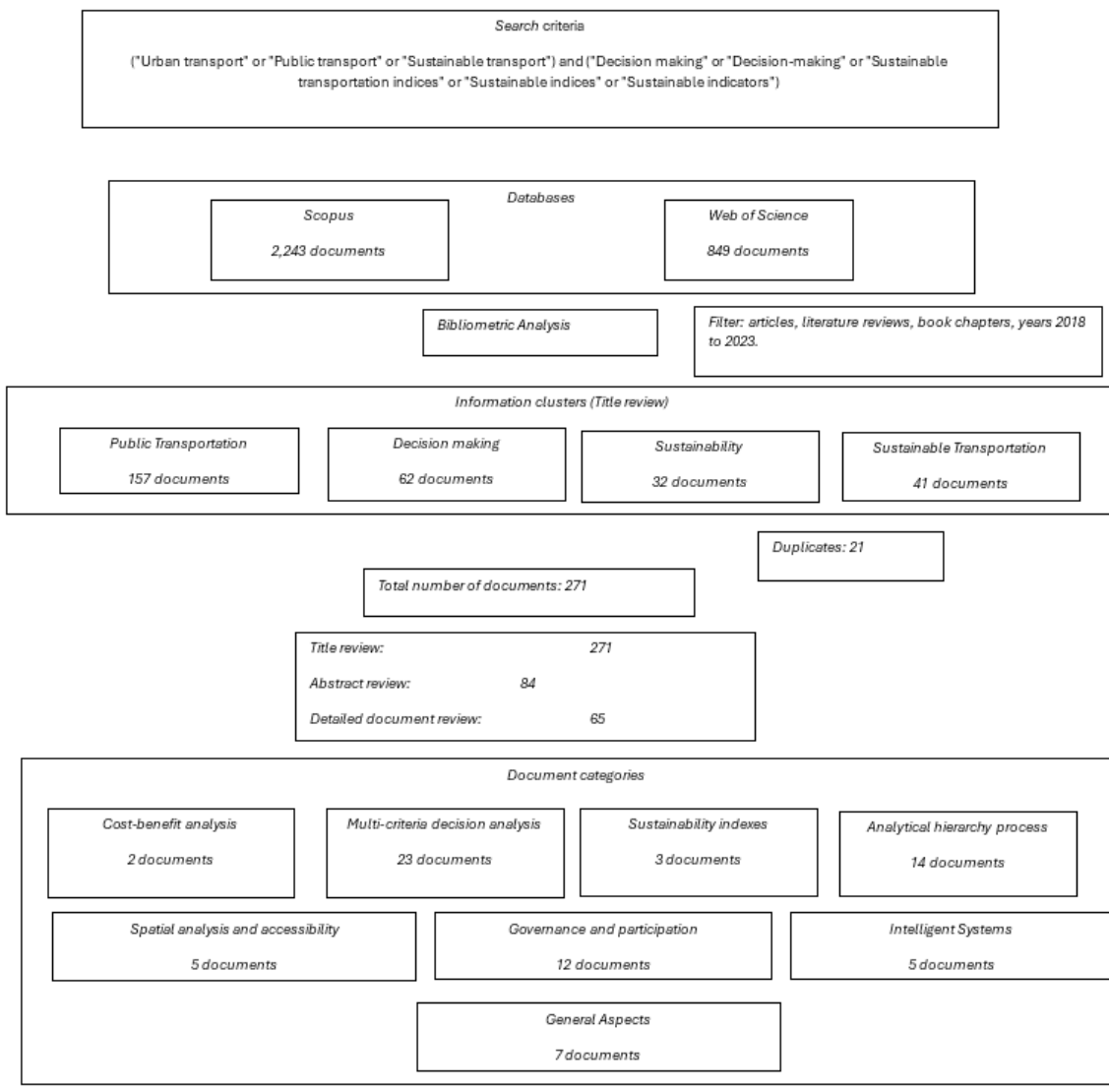


Figure 1. Flowchart of the literature screening process. Source: Own elaboration

doi: 10.25100/iyc.v27i1.14497

Table1 . Summary of database search results.

Description	Web of S	Scopus
Period of publications	2000 a 2024	1975 a 2024
Sources (Magazines, books, etc.)	325	852
Documents	849	2.243
Average years of publication	4,31	6,73
Average citations per document	19,23	16,62
Average citations per year per document	3,55	2,70
References	39.007	83.313

Source: Own elaboration with Bibliometrix

Results

The bibliometric research conducted in Scopus identified 2,243 documents published between 1975 and 2024 in 852 different sources, with an average citation rate of 16.62 citations per document, which denotes a high scientific interest in this topic. The main findings of the study, supported by the methodological rigor employed and the detailed analysis of the 65 documents selected, are presented below.

Evolution of scientific production

The yearly evolution of scientific output is displayed in Figure 2, which demonstrates that the records go all the way back to 1975. With an average of 3.20 publications year, the production volume was modest for the first 25 years. However, from the year 2000, a growing trend is observed, increasing the average to 32.92 publications per year. This development intensifies from 2013, when the scientific production in this field reaches an average of 158.18 publications per year.

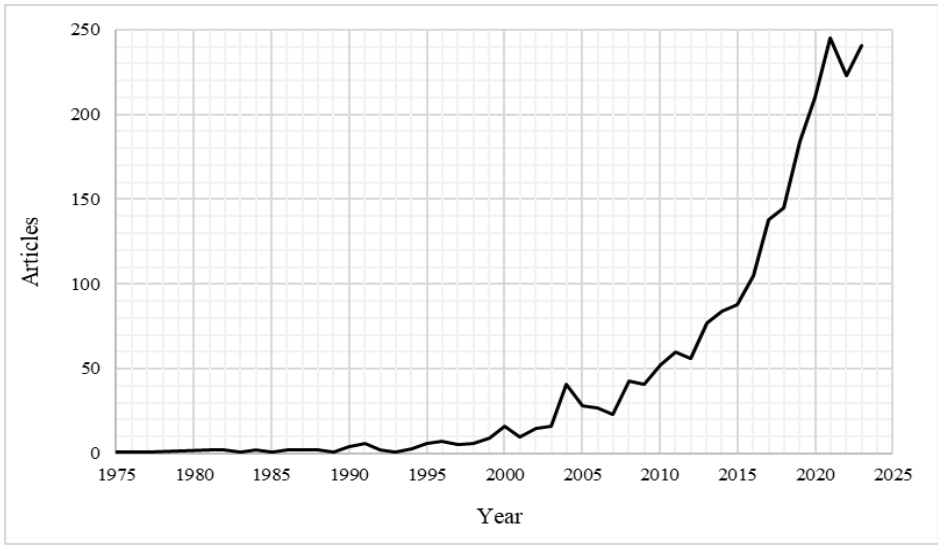


Figure. 2 Chronology of articles published with the keywords. Source: Own elaboration with Bibliometrix

