In Search of Equity: Advances and Gaps in Transport Planning for Diversity

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Abstract: This paper explores the rise of user-centric approaches in transport planning, highlighting mobility as central to quality of life and fair access. Through integrated knowledge mapping, it reviews leading theoretical, methodological, and empirical contributions, clarifying how diversity and equity are framed and where research gaps remain. Despite progress, disparities and forms of transport poverty persist, demanding stronger collaboration among stakeholders. Current frameworks often narrow user diversity to age, gender, or income, overlooking cultural, institutional, and spatial factors. Perspectives on equity and distributive ideals vary widely, and consensus is still lacking key performance indicators and acceptable thresholds for measuring transport justice.

Keywords: Equity; Justice; Diversity; Transport Planning

1. Introduction and background

Transportation planning has shifted from a narrow, operations-focused activity to a broad, interdisciplinary field connected to research, urban planning, policymaking, and society. Transport and territory shape each other: networks influence how cities develop and where people live, while geographic and land-use characteristics affect available travel modes and route choices. Research drives progress by improving analytical methods and theoretical approaches. Because mobility enables access to essential activities, high-quality mobility directly enhances quality of life. Ultimately, policymaking sets the goals and priorities of transport planning, making it a particularly influential factor, capable of responding to, or disregarding, scientific evidence and social needs.

Mobility's importance has become more widely recognized since Covid-19, bringing concepts like equitable mobility and transport poverty into mainstream discussion. Despite growing research, inequalities persist: some areas lack adequate transport, some people spend excessive time or money on basic trips, and certain groups remain underserved. Technological change promises safer, more efficient, and more sustainable mobility, but its benefits must be shared fairly. Achieving both system sustainability and user equity is challenging, with no one-size-fits-all solution.

Equity can be viewed [1] horizontally (equal treatment for similar situations) or vertically (different treatment to achieve fairness), reflecting different justice theories [2, Table 1]. Another aspect to consider is the diversity of users that studies, policies or implementations should consider. Indeed, the above theories are usually established in general terms. For example, "the least disadvantaged" are mentioned. But this group can be defined in many ways: least-disadvantaged because they have a low salary? Because they live in outlying areas? Because they have a low education level? Just because their daily mobility is complex? Because of several of these reasons (and others) at the same time?

In this context, this article uses knowledge mapping to analyze the integration of equity, justice and diversity perspectives in transportation planning and related areas, with the aim of organizing existing knowledge and identifying unexplored gaps. The

remainder of the paper is organized as follows: Section 2 describes the methodological approach and Section 3 shows the obtained results, which are discussed in Section 4. Finally, Section 5 includes the main conclusions extracted as well as the identified research gaps.

Table 1. Most well-known theories of justice and their relationship with equity.

Theory of justice	Explanation		Link to horizontal equity		Link to vertical equity
Rawl's egalitarianism	Fairness. Inequalities allowed only if benefiting the least advantaged	√	Treats similarly situated individuals equally	√√	Strongly supports via "the difference principle" prioritizing worst-off
Sufficientarianism	Anyone must reach a minimum standard	∕	Supports for those above the sufficiency threshold	√√	Strongly supports by focusing resources on those below the minimum threshold
Utilitarianism	Maximize overall coverage	~	Similar individuals may be treated differently if this increases total utility	∕	Supports only if redistribution increases total utility
Capabilities approach	Focus on real freedom and opportunities reached	√	Supports by ensuring comparable capabilities	√	Supports by providing extra resources to those with fewer capabilities
Intuitionism	Decisions guided by intuitive sense of right and wrong	~	Depends on intuitions of fairness	∕	May support vertical equity if intuitions favor helping disadvantaged
Libertarianism	Emphasis on individual liberty and property rights. Minimal external intervention	x	Opposes enforced horizontal equity beyond voluntary arrangements	x	Opposes redistribution

Note: √√ indicates a strong link, √ a significant link, ~ a weak link,∕a conditional link and x no relation at all.
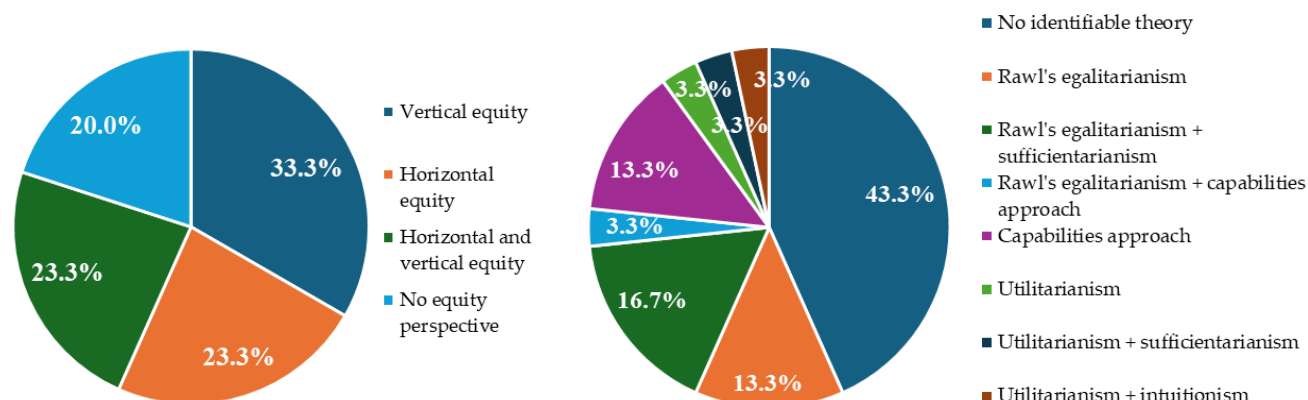
2. Methodology

