

Urban Planning and Transport indicators: a comparative analysis of three Brazilian experiences

Indicadores de Planejamento Urbano e Transportes: análise comparativa de três experiências brasileiras

Indicadores de Planificación Urbana y Transporte: análisis comparativo de tres experiencias brasileñas

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Abstract

This article compares three Brazilian experiences in using indicators for urban and transport planning – *Índice de Mobilidade Urbana Sustentável* (IMUS), *Sistema de Indicadores de Percepção Social* (SIPS), and *Projeto Indicadores* from the Ministry of Transport. The assessment considers thematic representativeness, methodological structure, data-collection feasibility, measurability, and practical applicability in public management. The analysis indicates that IMUS offers a broad view of sustainable urban mobility but requires a large volume of data and lacks clear operational guidelines. SIPS captures citizens' perceptions; however, its discontinuity and lack of standardization limit time-series comparisons. The Indicator Project stands out for conceptual consistency, a well-defined semantic network, and precise guidance, aligning with results-oriented management. The conclusion is that effectiveness depends on technical quality and the institutional capacity to update and apply data throughout the policy cycle.

Keywords: Indicator systems; Sustainable Urban Mobility Index (IMUS); Social Perception Indicator System (SIPS); Indicator Project.

Resumo

Este artigo compara três experiências brasileiras no uso de indicadores para o planejamento urbano e de transportes – *Índice de Mobilidade Urbana Sustentável* (IMUS), *Sistema de Indicadores de Percepção Social* (SIPS) e *Projeto Indicadores* do Ministério dos Transportes. A avaliação considera representatividade temática, estrutura metodológica, viabilidade de coleta, mensurabilidade e aplicabilidade prática na gestão pública. A análise evidencia que o IMUS propõe uma visão ampla da mobilidade urbana sustentável, mas exige grande volume de dados e carece de diretrizes operacionais claras. O SIPS capta a percepção cidadã, porém sua descontinuidade e a falta de padronização limitam comparações temporais. O Projeto Indicadores destaca-se pela consistência conceitual, rede semântica bem definida e orientações precisas, alinhando-se à gestão por resultados. Conclui-se que a efetividade depende da qualidade técnica e da capacidade institucional de atualizar e aplicar dados no ciclo de políticas.

Palavras-Chave: Sistemas de indicadores; Índice de Mobilidade Urbana Sustentável (IMUS); Sistema de Indicadores de Percepção Social (SIPS); Projeto Indicadores.

Resumen

Este artículo compara tres experiencias brasileñas en el uso de indicadores para la planificación urbana y del transporte – *Índice de Mobilidade Urbana Sustentável* (IMUS), *Sistema de Indicadores de Percepção Social* (SIPS), y el *Projeto Indicadores* del Ministerio de Transporte. La evaluación considera la representatividad temática, la estructura metodológica, la viabilidad de recolección de datos, la mensurabilidad y la aplicabilidad práctica en la gestión pública. El análisis muestra que el IMUS ofrece una visión amplia de la movilidad urbana sostenible, pero exige un gran volumen de datos y carece de directrices operativas claras. El SIPS capta la percepción ciudadana; sin embargo, su discontinuidad y la falta de estandarización limitan las comparaciones temporales. El Proyecto Indicadores se destaca por su coherencia conceptual, una red semántica bien definida y orientaciones precisas, alineándose con la gestión orientada a resultados. Se concluye que la efectividad depende de la calidad técnica y de la capacidad institucional para actualizar y aplicar los datos a lo largo del ciclo de políticas públicas.

Palabras-clave: Sistemas de indicadores; Índice de Movilidad Urbana Sostenible (IMUS); Sistema de Indicadores de Percepción Social (SIPS); Proyecto Indicadores.

1 Introduction

Diagnostic and monitoring instruments are fundamental in urban planning, as they make it possible to assess current conditions, identify problems, and support decision-making. In this context, indicators emerge as a key support tool by condensing complex information into simpler metrics, thereby enabling interpretation by the actors involved in the process (Pourre, 2020). A well-designed indicator system can present the main characteristics of a given phenomenon of interest in a clear manner, serving as a basis for tracking targets and policies and facilitating the communication of results to both decision-makers and society at large.

In recent decades, several initiatives in Brazil have sought to develop indicator systems to assess urban and transport-related aspects. This article focuses on three representative experiences in this field: (1) the Sustainable Urban Mobility Index (IMUS), conceived in the academic sphere to measure how sustainable mobility is in cities; (2) the Social Perception Indicator System (SIPS), a nationwide survey conducted by the Institute for Applied Economic Research (IPEA) aimed at capturing the population's assessment of public services and policies, including urban mobility; and (3) the Indicators Project of the Ministry of Transport, the result of an integrated methodology developed in partnership with the University of Brasília to create a set of performance indicators for the transport sector at the national level. Each initiative emerged with distinct purposes and in specific contexts, which suggests different structures and varying degrees of success in practical application: IMUS, seeking a composite index of urban sustainability; SIPS, oriented toward citizen perception across multiple themes; and the Indicators Project, focused on policy-relevant results in the national transport sector.