doi: 10.25100/iyc.v27i1.14497

It is important to highlight the remarkable growth in scientific production that has occurred in this century, from 16 papers per year in 2000 to 241 publications in 2023. The significance that the scientific community places on decision-making tools for attaining sustainability in transportation management is reflected in this growth.

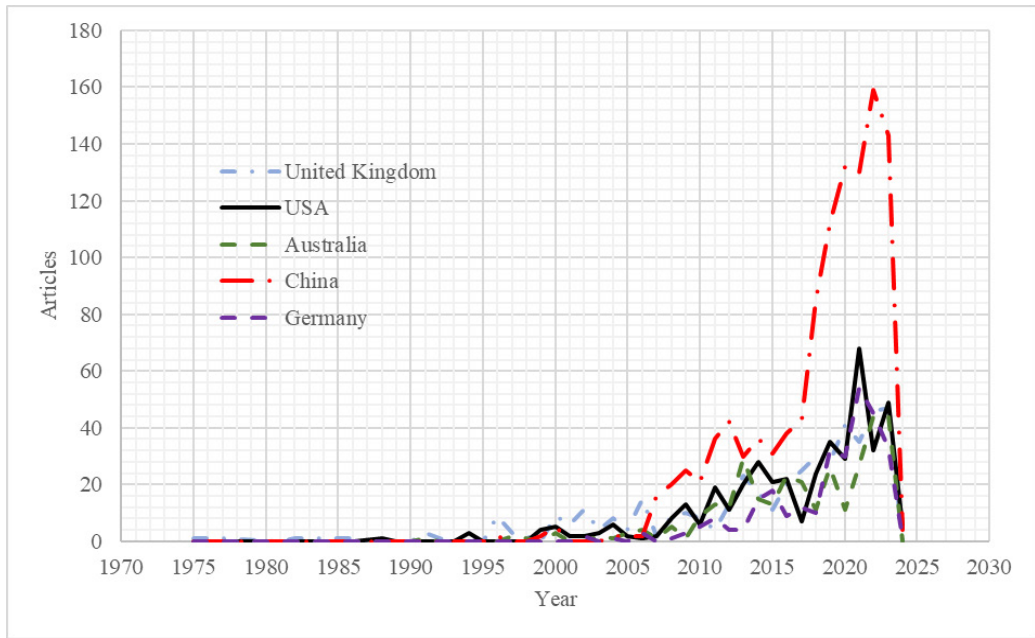


Figure 3. Annual scientific production by country. Source: Own elaboration with Bibliometrix

In the behavior of the evolution of scientific production it is important to take into account the context in which it is developed. For this purpose, the evolution of annual production by country was analyzed (Figure3). An increase in production is observed in China, a country that has demonstrated significant leadership in scientific production since 2015. The aforementioned highlights the importance of decision-making tools for nations experiencing accelerated urbanization processes, which may be due to the relevance of sustainable transportation (public transportation, walking and cycling) in urban planning since it is the mechanism that allows the participation of residents, particularly the most vulnerable, in the social and economic life of their cities (4,19).

Research centers

Table2 presents the most relevant research centers in the field. In first place is Delft University of Technology of the Netherlands with 95 (4.24%) published articles, followed by the Budapest University of Technology and Economics of Hungary, with 66 (2.94%) articles. It is worth noting that the ranking of institutions is led by China, which has 3 research centers on the list, followed by England with two universities. Notably, none of the ten most relevant institutions are from the American continent.

doi: 10.25100/iyc.v27i1.14497

Table 2 . Most relevant research centers

Research Center	Country	Documents
Delft University of Technology	Netherlands	95 (4,24%)
Budapest University of Technology and Economics	Hungary	66 (2,94%)
Beijing Jiaotong University	China	61 (2,72%)
Tongji University	China	45 (2,01%)
Southeast University	Bangladesh	40 (1,78%)
Beijing University of Technology	China	38 (1,69%)
University of Leeds	England	33 (1,47%)
University College London	England	30 (1,34%)
University of Belgrade	Serbia	26 (1,16%)
Technical University of Denmark	Denmark	24 (1,07%)

Source: Own elaboration with Bibliometrix data.

It has been noted that institutions in China and Europe have been the primary focus of concern for assistance in decision-making processes in sustainable transportation management.

Most influential magazines

Table 3 shows the journals with the highest number of publications, as well as their citations and ranking in relation to these indicators. It is important to note that Sustainability is the journal with the highest number of publications, with a total of 115. However, the most cited journal is Transportation Research Part A: Policy and Practice, with a total of 3,216 citations. It should be noted that the ten journals with the highest production represent only 23.23% of the total number of publications on this subject. The aforementioned confirms that decision-making processes for transportation management have primarily been a concern of researchers in the areas of sustainability with a multidisciplinary approach to transportation-related issues, although this scenario has not been unfamiliar or new to transportation researchers.