This research has used integrative knowledge mapping [3] as core methodology, bringing together findings from multiple sources, identifying patterns, overlaps, differences, and gaps in order to create a structured understanding of how and to which point equity, justice and diversity have been included in transportation planning. First, a set of 30 articles has been chosen using a novel approach that mixes traditional search engines such as Scopus with AI-tools such as Connected papers and Elicit. The terms "transport" or "transportation" or "mobility" together with "diversity", "equity" or "justice" were the basis of the search. The obtained lists were progressively refined based on the number of citations of the papers and their fields (being engineering and social sciences the most common contributors). The selected articles were systematically compared in order to find similarities and disparities among their approaches, also trying to recognize clear patterns across time or geography and to identify research gaps.

3. Obtained results

Starting with equity, Figure 2(a) shows the categories found and their shares. Horizontal equity studies examine how fairly accessibility is distributed, highlighting how urban form, density, and land use shape access [4, 5, 6]. Case studies in Melbourne, Toronto, and Flanders reveal major mismatches between public transport supply and social needs [7,8,9,10]. Some work also links accessibility with environmental justice, such as unequal access to green space [11, 12]. Vertical equity studies focus on vulnerable groups, mainly

including older adults, low-income households, and women, showing distinct mobility needs [13, 14, 15]. Research demonstrates how safety, reliability, and quality of life considerations vary across groups. Some authors combine both equity perspectives, revealing stark disparities (e.g., 70% of Melbourne's population accessing only 19% of supply) and calling for intentional redistribution [8, 16, 17, 18]. Justice frameworks include Rawlsian egalitarianism, sufficientarian thresholds, the capabilities approach, and utilitarian criteria such as "maximax" [16].

Figure 1. Paper distribution with regard to (a) equity perspective and (b) inferred theory of justice.

Diversity is interpreted variably: some studies examine age, income, and gender differences; others focus on broader disadvantaged groups such as vehicle-less households [13, 15, 7]. The examined studies also displayed a wide methodological range, from conceptual explorations to empirical analyses. While early contributions were largely theoretical, more recent work employed survey data, regression models, spatial–temporal methods, and simulations. Still, significant gaps remain. For instance, the implications of auto-mated vehicles remain poorly understood due to the limited availability of empirical evidence [19]. Geographically, most studies focus on North America and Europe.

4. Discussion

Research on equity, justice, and diversity in transport planning highlights the critical need to integrate both horizontal (general population access) and vertical (specific needs of disadvantaged groups) equity. While this integrated approach is found in academic studies, practical transport planning tends to prioritize the population as a whole, addressing the demands of specific groups later with suboptimal, "patchwork" solutions. Furthermore, many research works and most transport plans fail to articulate their underlying conception of justice (e.g., Rawlsian, capabilities approach) or define measurable targets, limiting the translation of these crucial theories into effective policy-making.

A core challenge is the measurement of equity. Although various indicators like Gini coefficients and accessibility thresholds are used, there is no accepted standard. This inconsistency complicates comparisons, undermines decision-makers' ability to implement policy, and raises questions about the transferability of case-specific methods across different socioeconomic and geographical contexts. Additionally, diversity in transport planning is often conceptualized too narrowly in practice, frequently limited to gender, age and income. Research shows that transport disadvantages intersect with a wider array of factors, including language barriers, cultural background, and digital capabilities, signaling the need for improved data collection and analysis methods to serve heterogeneous populations better.

Finally, the literature warns that well-meaning investments can have unintended consequences, such as triggering gentrification and displacing the very populations they intended to assist, emphasizing the need to integrate transport planning with housing and

land-use policies. Emerging mobility technologies also present uncertain distributional impacts that could exacerbate existing inequalities without careful policy design. In summary, while theoretical advances are significant, major practical challenges persist, necessitating standardized tools, measurable KPIs, and stronger mechanisms to embed pluralistic, well-informed justice principles into transport policy and appraisal.

5. Conclusions

This paper analyzes how equity, justice, and diversity have been treated in transport planning since the 1950s according to key literature. Although theory has expanded from accessibility and land use to broader concerns like social justice, implementation in policy remains inconsistent. Both horizontal and vertical equity are widely mentioned, but the needs of diverse groups are still insufficiently addressed. Key gaps include:

- the need to combine horizontal and vertical equity in a systematic, planned way;
- stronger engagement with theories of justice to make equity goals measurable and actionable;
- standardized indicators to assess equity in transport;
- wider treatment of diversity, including intersecting factors such as language, culture, and digital access;
- coordination with housing, land-use, and social policy to avoid unintended effects.

Overall, achieving socially just transport systems is both a technical and political challenge. Progress depends on translating conceptual advances into practical tools, involving citizens, and balancing equity with efficiency and sustainability so that transport benefits and burdens are shared fairly.

Conflicts of Interest: The authors declare no conflict of interest.

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