# Indicator-based evaluation of sustainable transport plans: A framework for Paris and other large cities

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## ABSTRACT

Using the City of Paris as a case study, this article makes a case for employing clear indicators to evaluate the effectiveness of sustainable urban transport plans. The article assesses the extent to which transport sustainability targets have been achieved, and whether the existing evaluations have been adequate. In addition to exploring the case study, the article addresses a meta-question: Which set of indicators is the most appropriate to evaluate transport sustainability achievements in a large and complex city like Paris? The flexible analytical framework constructed here can serve as an evaluation template for other, similar places.

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## 1. Introduction

In large cities of both developed and developing countries, transport problems have reached crisis dimensions. The physical and mental health of urban populations is seriously affected (directly or indirectly) by air, noise, and visual pollution, traffic crashes, congestion, and energy consumption. As a result, cities are taking a variety of steps to tackle transport problems. But where evaluations of those efforts have been performed, they have tended to be subjective rather than based on pre-determined indicators (Black et al., 2002).

Using the City of Paris as a case study, this article makes a case for employing clear and consistent indicators to evaluate the effectiveness of sustainable urban transport plans. In the collective imagination, Paris is considered as a beautiful, romantic city – a tourist's dream. Notwithstanding this alluring external image, its resident population has suffered from unsustainable urban transport practices in the past, which have had countless negative impacts (Hildermeier and Villareal, 2014).

In the new millennium, the City has made a concerted effort to become more sustainable in terms of transport. A number of plans have been produced and ambitious targets have been set. But, have these targets been realistic and effective? Have they been reached? Has plan implementation been evaluated objectively?

Canvassing existing reports, news articles, and academic papers, this study strives to answer these questions. Surprisingly, a similar enterprise has not been attempted before – notwithstanding the high profile of Paris., However, evaluations of urban transport plans (*plans de déplacements urbains* or PDU) are mandated every five years and the French national government has recommended the employment of indicators for this purpose since 2001 (CERTU, 2001).

In addition to exploring the case study, the article addresses a meta-question: Which indicator categories can be included in a "framework" to evaluate the efforts to advance sustainability in a large and complex city like Paris? The framework constructed here can serve as a template for other, similar places. The analysis helps reveal how the use of indicators has evolved across the various urban transportation plans.

The findings from the present study can be of use to Parisian planners and politicians who would like to improve the effectiveness of current and future urban transport plans and programs. They can also be of use to local media reporters and residents who are interested in seeing transport sustainability claims backed by data. At a more general level, the article can be of interest to scholars who work on comparative urban transportation research.

The first part of this article reviews the literature on sustainable transport indicators, and compares existing evaluation frameworks for urban transport. The new framework used in the case of Paris is presented at this point. Next, the case study context, data collection process, and methodology are described. The last part of the article discusses the research findings.

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## 2. Literature review

### 2.1. The case for using indicators in urban transport sustainability evaluations

The requirements that a sustainable urban transport system should fulfill are not straightforward. The definition of "urban transport sustainability" varies depending on the approach that policy makers adopt to make it operational and measurable. Given this ambiguity, indicators are fundamental tools that direct policy makers in the creation and assessment of policy targets. Indicators are broadly defined as variables representing an operational attribute of a system, or measuring progress toward an objective. In urban transport policy, indicators provide the ability to compare developments over time and space (Litman, 2015; Gudmundsson, 2004). Also, they offer the possibility to clearly evaluate the environmental, social, and economic outcomes of urban transport policies - the three pillars of sustainable development (Campbell, 1996).

Good targets and indicators are SMART: Specific, Measurable, Achievable, Relevant, and Time-bound (Doran, 1981). Two main types of indicators exist: descriptive indicators and performance indicators. Descriptive indicators simply indicate the state of a system. As such, they are useful in evaluating the sustainability of a transport system *at one point in time* or in comparing a cross section of settings. Based on these indicators, future policies can be crafted. However, descriptive indicators are not suitable for policy analysis *over time*. Performance indicators can compare descriptive indicators at two or more points in time (e.g., the percentage decrease in emissions or the percentage increase in cycling rates). Also they can compare a given state against a target. As such, performance indicators are much more relevant to the evaluation of urban transport plans (Jordan and Turnpenny, 2015).