Most recognized authors

Tabel 4 presents the most relevant authors in the subject, analyzing two aspects: i) authors with the highest number of publications and ii) most cited authors. It can be seen that, except for Moslem S, who leads the list of authors with the highest number of publications and occupies fourth place among the most cited authors, there are no significant coincidences between the two lists (publications vs citations). On the other hand, Owen N stands out as the most cited author, with a total of 761 citations.

doi: 10.25100/iyc.v27i1.14497

Table 3. Journals with the highest publication of related articles

Magazine	Documents	Citations	
		Ranking	Total
Sustainability (Switzerland)	115 (5,13%)	3	1.662 (4,46%)
Transportation Research Part A: Policy and Practice	84 (3,74%)	1	3.216 (8,63%)
Transportation Policy	67 (2,99%)	2	2.213 (5,94%)
Journal of Transport Geography	46 (2,05%)	4	1.330 (3,57%)
Transportation Research Part D: Transport and Environment	40 (1,78%)	7	1.139 (3,06%)
Transportation Research Record	38 (1,69%)	25	270 (0,72%)
Transportation	34 (1,52%)	8	1.110 (2,98%)
Sustainable Cities and Society	33 (1,47%)	14	533 (1,43%)
International Journal of Sustainable Transportation	32 (1,43%)	15	526 (1,41%)
Transportation Research Part C: Emerging Technologies	32 (1,43%)	8	1.195 (3,21%)

Source: Own elaboration with Bibliometrix data.

Table 4. Most relevant authors

Authors	Documents
Moslem S.	27 (1,20%)
Duleba S.	26 (1,16%)
Li X.	17 (0,76%)
Deveci M.	16 (0,71%)
Li J.	13 (0,58%)
Pamucar D.	13 (0,58%)
Chen Y.	12 (0,53%)
Wang Z.	12 (0,53%)
Cats O.	11 (0,49%)
Wang J.	11 (0,49%)

Authors	Citations
Owen N.	761 (2,04%)
Badland H.	750 (2,01%)
Giles-Corti B.	750 (2,01%)
Moslem S.	713 (1,91%)
Dannenberg Al.	712 (1,91%)
Foster S.	712 (1,91%)
Lowe M.	712 (1,91%)
Reis R.	712 (1,91%)
Sallis Jf.	712 (1,91%)
Stevenson M.	712 (1,91%)

Source: Own elaboration with Bibliometrix data.

Most influential countries

Table 5 presents the list of countries with the highest scientific production in the filed, along with the citations received and the corresponding ranking. Notably, China leads in scientific production with 1,118 published articles, accounting for 49.84% of the total scientific output. Regarding citations, this country maintains its leadership, although not as convincingly as in the number of publications.

Figure 4 illustrates the collaboration networks between countries. The size of the ellipses represents the level of scientific production in the field, the colors indicate the clusters formed by the research relationships, and the lines represent the collaboration between countries. A total of 45 countries were identified, grouped into five clusters. One cluster led by China and the United States of America stands out, as well as another cluster led by the United Kingdom and Germany. In addition, there is significant co-authorship between the United Kingdom and China.

doi: 10.25100/iyc.v27i1.14497

Table 5. Countries with the highest production of articles

Country	Documents	Citations	
		Ranking	Total
China	1.118 (49,84%)	1	3.993 (10,71%)
United Kingdom	451 (20,11%)	2	3.317 (8,90%)
United States of America	428 (19,08%)	3	2.844 (7,63%)
Australia	322 (14,36%)	4	2.480 (6,65%)
Germany	290 (12,93%)	10	961 (2,58%)
Italy	274 (12,22%)	9	1.085 (2,91%)
Spain	249 (11,10%)	6	1.307 (3,51%)
India	228 (10,16%)	13	770 (2,07%)
Netherlands	222 (9,90%)	5	1.934 (5,19%)
France	164 (7,31%)	19	444 (1,19%)

Source: Own elaboration with Bibliometriz data.

Figure 4. Collaboration networks between countries. Source: Own elaboration with Bibliometrix

Colombia is part of the cluster led by Spain and Italy, showing collaboration mainly with Spain and the United Kingdom. The collaboration network shows the leadership of China in the development of knowledge in this field, determined by a greater scientific production complemented by a wide collaboration network with other leading countries in the field such as the United Kingdom, the United States of America, Australia, etc. There is little scientific production from regions with accelerated urbanization processes such as Latin America and Africa.

Topics and Research Lines

The evolution of related scientific production allowed for the identification of three distinct periods.

doi: 10.25100/iyc.v27i1.14497

In the first period, spanning from 1975 to 2000, limited research focused on decision-making aspects, public transportation and the study of urban areas. In the second period, between 2001 and 2012, scientific interest shifted toward public transportation and sustainable development. New topics began to emerge, such as sustainable transportation, geographic information systems [GIS] and infrastructure. Finally, in the most recent period, studies continued to focus on public transportation and sustainability, while multi-criteria decision analysis [MCDA] was introduced as an emerging research topic. See Figure5

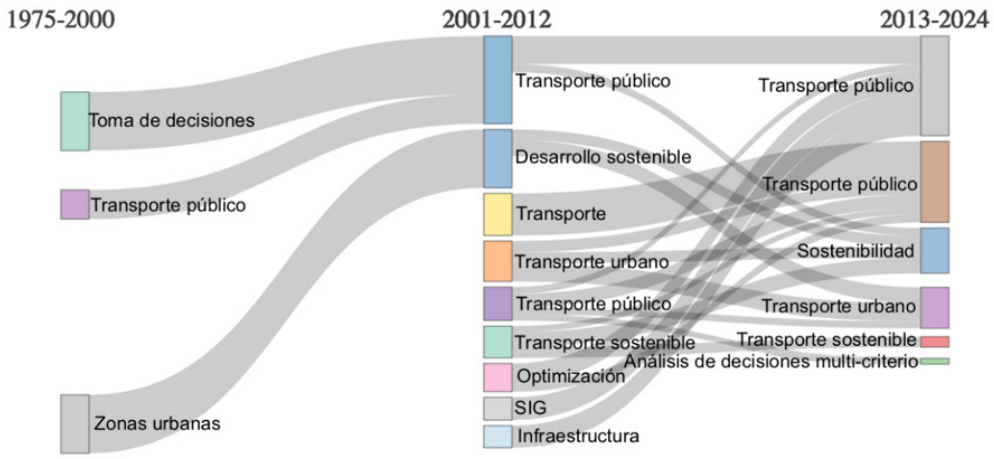


Figure 5. Evolution of research topics. Source: Own elaboration with Bibliometrix

The use of MCDA methods in recent years, together with the growing concern for sustainability and urban transportation, have strengthened the importance given to public transport in the sustainable development of urban environments and the need for decision-making support tools capable of integrating the different aspects of sustainability (2-5).