This article systematizes the main findings of Pourre's (2020) master's dissertation, a study that evaluated indicator systems based on widely recognized criteria – such as representativeness, methodological structure, feasibility of data collection, measurability, and applicability in public management – with the objective of verifying the extent to which each system meets desirable requirements to guide decision-making in the urban context. In addition, the dissertation applied, at the local scale, the system developed in the Indicators Project, thereby demonstrating its adaptability to local planning. The comparative analysis presented here thus seeks to organize these findings in an integrated way, contributing to the improvement of indicator use in Brazilian urban and regional planning.

The next section presents the theoretical framework underpinning the analysis. This is followed by a detailed description of the methodology adopted in the comparative study. Subsequently, the results of the evaluation of each initiative and their comparison are discussed, highlighting advantages, limitations, and opportunities for improvement. Finally, the conclusions are presented, synthesizing the main findings and emphasizing recommendations for the development of effective indicators to support urban and regional planning.

2 Theoretical framework

Indicators are commonly defined as sets of quantifiable data that represent, in a simplified way, certain phenomena or dimensions of interest, serving as proxies to measure performance or progress in a given area. An indicator is derived from raw data, as noted by Segnestam (2003), and may be based on an absolute figure that has not yet undergone statistical treatment. When aggregated or analyzed comparatively, indicators provide synthesized information that facilitates understanding of the reality under analysis and supports decision-making processes.

Indicators perform several essential functions in the context of planning and public management. Royuela (2001) emphasizes that a good indicator should, among other functions: (i) provide pertinent information on the problems under focus; (ii) support the development of policies and the establishment of priorities by identifying key factors; (iii) enable the monitoring of implemented actions (especially integrated policy actions); and (iv) serve as an instrument for disseminating information at all levels. In sum, well-designed indicators not only reflect aspects of reality but also guide interventions and make it possible to verify results over time.

In addition, the literature proposes desirable attributes that qualify a “good” indicator, that is, minimum conditions for indicators to be accepted as a reliable reference in decision support. According to guidelines from the Organisation for Economic Co-operation and Development (OECD, 2002), translated by Magalhães (2004), the requirements of an effective indicator can be grouped into three main dimensions:

- *Relevance for policy-making*: The indicator should be representative of the phenomenon it intends to measure, capturing its main dimensions in a balanced way. It should also prioritize simplicity, so as to be easily understood, and be capable of capturing changes over time, reflecting real variations in the situation. Ideally, relevant indicators also allow comparisons, whether at the international level or between different contexts, and have sufficiently broad scope to cover the essential aspects of the theme. Finally, it is desirable that reference values exist (targets, standards, or benchmarks) to give meaning to the observed values, thereby facilitating the interpretation of what constitutes “good” or “poor” performance.
- *Suitability for analysis and scientific basis*: A good indicator should be conceptually well grounded in consolidated scientific or technical knowledge, thereby ensuring its validity and rigor. Ideally, it should be aligned with international standards and there should be some degree of consensus regarding its definition, which enhances its credibility and comparability. Moreover, indicators need to be analytically useful, that is, capable of feeding analytical models, simulations, or information systems, thus expanding their potential use in more complex quantitative assessments.
- *Measurability and practical feasibility*: An indicator must be practically measurable, which requires feasibility in terms of the time and resources available to collect and process the necessary data. In other words, there is little value in defining ideal indicators if the data required are too costly or time-consuming to obtain. It is also crucial that data and methodologies be well documented and transparent, allowing for reproducibility and reliability of results. Finally, a good indicator must be updated at regular intervals, ensuring continuous monitoring and the detection of trends or policy impacts over time.

In line with the above criteria, other Brazilian authors emphasize similar points. Jannuzzi (2004), in his studies on social indicators, highlights the importance of conceptual clarity, political relevance, and ease of communication, whereas Machado (2004) underscores the need for performance indicators to be linked to clear objectives and subject to independent verification. Thus, there is a convergence of views that effective indicators should balance meaning (representativeness, relevance), grounding (methodological consistency), and practicality (feasibility of measurement and updating).

A critical aspect, particularly relevant for indicators applied to urban planning, is the quality of the underlying data. Accurate, reliable, and appropriate input data are a prerequisite for useful indicators. It is further recommended that data come from trustworthy sources and adequately represent the context under study. Data collection procedures must also meet standards of rigor, ensuring that the indicator reflects reality rather than introducing bias. In this sense, the operational and economic feasibility of data collection is an integral part of indicator assessment: indicators that require “numerous data inputs with complex procedures” may become difficult to apply in practice (Pourre, 2020). Thus, data quality and accessibility directly influence the potential of an indicator system to be implemented in a sustainable manner.