Once researchers have selected the appropriate *type* of indicators (descriptive or performance) to employ in a study, they face another dilemma: which *set* of indicators (i.e., which evaluation framework) to use? This choice depends on: (a) the scale of the plans to be evaluated (for example, at city or metropolitan level); (b) the geographical, economic, environmental, and social context for which they have been prepared; (c) the time in which they are created; and (d) the availability of data on the impact or outcomes of plans. For example, sustainable urban transport indicators in European Union cities would likely be different from those chosen for North American cities given the different context. Similarly, sustainable urban transport indicators for Amsterdam would likely be different from those chosen to evaluate all European Union capital cities, given the different scale. Indicators created in the postwar growth period would be irrelevant in the current climate of low growth and grave sustainability concerns (Bretagnolle, 2009; Gudmundsson, 2004; Meyer, 2005; USAID, 2011).

For these reasons, no existing framework has proven to be universal. While there is currently no standardized sustainable indicator set for urban transport, considerable progress is being made in defining how indicators should be formulated and selected. This is important if world cities are to be compared. In these authors' view, a standard framework can be flexible, in the sense that it can be adjusted based on context and data availability, or updated over time as new challenges emerge. However, in the current time and for a predetermined duration (e.g., a decade), a standard framework should address a set number of themes and be equally capable of evaluating the sustainable transport performance of cities of similar size, including Paris, Buenos Aires, Nairobi, and the like.

A few authors have already proposed a few such *urban transport* frameworks. These will be reviewed next. Note that, frameworks developed to evaluate the performance of states, nations, or federations, or the performance of *transport* in general (i.e., which includes *intercity transport*), have not been included in this review. Also excluded are analytical frameworks which have not been tested in a real-world setting, because the application of a set of indicators to a particular city reveals various difficulties and inconsistencies, which are missed in general theoretical discussions.

The authors acknowledge that government agencies, transit operators or their associations, non-profit organization, and EU project teams (that typically include both academics and practitioners from government agencies) have been preparing indicator-based evaluations in the last decade, or have been pressing for the adoption of indicators during the evaluation of urban transport plans; see, for example, Transport for London (2016), UITP (2014), WBCSD (2016), Ecomobility Shift (2016), Civitas Plus II (2016), and Polis Network (2016). This body of literature provides useful concepts in terms of urban transport sustainability, as well as relevant discussions of the theoretical advantages and disadvantages of particular indicators or sets thereof. Therefore, it was reviewed by the authors while constructing the present framework. However, in an effort to maintain objectivity and avoid bias but also given a multitude of approaches and the fact that several of the abovementioned projects are still ongoing, preference was given to frameworks published in peer-reviewed scholarly journals.

### 2.2. Comparison of existing evaluation frameworks

After an extensive search of scholarly sources, the authors could only identify three studies that evaluate the transport sustainability of particular cities, which complied with the selection criteria: Lyon (0.5 million inhabitants), Taipei (2.5 million inhabitants), and Melbourne (4 million inhabitants). They employ various performance indicators, which are listed in Table 1 (Shiau and Liu, 2013; Reisi et al., 2014; Nicolas et al., 2003). The three frameworks address common topics, including: air pollution, noise pollution, traffic accidents, accessibility, transport cost, and energy consumption. However, the indicators that they employ are calibrated differently. For instance, the general concept of "safety" is operationalized as "cost of traffic crashes" in Melbourne, "risk level" in Lyon, and "number of injuries" in Taipei. While parking is lumped with economic issues in Melbourne and Lyon, it is treated as a technical issue in Taipei. All three frameworks ignore important urban transport issues such as wayfinding and the relationship of transport with other industries. The Lyon and Melbourne frameworks are structured around the social, environmental, and economic dimensions of urban transport sustainability. The Taipei framework is unstructured but it contains some indicators (such as length of bus lanes) which the other two frameworks lack. Clearly, the indicators employed in these three frameworks depend on the respective city's context.

### 2.3. Construction of a framework for paris

None of the frameworks reviewed above are comprehensive nor a perfect fit for the case of Paris. Therefore, the authors opted for the creation of a new, composite and flexible framework (Table 3). While general *transport* frameworks have been excluded from this review, as noted, the list of indicators suggested in recent literature review report by Litman (2015) has been taken into consideration, due to its comprehensive nature. The framework formulated by the authors allows its users to employ selected indicators. It can also be contracted or expanded as needed. It can contain context-specific indicators which can be determined after a thorough review of the targets set in local transport plans. As a starting point, the authors have suggested a menu of indicators which combines all the recurring indicators in the three existing frameworks and all the recurring targets in the transport plans for