Figure6 illustrates the co-occurrence network of terms in related research, identifying five keyword clusters that have shaped the field. The first cluster focuses on public transportation, where the study of accessibility and sustainable mobility has been highly relevant. Additionally, aspects such as the built environment, equity and the use of technologies like GIS and big data stand out. The second identified cluster is related to sustainability. The most relevant aspects are urban transportation, transportation planning and decision-making. The third cluster is associated with sustainable transportation, with key aspects including user satisfaction analysis, transportation policies, multi-criteria decision-making and smart cities. The fourth cluster refers to decision-making, with a primary focus on public transportation, analytical hierarchy process [AHP] and transportation planning. Lastly, the fifth cluster focuses transport studies, where AHP and multi-criteria decision-making play a central role.

doi: 10.25100/iyc.v27i1.14497

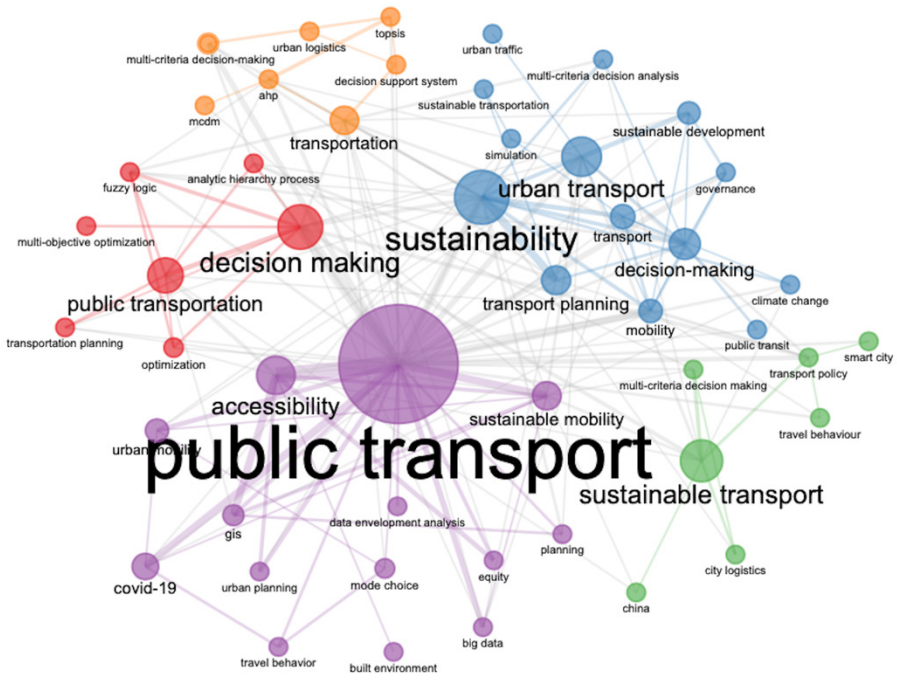


Figure 6. Keyword co-occurrence network in research. Source: Own elaboration with Bibliometrix

The research co-occurrence network ratifies the importance of public transportation in achieving sustainable transportation, sustainable mobility, accessibility and sustainability. Additionally, research on decision-support tools has focused on analyzing issues related to public transportation and sustainability. It should be mentioned that despite the fact that the relationship between public transportation and factors like equity, GIS, accessibility, and simulations has been well examined, it has not been addressed in the scientific literature when it comes to decision-making.

Table 6 presents the decision-support tools addressed in the 65 selected documents. It is observed that MCDA is the most addressed method in the scientific literature with 23 articles, followed by analytical hierarchy processes [AHP] with 14 articles. In addition, there is evidence of a growing concern of researchers to involve stakeholders as reflected in 12 articles identified with this theme. However, the use of technologies in decision-making processes still requires further research, as reflected in the low number of articles related to intelligent systems, spatial analysis, and accessibility.

doi: 10.25100/iyc.v27i1.14497

Table 6. Decision-Support Tools Used in Scientific Production.

Evaluation Approach	Number of Documents	Scientific Production
Cost-benefit analysis [CBA]	2	(2), (20)
Multi Criteria Decision Analysis [MCDA]	23	(21), (22), (23), (24), (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), (35), (36), (37), (2), (38), (39), (40), (41)
Spatial analysis and accessibility	5	(42), (43), (44), (45), (46)
General aspects	6	(13), (14), (15), (5), (47), (16)
Governance and participation	12	(38), (39), (40), (48), (49), (50), (51), (52), (53), (54), (55), (56)
Sustainability indexes	2	(57), (58)
Analytic Hierarchy Process [AHP]	14	(41), (59), (60), (61), (62), (63), (64), (65), (66), (67), (68), (69), (70), (56)
Intelligent systems	5	(71), (72), (73), (74), (75)

Source: Own elaboration.

On the However, the scientific community has shown little interest in using the traditional CBA method as a decision-making tool for achieving transport sustainability in recent years. This is likely because, even though significant progress has been made in determining the monetary values of non-traded effects in real markets, such as social or environmental ones, it is still challenging to obtain accurate estimates or even acceptable approximations for significant effects on humans, such as the value of biodiversity and a unique landscape, among others (6).

Discussion and conclusion

Although the topics have evolved over time, aspects related to public transportation have been a constant concern for the scientific community. In addition, sustainability, sustainable transportation, and decision-making, have emerged in recent years as the four main research lines. Although research has jointly addressed issues such as sustainability and decision-making, public transportation and sustainable mobility, or decision-making and public transportation, they still require further research that comprehensively addresses the decision-making processes that contribute to sustainable transportation.

The bibliometric review identifies a gap in the literature regarding the use of accessibility, GIS, equity and simulations as decision-support tools in sustainable transportation management. Therefore, further research is needed to understand and integrate these elements into decision-making processes, given their potential to assess the integration of transportation and land use, consider the location of vulnerable populations, analyze the spatial distribution of impacts, and take advantage of new technologies, elements that are fundamental to achieve the transition of transportation towards sustainability.

The low participation of Latin American and African countries in related scientific production is evident, regions whose urbanization process has been described as an urban explosion (76), a

doi: 10.25100/iyc.v27i1.14497

situation that is evidenced by the fact that while Europe took 123 years to double its population, Latin America did it in 31 years and Africa in 27 years (77). This is why further research is needed to define conceptual frameworks to support decision-making adapted to the urban context of developing countries, especially in regions such as Latin America and Africa.