Accordingly, the theoretical framework indicates that the evaluation of indicator systems should consider: (a) whether they adequately cover the phenomena they are intended to measure (thematic coverage and representativeness); (b) whether they are supported by solid conceptual bases and transparent methods; (c) whether they are practically measurable, given the available resources and data; and (d) whether they effectively contribute to monitoring and decision-making – which requires indicators that are relevant, accessible, and updatable. The following section details how the comparative analysis of the three Brazilian experiences was conducted in light of these principles.

3 Methodology

This research is characterized as a comparative qualitative study, based on documentary and bibliographic analysis. The study adopted as its analytical corpus three Brazilian indicator systems – IMUS, SIPS, and the Indicators Project – selected according to explicit criteria of: (i) technical and institutional relevance in the field of urban and transport planning; (ii) existence of systematized primary documentation; and (iii) representativeness of distinct conceptual approaches (sustainability, social perception, and results-oriented management). This selection defines the analytical scope and ensures comparability among methodologically heterogeneous objects that are nonetheless aligned with the objective of evaluating instruments that support public decision-making.

As a starting point, the original documents and associated literature for each initiative were examined – including Costa’s (2008) dissertation on IMUS, the IPEA technical publication on SIPS (IPEA, 2014), and the methodological report of the Indicators Project prepared within the Ministry of Transport (Brasil, 2007) – as well as the secondary analysis developed in Pourre’s (2020) master’s dissertation, from which the systematic assessments of the three experiences used in this article were drawn.

The comparison between the systems was guided by a set of criteria derived from consolidated references in the literature, notably OECD (2002), Jannuzzi (2004), Machado

(2004), and Brasil (2007). These criteria, previously presented in the theoretical framework, were operationalized into four central dimensions:

- (i) *Thematic representativeness*: verifying whether the indicators cover the essential aspects of the phenomenon of urban mobility or the public policy under consideration;
- (ii) *Methodological structure and foundation*: examining how the indicators are organized, whether there is a hierarchical structure, use of weights, an underlying conceptual model or logical framework, and whether their development involved technical-scientific grounding;
- (iii) *Feasibility of data collection and measurability*: including the availability of existing data, the need for field surveys, estimated costs and efforts, and frequency of data collection. Likewise, verifying whether formulas and units of measurement are clearly defined and whether data can be quantified in a standardized manner; and
- (iv) *Urban applicability and decision support*: assessing whether the system has been or can be implemented in cities or regions, how easily this can be done, and in what ways it concretely supports decision-making processes and policy monitoring.

The comparison was conducted as follows: initially, each experience was described in light of the criteria listed above. Subsequently, a comparative analysis was carried out to highlight similarities and differences. Key information from each model was synthesized in an analytical matrix, ensuring uniformity in the evaluation.

It is important to emphasize that the present analysis is predominantly limited to information documented in the original studies and existing evaluations – it is not an empirical assessment of field performance, but rather a critical analysis based on theoretical criteria and documentary evidence. This approach makes it possible to identify potential advantages and intrinsic limitations of each indicator system, serving as input for academic and professional debates on how to improve these tools.

The next section presents the results and discussion, organized first around each experience considered and then followed by an integrative comparison among them.

4 Results and discussion

4.1 Sustainable Urban Mobility Index (IMUS)

IMUS was developed by Costa (2008) as a synthetic index designed to measure how sustainable urban mobility is in a given city. Its calculation is based on a hierarchical structure of criteria distributed across three dimensions – social, economic, and environmental – reflecting the premise that the sustainability of mobility involves these spheres. The original IMUS model comprises nine thematic domains (Accessibility, Environmental Aspects, Social Aspects, Political Aspects, Transport Infrastructure, Non-Motorized Modes, Integrated Planning, Traffic and Circulation, and Urban Transport Systems), unfolded into 37 specific themes and, in total, 87 individual indicators. Each individual indicator represents a performance measure or condition related to a theme, and these indicators are aggregated to compose results at the levels of theme, domain, dimension, and, ultimately, a single global index between 0 and 1 representing the city's overall performance in sustainable mobility.

The aggregation of indicators in IMUS is carried out through a system of relative weights assigned to each criterion. This allows the calculation of both the result for each dimension (social, economic, environmental) and the combined total index. The methodology thus assumes compensation among criteria: indicators with low performance may be offset by others with high values within a weighted average, without excluding any criterion from the calculation. This logic ensures that all domains and themes contribute to the index – the authors of IMUS argue that removing any theme could distort the assessment. On the other hand, such a compensation mechanism implies that excellent results in certain aspects may mask serious deficiencies in others, if no safeguards are in place, which is pointed out as a potential limitation of the approach.

With regard to representativeness, IMUS seeks to broadly encompass factors relevant to sustainable mobility. However, the relevance of some specific domains for capturing the phenomenon of mobility is questioned here. For instance, one may ask to what extent the existence of environmental impact studies, such as CO₂ emissions measurements, actually represents aspects of urban mobility itself. This issue suggests that, although the scope is comprehensive, not all indicators selected may be directly linked to the mobility experience or to the performance of the transport system, potentially including more indirect factors.