Scientific research shows a trend toward the search for evaluation frameworks for transportation policies, programs and projects to better manage the complex situations and unexpected consequences of the sector (2). These frameworks consider the dynamic and interdisciplinary nature of transport systems (9) in decision-making processes, with the objective of ensuring that plans and activities contribute to sustainable development. However, it is necessary to move towards the definition of frameworks to assist in decision-making to include the social, economic, environmental and spatial dimensions, as well as the participation of stakeholders, so that transport management contributes to sustainable development as defined by UN-Habitat (4).

The MCDA methods and index construction have established themselves as powerful tools that go beyond the economic and aggregated perspective of the CBA method, which tends to overlook the social and environmental effects of projects (6). These methodologies allow for the incorporation of environmental, social, economic and spatial aspects into a series of indicators, indexes and sub-indexes, enabling the production and communication of relevant information for decision-makers and stakeholders.

Similarly, the literature highlights significant progress in implementing methods that strengthen governance processes and citizen participation. This is achieved through analytic hierarchy processes that engage various stakeholders, including decision-makers, experts and citizens. These processes contribute significantly to the sustainability of transportation plans and projects. Additionally, the use of accessibility measures and GIS has enabled more in-depth spatial analyses of the effects of transportation programs and projects. This facilitates a better understanding of the distribution of benefits and costs across territories, allowing for the incorporation of equity assessments in decision-making processes to identify impacts on disadvantaged population groups.

Lastly, it should be noted that the majority of decision-making tools for sustainable transportation management react to an objectivist approach. In order to ascertain whether conformist, adaptive, or reflexive approaches could promote citizen participation and the use of new technologies in the decision-making process, more research is necessary.

CRediT authorship contribution statement

Conceptualization - Ideas: Juan Carlos Orobio Quiñones, Jackeline Murillo-Hoyos, Ciro Jaramillo Molina. Data Curation: Juan Carlos Orobio. Formal analysis: Juan Carlos Orobio. Acquisition of funding: Juan Carlos Orobio. Investigation: Juan Carlos Orobio. Methodology: Juan Carlos Orobio. Project Management: Juan Carlos Orobio Quiñones, Jackeline Murillo-Hoyos, Ciro Jaramillo Molina. Resources: Universidad del Valle. Software: Universidad del Valle. Supervision: Jackeline Murillo-Hoyos, Ciro Jaramillo Molina. Validation: Juan Carlos Orobio Quiñones, Jackeline Murillo-Hoyos, Ciro Jaramillo Molina. Visualization - Preparation: Juan Carlos Orobio Quiñones, Daniel Eduardo Guzmán Rodríguez. Writing - original draft - Preparation: Juan Carlos Orobio Quiñones, Daniel

doi: 10.25100/iyc.v27i1.14497

Eduardo Guzmán Rodríguez, Jackeline Murillo-Hoyos, Ciro Jaramillo Molina. Writing - revision and editing - Preparation: Juan Carlos Orobio Quiñones, Daniel Eduardo Guzmán Rodríguez, Jackeline Murillo-Hoyos, Ciro Jaramillo Molina.

Funding: Universidad del Valle.

Conflict of interest: does not declare.

Etics Aspects: does not declare.

References

1. Meinard Y, Tsoukiàs A. On the rationality of decision aiding processes. Eur J Oper Res [Internet]. 2019;273(3):1074-84. Disponible en: https://doi.org/10.1016/j.ejor.2018.09.009

2. Marleau Donais F, Abi-Zeid I, Waygood EOD, Lavoie R. A review of cost-benefit analysis and multicriteria decision analysis from the perspective of sustainable transport in project evaluation. EURO Journal on Decision Processes. 1 de noviembre de 2019;7(3-4):327-58. https://doi.org/10.1007/s40070-019-00098-1

3. Suprayoga GB, Bakker M, Witte P, Spit T. A systematic review of indicators to assess the sustainability of road infrastructure projects. European Transport Research Review. 2020;12(1). https://doi.org/10.1186/s12544-020-0400-6

4. Programa de las Naciones Unidas para los Asentamientos Humanos (ONU-Habitat). La nueva agenda urbana. Hábitat y Sociedad. 2020. 1-194 p. Disponible en: https://onu-habitat.org/images/Publicaciones/Nueva-Agenda-Urbana-Ilustrada.pdf.

5. Nguyen TT, Brunner H, Hirz M. Towards a Holistic Sustainability Evaluation for Transport Alternatives. EUROPEAN JOURNAL OF SUSTAINABLE DEVELOPMENT. 2020;9(4):1-12. https://doi.org/10.14207/ejsd.2020.v9n4p1

6. De Brucker K, MacHaris C, Verbeke A. Multi-criteria analysis and the resolution of sustainable development dilemmas: A stakeholder management approach. Eur J Oper Res [Internet]. 2013;224(1):122-31. Disponible en: http://dx.doi.org/10.1016/j.ejor.2012.02.021

7. Munda G. Multiple criteria decision analysis and sustainable development. International Series in Operations Research and Management Science. 2005; 233:953-86. https://doi.org/10.1007/0-387-23081-5_23

8. Yannis G, Kopsacheili A, Dragomanovits A, Petraki V. State-of-the-art review on multi-criteria decision-making in the transport sector. Journal of Traffic and Transportation Engineering (English Edition) [Internet]. 2020;7(4):413-31. Disponible en: https://doi.org/10.1016/j.jtte.2020.05.005

9. Illahi U, Mir MS. Development of indices for sustainability of transportation systems: A review of state-of-the-art. Ecol Indic. noviembre de 2020;118. https://doi.org/10.1016/j.ecolind.2020.106760

10. Freudenberg M. Composite indicators of country performance: a critical assessment. OECD Science, Technology and Industry Working Papers [Internet]. 2003; 16:35. Disponible en: https://www.oecd.org/en/publications/composite-indicators-of-country-performance_405566708255.html

doi: 10.25100/iyc.v27i1.14497

11. Bueno PC, Vassallo JM, Cheung K. Sustainability Assessment of Transport Infrastructure Projects: A Review of Existing Tools and Methods. 2015;1647. Disponible en: https://doi.org/10.1080/01441647.2015.1041435

12. Tao C Chung, Hung CC. A Comparative Approach of the Quantitative Models for Sustainable Transportation. Journal of the Eastern Asia Society for Transportation Studies. 2003; 5:3329-44. Disponible en: https://easts.info/2003journal/papers/3329.pdf

13. Nikulina V, Simon D, Ny H, Baumann H. Context-adapted urban planning for rapid transitioning of personal mobility towards sustainability: A systematic literature review. Sustainability (Switzerland). 15 de febrero de 2019;11(4). https://doi.org/10.3390/su11041007

14. Awasthi A, Omrani H, Gerber P. Investigating ideal-solution based multicriteria decision-making techniques for sustainability evaluation of urban mobility projects. TRANSPORTATION RESEARCH PART A-POLICY AND PRACTICE. octubre de 2018; 116:247-59. https://doi.org/10.1016/j.tra.2018.06.007

15. Velasco Arevalo A, Gerike R. Sustainability evaluation methods for public transport with a focus on Latin American cities: A literature review. Int J Sustain Transp. 2023;17(11):1236-53. https://doi.org/10.1080/15568318.2022.2163208

16. Venter C, Leong WY. Workshop 6 report: Wider impacts of public transport and successful implementation of desirable and beneficial projects. RESEARCH IN TRANSPORTATION ECONOMICS. septiembre de 2018;69(SI):489-93. https://doi.org/10.1016/j.retrec.2018.08.006

17. Templier M, Paré G. A framework for guiding and evaluating literature reviews. Communications of the Association for Information Systems. 2015; 37:112-37. https://doi.org/10.17705/1CAIS.03706

18. Zemigala M. Tendencies in research on sustainable development in management sciences. J Clean Prod [Internet]. 2019; 218:796-809. Disponible en: https://doi.org/10.1016/j.jclepro.2019.02.009

19. Karner A. Assessing public transit service equity using route-level accessibility measures and public data. J Transp Geogr [Internet]. 2018;67(June 2017):24-32. Disponible en: https://doi.org/10.1016/j.jtrangeo.2018.01.005

20. Alogdianakis F, Dimitriou L. In-Depth Appraisal of Bus Transport Services for Sustainability Performance: A Cost-Benefit Analysis Approach. Transp Res Rec. 2023; https://doi.org/10.1177/03611981231190090

21. Pamu□ar D, Durán-Romero G, Yazdani M, López AM. A decision analysis model for smart mobility system development under circular economy approach. Socioecon Plann Sci. 1 de abril de 2023;86. https://doi.org/10.1016/j.seps.2022.101474

22. Lee DJ. A multi-criteria approach for prioritizing advanced public transport modes (APTM) considering urban types in Korea. Transp Res Part A Policy Pract. 1 de mayo de 2018; 111:148-61. https://doi.org/10.1016/j.tra.2018.02.005

doi: 10.25100/iyc.v27i1.14497

23. Broniewicz E, Ogrodnik K. A comparative evaluation of multi-criteria analysis methods for sustainable transport. Energies (Basel). 2 de agosto de 2021;14(16). https://doi.org/10.3390/en14165100

24. Goyal S, Agarwal S, Singh NSS, Mathur T, Mathur N. Analysis of Hybrid MCDM Methods for the Performance Assessment and Ranking Public Transport Sector: A Case Study. Sustainability (Switzerland). 1 de noviembre de 2022;14(22). https://doi.org/10.3390/su142215110

25. Alkharabsheh A, Moslem S, Oubahman L, Duleba S. An integrated approach of multi-criteria decision-making and grey theory for evaluating urban public transportation systems. Sustainability (Switzerland). 1 de marzo de 2021;13(5):1-15. https://doi.org/10.3390/su13052740

26. Ortega J, Moslem S, Palaguachi J, Ortega M, Campisi T, Torrisi V. An integrated multi criteria decision-making model for evaluating park-and-ride facility location issue: A case study for cuenca city in Ecuador. Sustainability (Switzerland). 1 de julio de 2021;13(13). https://doi.org/10.3390/su13137461

27. Kalifa M, Özdemir A, Özkan A, Banar M. Application of Multi-Criteria Decision analysis including sustainable indicators for prioritization of public transport system. Integr Environ Assess Manag. 1 de enero de 2022;18(1):25-38. https://doi.org/10.1002/ieam.4486

28. Damidavi□ius J, Burinskiene M, Antucheviciene J. Assessing sustainable mobility measures applying multicriteria decision-making methods. Sustainability (Switzerland). 1 de agosto de 2020;12(15). https://doi.org/10.3390/su12156067

29. Kolak O□, Feyzio□lu O, Noyan N. Bi-level multi-objective traffic network optimisation with sustainability perspective. Expert Syst Appl. 15 de agosto de 2018; 104:294-306. https://doi.org/10.1016/j.eswa.2018.03.034

30. Ueasin N. Decision-making on Public Transportation Services Based on the Socio-economic, Psychological, and Environmental Concern Factors. The Open Transportation Journal. 22 de abril de 2020;14(1):22-31. https://doi.org/10.2174/1874447802014010022

31. Gutiérrez LR, De Vicente Oliva MA, Romero-Ania A. Economic, Ecological and Social Analysis Based on DEA and MCDA for the Management of the Madrid Urban Public Transportation System. Mathematics. 1 de enero de 2022;10(2). https://doi.org/10.3390/math10020172

32. Kundu P, Görçün ÖF, Garg CP, Küçükönder H, Çanakçıo□lu M. Evaluation of public transportation systems for sustainable cities using an integrated fuzzy multi-criteria group decision-making model. Environ Dev Sustain. 2023. https://doi.org/10.1007/s10668-023-03776-y

33. Munjal R, Liu W, Li X, Gutierrez J, Chong PHJ. Multi-Attribute Decision-making for Energy-Efficient Public Transport Network Selection in Smart Cities. Future Internet. 1 de febrero de 2022;14(2). https://doi.org/10.3390/fi14020042