From the standpoint of methodological structure, IMUS provides definitions for its indicators and a clear hierarchical organization, but it does not make explicit a “semantic network” or integrative conceptual model (also known as a framework, which articulates indicators based on objectives, concepts, or logical relationships). The selection of indicators composing the index was carried out by combining an extensive review of existing indicators with indicators proposed in specialized workshops, totaling 645 indicators considered, of which 87 were selected based on the feasibility of data collection. This strategy sought technical legitimacy; however, as noted by Pourre (2020), it relied heavily on expert consultation, which implies a certain degree of subjectivity (“guesswork”) in the final selection. Furthermore, IMUS did not incorporate into its structure the possibility of disaggregating results by transport mode, by type of user/object transported (e.g., passengers vs. freight or bus vs. car), or by specific time periods (e.g., month or year). This absence of partial aggregations limits more targeted analyses – for example, it is not possible to derive from IMUS specific evidence on public versus private transport, or on a particular temporal interval, since the index is a single combination of many aspects (Pourre, 2020).

In terms of data collection feasibility and measurability, IMUS presents significant challenges. Because it encompasses 87 indicators, the volume of data required is extremely high, making the process of applying the index complex and labor-intensive. Costa (2008) proposed a classification of data availability as short, medium, or long term, and data quality as high, medium, or low for each indicator – combining these factors to indicate whether a given indicator was measurable in that context. However, the parameters distinguishing, for example, “high” from “medium” or “low” quality were not clearly defined. Thus, although there is an awareness of the importance of data quality, IMUS did not explicitly establish objective and transparent criteria for this assessment.

With respect to urban applicability and decision support, IMUS was conceived to be applied in cities. Its result – a single index between 0 and 1 – can be used to compare cities or to assess a city’s progress over time in terms of sustainable mobility. This capacity for synthesis in a single number is both a strength (because it facilitates communication with

decision-makers and society) and a weakness (due to the potential for excessive simplification and loss of nuance). Positive aspects include the fact that IMUS compiled a broad range of information sources and relevant indicators during its conception, offering a useful inventory of potential metrics for managers. Conversely, the lack of regular updates (IMUS did not become institutionalized as a periodically applied system, remaining largely an academic proposal) and the methodological gaps mentioned above limit its direct use as a tool for continuous management.

In summary, IMUS made an important contribution by proposing a comprehensive and integrated structure for assessing sustainable urban mobility, but it presents limitations in terms of analytical flexibility, practicality of data collection, and, consequently, effective application in the daily routine of urban planning, particularly for urban managers.

4.2 Social Perception Indicator System (SIPS)

SIPS is a household opinion survey created by IPEA in the early 2010s with the objective of generating primary data to inform public policies (IPEA, 2014). Three editions were conducted with different thematic focuses: the first (2010/2011) addressed justice, health, mobility, among others; the second (2011/2012) maintained mobility and added themes such as security and social assistance; and the third (2013/2014) focused on violence against women and telecommunications.

Each edition of SIPS therefore adopted a distinct thematic scope, combining a broad survey of multiple subjects. In addition to varying themes, SIPS also modified its sampling methodology over time: the first edition used quota sampling, while from the second edition onwards probabilistic sampling in three stages was adopted, thus enhancing national representativeness. This change brought greater statistical rigor, but SIPS never established a fixed set of indicators, varying instead according to the theme of each edition.

In terms of thematic representativeness, SIPS brings to light aspects of citizens' everyday experiences, which provides a valuable perspective that complements "objective" indicators with the dimension of perceived quality and public acceptance. On the other hand, as mentioned, the representativeness of SIPS is undermined by the lack of continuity: indicators captured in one edition may not be repeated in the next, making it difficult to track temporal trends (Pourre, 2020). This discontinuity means that SIPS does not establish a consistent time series for each topic; for example, questions on mobility in 2011 did not necessarily reappear in 2012 or 2014, preventing direct year-to-year comparison. For urban management, this is an important limitation, as mobility policies often require continuous monitoring of satisfaction and use over several years.

Analyzing the methodological structure, it is evident that SIPS does not constitute a single index or a fixed set of indicators, but rather a flexible system of topic-based surveys that exhibits certain weaknesses. Although the data are collected with statistical rigor, transparency is limited: raw SIPS microdata and detailed methodological information on question design are not fully disclosed to the public. IPEA's reports present aggregated results and some methodological notes, but the files made available by the Institute do not specify the methodologies underpinning the formulation of the questions and statements in the questionnaire. In other words, the process for constructing the perception indicators is not known in detail – for instance, whether questions validated in previous studies were adopted, whether extensive pre-testing was conducted, or which

criteria guided the inclusion of certain topics and the exclusion of others in each edition. This lack of documentation makes it difficult to scientifically assess the quality of SIPS indicators and constrains their reproducibility by other agencies or researchers, since there is no public SIPS manual that would allow the survey to be easily replicated in another location or period.

The feasibility of SIPS data collection depended largely on IPEA's operational and financial capacity to conduct large-scale household surveys. As a producer of primary data, IPEA internally assumed both methodological development and fieldwork through interviews (Pourre, 2020). This ensured control over the process and the quality of the data collected, but it also made SIPS highly centralized – other entities (for example, municipal governments or universities) would face difficulties applying exactly the same method without access to the original resources or sampling design. The irregular periodicity of the editions indicates that sustaining regular data collection was challenging for IPEA, possibly due to budgetary constraints or shifting institutional priorities.

In terms of measurability, SIPS indicators are essentially outcomes of closed-ended questions and are therefore easily quantifiable as percentages or satisfaction indices. It is important to emphasize, however, that the data produced are perceptions rather than objective measurements – for example, “perceived quality of transport” may diverge from objective indicators such as punctuality or crowding, while still being valid as an expression of public opinion. A critical point is that SIPS does not provide raw data on transport system performance, but rather information derived from opinion surveys. This means that its use in management requires combining it with other data: decision-makers may use SIPS to capture satisfaction levels or the importance attributed to certain aspects, but they will need other indicators (actual performance) to analyze causes or design interventions. Even so, from the standpoint of data quality, SIPS surveys were conducted with statistical rigor (particularly in the second and third editions), which lends credibility to the results reported for the population under study.

Regarding urban applicability and decision support, SIPS made an innovative contribution by incorporating the population's voice in a structured way into policy evaluation. In the field of urban mobility, this translates into better understanding users' demands and satisfaction levels, which is crucial for guiding improvements from the user's perspective. SIPS reports provided preliminary analyses by theme, enabling the identification, for example, of the percentage of the population dissatisfied with a given aspect or of which factor was considered a priority by citizens. Such information can help decision-makers prioritize actions that respond to social perceptions – for instance, if the majority evaluates safety in public transport negatively, policies in that direction may be emphasized.

However, the lack of regularity in SIPS undermined its potential as a continuous monitoring tool. To effectively support the public policy cycle, it would be desirable for such perception indicators to be updated periodically, so as to assess whether interventions have led to improvements in citizens' views. Moreover, because SIPS is conducted at the national scale, results are often aggregated by large regions or for the country as a whole. This provides a macro-level overview, but a municipal government, for example, may find it difficult to extract SIPS data that are specific to its city (unless the city is large enough to have its own subsample). In other words, local applicability is limited if the survey is not broken down to the municipal level. As far as is known, there has been no institutionalization of a “municipal SIPS” – the initiative remained centralized within IPEA.

In sum, SIPS adds the dimension of public perception to the discussion of urban indicators, offering valuable insights into how policies and services are experienced by citizens and fulfilling criteria of statistical representativeness of the population. Nevertheless, its discontinuity and lack of methodological openness make it difficult to incorporate SIPS consistently as an urban planning tool over time or to replicate it in other spheres. As an experience, it revealed both the potential of opinion surveys for urban governance and the institutional obstacles to maintaining them systematically.

4.3 Indicators Project of the Ministry of Transport

The Indicators Project, developed by the Ministry of Transport in partnership with the University of Brasília (CEFTRU), originated from a master's dissertation (Magalhães, 2004) and resulted, in 2011, in the proposal of a national system for evaluating public transport policies. Unlike IMUS (academic in origin) and SIPS (linked to IPEA), the Project was conceived within a governmental body, oriented explicitly toward public sector management.

A distinctive feature of this project was the development of a robust semantic scheme to underpin the indicators. This semantic scheme functions as the theoretical “backbone” of the indicator system, making explicit how each indicator relates to elements of the transport results chain. The system comprises 45 indicators, each with its definition, formula, variables, data sources, and target audience clearly specified.

In addition, an explicit process for indicator selection and evaluation was employed. Eliminatory and classificatory criteria were applied to arrive at the final set, ensuring that each indicator met requirements of relevance and feasibility (Brasil, 2007). In essence, the project sought to guarantee that the chosen indicators were representative of transport objectives and sustainable in terms of data requirements.

With regard to representativeness, the Indicators Project is assessed as satisfactory, since the selected indicators cover, in a balanced way, the key aspects of transport system functioning. By including indicators of effectiveness (whether policies achieve their goals) and efficiency (whether they do so using resources rationally and minimizing negative externalities), it focuses on final outcomes, thus aligning with results-based management. Representativeness is also reflected in the coverage of multiple transport modes and in the concern with both accessibility and the quality and impact of the service.

As for methodological structure, the Indicators Project proves to be the most complete of the three cases. It presents an explicit structure (the semantic network) that links indicators to objectives and concepts – something absent in the other models. It provides full documentation of formulas and data sources, ensuring technical transparency. Moreover, it allows for different levels of aggregation: indicators can be viewed in disaggregated form (for example, an indicator calculated separately for road, rail, etc.) or in aggregated form (a summary indicator for the entire system), depending on the analyst's needs. This confers flexibility, enabling both sectoral and integrated analyses. Notably, the Indicators Project is results-oriented – that is, its structure is not limited to a static diagnosis but is embedded in a management cycle (planning, monitoring, evaluation).