34. Wołek M, Jagiełło A, Wola□ski M. Multi□criteria analysis in the decision□making process on the electrification of public transport in cities in poland: A case study analysis. Energies (Basel). 1 de octubre de 2021;14(19). https://doi.org/10.3390/en14196391

doi: 10.25100/iyc.v27i1.14497

35. Turo K. Multi-Criteria Decision Analysis during Selection of Vehicles for Car-Sharing Services-Regular Users' Expectations. Energies (Basel). 1 de octubre de 2022;15(19). https://doi.org/10.3390/en15197277

36. Cie la M, Sobota A, Jacyna M. Multi-Criteria decision-making process in metropolitan transport means selection based on the sharing mobility idea. Sustainability (Switzerland). 1 de septiembre de 2020;12(17). https://doi.org/10.3390/su12177231

37. Romero-Ania A, Rivero Gutiérrez L, De Vicente Oliva MA. Multiple criteria decision analysis of sustainable urban public transport systems. Mathematics. 2 de agosto de 2021;9(16). https://doi.org/10.3390/math9161844

38. Nalmpantis D, Roukouni A, Genitsaris E, Stamelou A, Naniopoulos A. Evaluation of innovative ideas for Public Transport proposed by citizens using Multi-Criteria Decision Analysis (MCDA). European Transport Research Review. 1 de diciembre de 2019;11(1). https://doi.org/10.1186/s12544-019-0356-6

39. dos Santos JB, Lima JP. Quality of public transportation based on the multi-criteria approach and from the perspective of user's satisfaction level: A case study in a Brazilian city. Case Stud Transp Policy. septiembre de 2021;9(3):1233-44. https://doi.org/10.1016/j.cstp.2021.05.015

40. Barfod MB. Supporting sustainable transport appraisals using stakeholder involvement and mcda. Transport. 2018;33(4):1052-66. https://doi.org/10.3846/transport.2018.6596

41. Rivero Gutierrez L, De Vicente Oliva MA, Romero-Ania A. Managing Sustainable Urban Public Transport Systems: An AHP Multicriteria Decision Model. Sustainability. mayo de 2021;13(9). https://doi.org/10.3390/su13094614

42. Cavallaro F, Dianin A. An innovative model to estimate the accessibility of a destination by public transport. Transp Res D Transp Environ. 1 de marzo de 2020;80. https://doi.org/10.1016/j.trd.2020.102256

43. Song Y, Wu P, Hampson K, Anumba C. Assessing block-level sustainable transport infrastructure development using a spatial trade-off relation model. International Journal of Applied Earth Observation and Geoinformation. 25 de diciembre de 2021;105. https://doi.org/10.1016/j.jag.2021.102585

44. ochowska R, Kłos MJ, Soczówka P, Pilch M. Assessment of Accessibility of Public Transport by Using Temporal and Spatial Analysis. Sustainability (Switzerland). 1 de diciembre de 2022;14(23). https://doi.org/10.3390/su142316127

45. Liu R, Chen Y, Wu J, Xu T, Gao L, Zhao X. Mapping spatial accessibility of public transportation network in an urban area - A case study of Shanghai Hongqiao Transportation Hub. Transp Res D Transp Environ. 1 de marzo de 2018; 59:478-95. https://doi.org/10.1016/j.trd.2018.01.003

46. Curtis C, Ellder E, Scheurer J. Public transport accessibility tools matter: A case study of Gothenburg, Sweden. Case Stud Transp Policy. 1 de marzo de 2019;7(1):96-107. https://doi.org/10.1016/j.cstp.2018.12.003

doi: 10.25100/iyc.v27i1.14497

47. Wey WM, Huang JY. Urban sustainable transportation planning strategies for livable City's quality of life. Habitat Int. 1 de diciembre de 2018;82:9-27. https://doi.org/10.1016/j.habitatint.2018.10.002

48. de Paula L, Silva Marins FA. Algorithms applied in decision-making for sustainable transport. J Clean Prod. marzo de 2018; 176:1133-43. https://doi.org/10.1016/j.jclepro.2017.11.216

49. Carteni A, D'Acierno L, Gallo M. A Rational Decision-Making Process with Public Engagement for Designing Public Transport Services: A Real Case Application in Italy. Sustainability. agosto de 2020;12(16). https://doi.org/10.3390/su12166303

50. Sagaris L. Citizen participation for sustainable transport: Lessons for change from Santiago and Temuco, Chile. Research in Transportation Economics. 1 de septiembre de 2018; 69:402-10. https://doi.org/10.1016/j.retrec.2018.05.001

51. Wann-Ming W. Constructing urban dynamic transportation planning strategies for improving quality of life and urban sustainability under emerging growth management principles. Sustain Cities Soc. 1 de enero de 2019; 44:275-90. https://doi.org/10.1016/j.scs.2018.10.015

52. Zhang C, Hu Y, Lu W. EVALUATING-THE-COMPREHENSIVE-BENEFIT-OF-PUBLIC-TRANSPORT-SERVICE--THE-PERSPECTIVE-OF-THREE-STAKEHOLDERSPromet--Traffic--Traffico. Traffic&Transportation. 2021; 34:179-93. https://doi.org/10.7307/ptt.v34i2.3855

53. Zhang L, Yuan J, Gao X, Jiang D. Public transportation development decision-making under public participation: A large-scale group decision-making method based on fuzzy preference relations. Technol Forecast Soc Change. 1 de noviembre de 2021;172. https://doi.org/10.1016/j.techfore.2021.121020

54. Ogryzek M, Krupowicz W, Sajnog N. Public Participation as a Tool for Solving Socio-Spatial Conflicts of Smart Cities and Smart Villages in the Sustainable Transport System. Remote Sens (Basel). diciembre de 2021;13(23). https://doi.org/10.3390/rs13234821

55. Ghorbanzadeh O, Moslem S, Blaschke T, Duleba S. Sustainable Urban Transport Planning Considering Different Stakeholder Groups by an Interval-AHP Decision Support Model. Sustainability. enero de 2019;11(1). https://doi.org/10.3390/su11010009

56. Duleba S. AN AHP-ISM APPROACH FOR CONSIDERING PUBLIC PREFERENCES IN A PUBLIC TRANSPORT DEVELOPMENT DECISION. TRANSPORT. 2019;34(6):662-71. https://doi.org/10.3846/transport.2019.9080