Feasibility of data collection and measurability were addressed carefully in the Indicators Project, with specific stages dedicated to these aspects. First, an analysis of the quality of existing data was conducted: the project examined whether the data required for each indicator met minimum quality requirements. To this end, quality criteria were defined and,

for each indicator, the availability and condition of the necessary data were identified. Second, the project included a study of the feasibility of additional data collection in cases where the required data did not exist in secondary sources.

However, a critical point is that the system does not include indicators of user perception or satisfaction, which reduces its capacity to capture social demands directly. Although it enables precise assessment of institutional targets, it lacks mechanisms to incorporate citizens' perspectives. Furthermore, there is still no public documentation of its full application in urban policies, which prevents empirical verification of its suitability for different scales.

Despite this, it is important to clarify that, with respect to urban applicability and decision support, although the Indicators Project was developed with a national focus, it has potential for adaptation to local and regional levels. The presence of a clear conceptual structure and a semantic network facilitates recalibration of the system for different scales. Indeed, Pourre's (2020) master's dissertation used the Indicators Project as a methodological basis for a case study on public bus transport in the Federal District, demonstrating this capacity for adjustment to the local urban context.

Moreover, because it is results-oriented and directly linked to public policy objectives, the Indicators Project has a high potential to support decision-making: each indicator can be interpreted in light of established targets and, therefore, can inform whether actions are effective or not. It is also important to highlight that all information on data sources and formulas is documented, allowing managers to understand the exact meaning of each metric and to trust its data basis. This contrasts positively with SIPS, for example, where the lack of methodological detail hinders broader use.

In sum, the Indicators Project is a methodologically exemplary initiative, aligned with a results-based management logic and capable of guiding objective evaluations. However, its effectiveness depends on institutionalization, technical adaptation at the local level, and integration with other instruments that are more sensitive to the urban context and to social perceptions. Its replication in municipal contexts will require investments in capacity-building, data interoperability, and, possibly, structural simplifications to ensure practical applicability.

5 Integrative Comparison and Critical Analysis

Contrasting the three experiences, we can identify some main patterns and divergences regarding the evaluated criteria:

- *Thematic representativeness*: IMUS and the Indicators Project both aim to broadly encompass the phenomenon of mobility/transport, but with distinct emphases – IMUS targets urban sustainability in its various dimensions (social, environmental, economic), whereas the Indicators Project focuses on transport policy outcomes. Both achieve good representativeness within their respective proposals, but IMUS has raised doubts as to the pertinence of some indicators in directly reflecting mobility, while the Indicators Project was designed to ensure precise conceptual alignment. SIPS, in turn, has a variable thematic scope and is more limited in temporal coverage. In terms of content, SIPS adds the human dimension (satisfaction/opinion) that is missing from the others; however, because it is not continuous, its temporal representativeness is weak.

- *Methodological foundation and structure:* The Indicators Project stands out for presenting the most robust and well-documented methodology, with conceptual definitions and transparent selection criteria (Pourre, 2020). IMUS has a clear hierarchical structure and is grounded in the literature on urban sustainability, but its aggregation methodology (compensatory index) and the absence of an integrative semantic model leave room for questions regarding the interpretation of its composite result. In addition, IMUS did not provide public details on weighting beyond the published material and has not been updated since its creation. SIPS does not have a fixed structure of indicators, although its survey methodology evolved toward stronger statistical standards in the second edition; even so, it suffers from a lack of accessible documentation and from non-uniformity across editions. In terms of scientific rigor, the Indicators Project may be classified as the most solidly grounded, followed by IMUS (which resulted from a doctoral thesis and related articles), and lastly SIPS (which functions more as an applied survey instrument, with fewer explicit academic references in its publicly disclosed design).
- *Feasibility of data collection and measurability:* Here the contrast is particularly marked. IMUS, although theoretically and conceptually interesting, has proved to be operationally unviable due to the enormous volume of data required and the lack of clear guidelines for collecting such data when not already available (Pourre, 2020). Its application demands multidisciplinary efforts and would still likely face substantial data gaps. SIPS, by contrast, was entirely feasible in the editions carried out – after all, the data were successfully collected by IPEA – but this feasibility depended on significant resources, as it is a national survey, and it did not prove sustainable as a permanent program. Furthermore, the transferability of this methodology to other contexts is quite limited. The Indicators Project, in turn, incorporated feasibility analysis from the outset and was adjusted to the reality of available data, including proposals (pilot surveys) to address data gaps. Thus, it is the only one that ensures that all its defined indicators can, in fact, be measured regularly with reasonable effort, or that they will be reformulated when this is not possible. In terms of intrinsic measurability, all three have quantifiable indicators (IMUS with formulas for each indicator, SIPS with response percentages, and the Project with defined formulas). However, only the Indicators Project explicitly addresses the challenge of continuous updating – its design anticipates ongoing use for program monitoring, whereas IMUS and SIPS ended up being applied as one-off initiatives.
- *Urban applicability and decision support:* The ultimate purpose of an indicator system is to function as a management tool that captures key aspects of complex phenomena. In this respect, the Indicators Project has an advantage because it was conceived within a governmental setting, explicitly aimed at tracking public policies (which intrinsically aligns it with decision-making). In addition, its multiscale reach and possibilities for disaggregation make it adaptable to different levels of government, including municipalities, provided they have access to the relevant data. IMUS, although designed for local urban use, was not institutionalized in any city as an official planning tool (it was applied as a pilot in some studies, but not integrated into regular decision-making processes). Nonetheless, the IMUS concept could, if simplified or adapted, be useful to cities for diagnosing the sustainability of mobility, particularly for comparative purposes and for raising awareness of the multiple factors involved in mobility. SIPS, in turn, generated information potentially very useful for policies (for example, revealing the population's perceptions of priorities), but due to

its lack of recurrence and local detail, its concrete impact on decisions was limited. We may infer that federal managers had access to IPEA's reports and may have considered some results, but there is no evidence of systematic use in local urban planning.

Overall, the experience of the Indicators Project stands out from the others by meeting the criteria in a more balanced way. As summarized by Pourre (2020), it is the only one of the three models that is results-oriented, allows for several types of aggregation, cites all sources used in the formulation of each indicator, and presents clear selection criteria with satisfactory representativeness and evaluation parameters. By contrast, IMUS falls short in operationalization, with gaps related to data collection and the possibility of excessive compensation of poor criteria by good ones. SIPS, for its part, falls short in continuity and transparency, despite incorporating the user's perspective. Table 1 below provides a comparative summary of some key points identified in this analysis.

Table 1: Summary comparison between IMUS, SIPS, and the Indicators Project with respect to the evaluated criteria.

Criterion	IMUS (Sustainable Urban Mobility Index)	SIPS (Social Perception Indicator System)	Indicators Project (Ministry of Transport)
Origin and Nature	Academic (doctoral dissertation); Composite index of urban sustainability.	Institutional (IPEA); public opinion survey conducted in thematic editions.	Governmental (Ministry of Transport); performance indicator system.
Representativeness	Broad coverage (87 indicators in 9 domains).	Focuses on citizens' perceptions; encompasses important qualitative aspects, but is limited by the lack of continued repetition.	Comprehensive coverage of 45 indicators proposed for the 31 elements represented in the semantic network.
Methodological Structure	Hierarchical indicator structure with weights; no semantic model; Compensatory aggregation (weighted average).	Varies by theme; questionnaires based on statistical sampling; methodology is not fully transparent to the public.	Defined semantic network; indicators with clear formulas, data sources, and uses; explicit selection criteria applied.
Data Collection & Measurability	Requires a large amount of data from diverse sources; analysis of data availability/quality without clear criteria; additional data collection suggested but with no defined protocol.	Primary data collected by IPEA; feasible in the editions carried out, but costly and non-continuous; opinion-based indicators (do not measure actual performance).	Data quality assessed with proposals to fill gaps; all indicators are measurable with data that are available or can be regularly obtained.
Applicability & Decision Support	Potential use in comparative urban diagnostics; not officially implemented by cities (only isolated applications); global index that is easy to communicate but requires detailed analysis.	Provides insights on satisfaction levels and popular priorities; useful for guiding policies from the user's perspective; without local institutionalization and without a defined periodicity, it has limited impact on continuous planning.	Integrated into results-based management; applicable at multiple scales with appropriate adaptations; strong decision support through its linkage to targets and program evaluation.

Source: Adapted from Pourre (2020).

Finally, it is important to underscore a transversal point: for any indicator system to be effective, it is necessary to ensure in advance that the required data will be available and that there is sufficient institutional capacity to collect them on a regular basis. Otherwise, even the best conceptual design will fail due to practical infeasibility. As noted by Pourre (2020), before applying any indicator it is essential to verify the availability of consolidated data and the financial and operational feasibility of data collection – the cost of obtaining the data cannot render the indicator itself unviable. This warning is particularly relevant in Brazilian municipal contexts, where there is often a shortage of structured information systems.

In conclusion of this comparative analysis, we observe that the three experiences offer complementary lessons: IMUS highlighted the concern with sustainability, while drawing attention to the limits of excessive complexity; SIPS demonstrated the value of social surveys and the subjective dimension, but also the need for institutionalization and consistency over time; and the Indicators Project illustrated good practices in the design of results-oriented indicators, even though its success depends on effective implementation and continuity.