57. Abdulwahab AM, Ismael NT, Altameemi WTM, Musa HS. Proposed Sustainable Indicators to Assess Transport Sustainability in Baghdad City. International Journal of Sustainable Development and Planning. 1 de abril de 2023;18(4):1103-11. https://doi.org/10.18280/ijsdp.180413

58. Ghafouri-Azar M, Diamond S, Bowes J, Gholamalizadeh E. The sustainable transport planning index: A tool for the sustainable implementation of public transportation. Sustainable Development. 1 de agosto de 2023;31(4):2656-77. https://doi.org/10.1002/sd.2537

doi: 10.25100/iyc.v27i1.14497

59. Xinlei M, Wen C, Zhan G, Tao Y. Adaptive decision support model for sustainable transport system using fuzzy AHP and dynamical Dijkstra simulations. Mathematical Biosciences and Engineering. 2022;19(10):9895-914. https://doi.org/10.3934/mbe.2022461

60. Tsami M, Adamos G, Nathanail E, Budilovich (Budilovica) E, Yatskiv (Jackiva) I, Magginas V. A DECISION TREE APPROACH FOR ACHIEVING HIGH CUSTOMER SATISFACTION AT URBAN INTERCHANGES. TRANSPORT AND TELECOMMUNICATION JOURNAL. septiembre de 2018;19(3, SI):194-202. https://doi.org/10.2478/ttj-2018-0016

61. Moslem S, Celikbilek Y. An integrated grey AHP-MOORA model for ameliorating public transport service quality. EUROPEAN TRANSPORT RESEARCH REVIEW. diciembre de 2020;12(1). https://doi.org/10.1186/s12544-020-00455-1

62. Kutlu Gündo□du F, Duleba S, Moslem S, Aydın S. Evaluating public transport service quality using picture fuzzy analytic hierarchy process and linear assignment model. Appl Soft Comput. 1 de marzo de 2021;100. https://doi.org/10.1016/j.asoc.2020.106920

63. Duleba S, Moslem S. Examining Pareto optimality in analytic hierarchy process on real Data: An application in public transport service development. Expert Syst Appl. febrero de 2019; 116:21-30. https://doi.org/10.1016/j.eswa.2018.08.049

64. Pham TXT, Nguyen NT, Duong LBT. Hierarchy-attribute decision-making regarding public buses and private motorbikes: a case study in Ho Chi Minh City, Vietnam. PUBLIC TRANSPORT. marzo de 2021;13(1):233-49. https://doi.org/10.1007/s12469-020-00256-8

65. Tumsekcali E, Ayyildiz E, Taskin A. Interval valued intuitionistic fuzzy AHP-WASPAS based public transportation service quality evaluation by a new extension of SERVQUAL Model: P-SERVQUAL 4.0. Expert Syst Appl. diciembre de 2021;186. https://doi.org/10.1016/j.eswa.2021.115757

66. Duleba S. Introduction and comparative analysis of the multi-level parsimonious AHP methodology in a public transport development decision problem. JOURNAL OF THE OPERATIONAL RESEARCH SOCIETY. 2022; 73:230-43. https://doi.org/10.1080/01605682.2020.1824553

67. Lin G, Xu H, Wang S, Lin C, Huang C. Performance Optimisation of Public Transport Networks Using AHP-Dependent Multi-Aspiration-Level Goal Programming. Energies (Basel). 1 de septiembre de 2022;15(17). https://doi.org/10.3390/en15176479

68. Cyril A, Mulangi RH, George V. Performance Optimization of Public Transport Using Integrated AHP-GP Methodology. Urban Rail Transit. junio de 2019;5(2):133-44. https://doi.org/10.1007/s40864-019-0103-2

69. Hamurcu M, Eren T. Strategic Planning Based on Sustainability for Urban Transportation: An Application to Decision-Making. Sustainability. mayo de 2020;12(9). https://doi.org/10.3390/su12093589

70. Jasti PC, Ram VV. Sustainable benchmarking of a public transport system using analytic hierarchy process and fuzzy logic: a case study of Hyderabad, India. PUBLIC TRANSPORT. octubre de 2019;11(3):457-85. https://doi.org/10.1007/s12469-019-00219-8

doi: 10.25100/iyc.v27i1.14497

71. Deveci M, Mishra AR, Gokasar I, Rani P, Pamucar D, Ozcan E. A Decision Support System for Assessing and Prioritizing Sustainable Urban Transportation in Metaverse. IEEE Transactions on Fuzzy Systems. 1 de febrero de 2023;31(2):475-84. https://doi.org/10.1109/TFUZZ.2022.3190613

72. Luo XG, Zhang HB, Zhang ZL, Yu Y, Li K. A new framework of intelligent public transportation system based on the internet of things. IEEE Access. 2019; 7:55290-304. https://doi.org/10.1109/ACCESS.2019.2913288

73. Rodriguez Gonzalez AB, Vinagre Diaz JJ, Wilby MR, Fernandez Pozo R. Data-Driven Performance Evaluation Framework for Multi-Modal Public Transport Systems. SENSORS. enero de 2022;22(1). https://doi.org/10.3390/s22010017

74. Fumagalli LAW, Rezende DA, Guimarães TA. Data Intelligence in Public Transportation: Sustainable and Equitable Solutions to Urban Modals in Strategic Digital City Subproject. Sustainability (Switzerland). 1 de abril de 2022;14(8). https://doi.org/10.3390/su14084683

75. Reyes-Rubiano L, Serrano-Hernandez A, Montoya-Torres JR, Faulin J. The Sustainability Dimensions in Intelligent Urban Transportation: A Paradigm for Smart Cities. Sustainability. octubre de 2021;13(19). https://doi.org/10.3390/su131910653

76. Montero L, García J. Panorama multidimensional del desarrollo urbano en América Latina y el Caribe [Internet]. Comisión Económica para América Latina y el Caribe (CEPAL). 2017. Disponible en: http://repositorio.cepal.org/bitstream/handle/11362/41974/S1700257_es.pdf?sequence=1&isAllowed=y

77. Montoya JW. Cambio urbano y evolución discursiva en el análisis de la ciudad latinoamericana: de la dependencia a la globalización [Internet]. Vol. 91, Universidad Nacional de Colombia. 2006. 96 p. Disponible en: https://repositorio.unal.edu.co/handle/unal/2868

doi: 10.25100/iyc.v27i1.14497