Conclusions

This article conducted a comparative analysis of three Brazilian experiences in the use of indicators – IMUS, SIPS, and the Indicators Project – based on four analytical criteria, outlining a critical overview of their merits, limitations, and contributions to urban management. From the discussion developed throughout the text, it is possible to derive a set of core conclusions and lessons that synthesize both the advances and the challenges present in these initiatives:

1. The experiences confirm the practical relevance of theoretical criteria for good indicators: Initiatives that met these criteria more comprehensively, such as the Indicators Project, proved to be more robust and potentially more useful. Adequate thematic representativeness, a solid conceptual basis, feasible measurability, and periodic updating are not merely abstract principles; their absence, for example, results in the difficulty of applying IMUS or in the discontinuity of SIPS. Thus, future indicator systems should be designed from the outset to incorporate these attributes.
2. Complexity versus applicability: IMUS exemplifies the risk of an excessively complex system: although technically comprehensive, its full implementation becomes quite difficult. SIPS, by contrast, opted for simple indicators (direct questions to the public), which are easy to understand but entail a loss of temporal comparability. Ideally, a balance should be sought: a sufficient set of indicators to cover the phenomenon being represented, combined with structures that prioritize clarity so as to increase the likelihood that the system will become a long-term reference.
3. Continuity and institutionalization are crucial: An indicator or index only yields its full benefits if it is maintained over time, allowing trends to be monitored and policy outcomes to be assessed on a continuous basis. In this respect, neither IMUS nor SIPS became consolidated: the former remained restricted to isolated studies, and the latter did not have its continuation guaranteed. In contrast, the Indicators Project was conceived with integration into the management cycle as a core premise. Therefore, when proposing new systems, mechanisms of institutionalization should be envisaged – for example, linking them to permanent urban observatories, to legal

requirements for monitoring, or to partnerships between government and academia that ensure regular updates.

4. **Data-availability, quality, and transparency:** The Indicators Project exemplified good practices by assessing primary data sources and proposing pilot efforts to generate missing data. Equally important is transparency: documenting methodologies and making all materials publicly available increases reliability and facilitates collaboration. The contrast between the methodological openness of the Indicators Project and the opacity of SIPS clearly illustrates this point.
5. **Adaptability to different scales:** Finally, the three cases studied underscore the importance of adapting indicator systems to specific contexts. Not all national indicators will be relevant for every city, and vice versa. The Indicators Project introduced a scalable approach through its semantic network, which may be regarded as good practice. Ideally, indicator systems should be modular and flexible – allowing the selection of subsets of indicators according to local realities without losing core comparability. In this way, cities in different situations can use the same “language” of indicators while assigning different weights or emphases according to their priorities.

In conclusion, the use of indicators in Brazilian urban and regional planning is in a stage of learning and consolidation. Each of the three experiences evaluated has contributed in its own distinct way to this field. Managers and researchers should draw on these lessons to build the next generation of urban indicators: tools that are at once theoretically well grounded and feasible to implement, capable of generating accurate diagnoses and guiding transformative action. Only with reliable and meaningful indicators will it be possible to promote more informed and effective decision-making – a necessary condition for addressing the complex challenges of Brazilian cities in the twenty-first century.

References

- BRASIL. Ministério dos Transportes. Secretaria de Gestão de Programas de Transportes. **Metodologia integrada de suporte ao planejamento, acompanhamento e avaliação dos programas nacionais de transportes:** relatório síntese. Brasília: Ministério dos Transportes, 2007.
- COSTA, M. S. **Um índice de mobilidade urbana sustentável.** PhD Thesis (PhD in Civil Engineering) – Escola de Engenharia de São Carlos, Universidade de São Paulo. São Carlos, 2008. Available at: <https://doi.org/10.11606/T.18.2008.tde-01112008-200521> (Accessed 2 December 2025).
- IPEA – INSTITUTO DE PESQUISAS ECONOMICAS APLICADAS. **SIPS – Sistema de Indicadores de Percepção Social.** Metodologia. Brasília: IPEA, 2014. Available at: http://www.ipea.gov.br/portal/images/stories/PDFs/SIPS/120418_sips_metodologia.pdf (Accessed 2 December 2025).
- JANNUZZI, P. M. **Indicadores sociais no Brasil:** conceitos, fontes de dados e aplicações. Campinas: Alínea: 2004.
- MACHADO, S. B. **Utilização de indicadores de desempenho na avaliação da gestão realizada pelo TCU.** Brasília: Instituto Serzadello do Tribunal de Contas da União: 2004.

MAGALHÃES, M. T. Q. **Metodologia para desenvolvimento de sistemas de indicadores:** uma aplicação no planejamento e gestão da Política Nacional de Transportes. Dissertation thesis (*Mestrado* in Transports) – Universidade de Brasília, Brasília, 2004.

OECD – ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. **OECD Framework for Environmental Indicators.** Paris: OECD: 2002.

POURRE, C. B. F. **Indicadores de resultados finalísticos como instrumento de diagnóstico do transporte urbano:** um estudo de caso do Distrito Federal. 2020. 167 f., il. Dissertation thesis (*Mestrado* in Architecture and Urbanism) – Universidade de Brasília, Brasília, 2020. Available at: <http://repositorio.unb.br/handle/10482/38743>. (Accessed 2 December 2025).

ROYUELA, M. A. **Los sistemas de indicadores ambientales y su papel en la información e integración del medio ambiente.** I Congreso de Ingeniería Civil, Territorio y Medio Ambiente, p. 1231-1256, 2001.

SEGNSTAM, L. **Indicators of environmental and sustainable development:** theories and practical experiences. Environmental economic series Washington. Washington DC: The World Bank, 2003.