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The definition of equity in transport

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Abstract

Equity is a concept related to the objective of narrowing inequalities and to other notions such as justice, convergence, and fairness. The study of equity has been widely addressed within the transport sector and has been often interpreted as the study of accessibility and cohesion. However, these concepts are not totally coincident, and their definition is fraught with confusion and pluralism, with implications on the ability of transport decision making to include equity goals in the planning process. In this paper, we shed some lights on the state-of-the-art of transport-related equity studies, discussing how the concept can be framed and tied to related terms, like justice, fairness, and accessibility. Then, we explore different approaches to the conceptualization of equity in transport, from the understanding of what equity is and which impacts it generates on the transport sector and on the society, to the inclusion of equity in transport planning and project appraisal. This contribution shows the centrality of equity in contemporary transport planning. Moreover, it suggests that the plural acceptation of transport equity calls for the definition of a more comprehensive tool for the evaluation of projects. This should be able to integrate the traditional cost-benefit analysis with other equity aspects that are often left aside from the project and policy appraisals.

Keywords: Equity; Transport planning; Justice; Fairness; Accessibility

1. Introduction

Equity is a broad category related to the comprehensive objective of reducing inequalities (Dall'Erba and Le Gallo, 2008; Bruzzone et al., 2022). The link between sustainable and equitable transport, as well as the concern for equitable investments within transport projects and policies, are stressed in several development strategies, including the policy priorities of the European Union (EC, 2021a) and the "Sustainability Commitment" of the American Public Transit Association (Osman, 2018). Equity issues are included as part of the European Commission's Mobility and Transport strategy, which includes the social implications of transport projects among the impacts to

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be assessed (EC, 2021b). Moreover, the EU cohesion policy has comprised the promotion of sustainable and equitable transport among the 11 Thematic Objectives of the 2014-2020 strategy, as well as among the five Policy Objectives of the new 2021-2027 strategy (EC, 2021a). The EU cohesion strategy ensures that transport investments address existing inequality in connectivity and regional accessibility. Furthermore, it avoids future disparities in the sustainable transformation of the transport network. The strategy calls for complementary investments in secondary networks in parallel to major networks to maximize their induced opportunities and make sure that all regions can benefit from the infrastructural development. It also supports sustainable and equitable solutions for regional and local transport and fosters cooperation within multi-annual, cross-regional, and cross-sectoral investments and planning strategies.

Despite authorities and recent literature recognizing the evident link between sustainability and equity in the transport sector, the debate among scholars on possible definitions of equity and the extent of equity issues and implications within transport and mobility is still open. According to Ogryczak (2009), the study of equity, accessibility and cohesion in transport has been widely addressed, but the definitions of those different concepts are fraught with confusion and pluralism. After more than a decade, the condition has not changed (Figliozzi and Unnikrishnan, 2021).

This paper analyses different definitions of equity, discusses their adaptation to transport and explores the category looking at different applications of the concept in the case of transport plans and projects (Section 2). Moreover, the links between equity, equality, justice, fairness, and accessibility are presented, setting each idea into the appropriate frame and providing readers with a *fil-rouge* to understand their conceptual differences and connections (Section 3). Section 4 hints at the difficulty of incorporating equity goals in transport policy, plans and projects, also due to the obstacles in equity appraisal and assessment. Section 5 concludes the paper.

2. Different dimensions of equity in transport

The Cambridge Dictionary (2022) defines equity as "*the situation in which everyone is treated fairly and equally*". The Collins Dictionary (2022) does not explicitly call out the concept of equality, and instead states that "*equity is the quality of being fair and reasonable in a way that gives equal treatment to everyone*". The terms "*equity*" and "*equality*" are often interchanged, which leads to confusion (Carleton and Porter, 2018). In general, the concept of equality suggests that people or groups have the same rights and opportunities and should therefore be treated in the same way, while equity means that, since people and groups might not be provided with the same opportunities, they should be provisioned differently to address such disparities.

Authors approaching the concept of equity within spatial and transport planning tend to adopt a distributive perspective, widely considered a key component of equity (Martens et al., 2019). Despite distributive equity sometimes overlaps with the concept of equality (Foth et al., 2013), the idea of providing the same level of service to all residents is clearly inapplicable (Carleton and Porter, 2018), enhancing how equity in transport is more related to the concepts of "fairness" and "justice" than "equality".

A definition of equity recalled in several recent works (e.g., Di Ciommo and Shiftan, 2017; Martens et al., 2019) is given by Boucher and Kelly (1998). They state that equity is "*the morally proper distribution of benefits and costs (burdens) over members of society*". Starting from this general definition, three key components of equity can be identified: benefits and costs that are being distributed, the population and social groups to which those benefits are being distributed, and the yardstick or distributive principle that determines whether a particular distribution is morally proper and socially acceptable or not. Foth et al. (2013) refer to a definition of equity first introduced by Krumholz and Forrester (1990): equity planning "*is about providing a wider variety of choices to people who have fewer ones*". This definition is particularly suitable to transport planning, as policymakers must make choices between providing the optimum service for the majority of users (and its maximization) or improving the geographic coverage of the service, including less-populated areas (Walker, 2008).

In transport, it is difficult to conceptualize equity, as there is no standard definition of fairness with relation to transport benefits, both within the assessment of the fairness of a situation and of an intervention (Martens et al., 2012; Martens et al., 2019). Nevertheless, authors have approached transport-related equity in several ways. A common distinction is made between horizontal equity and vertical equity (Welch, 2013; El-Geneidy et al., 2016; Camporeale et al., 2019; Litman, 2021). Although other authors identify further specifications of transport-related equity (Thomopoulos et al., 2009), the subdivision among vertical and horizontal equity is the most frequent.

Vertical equity, also defined social equity, is increasingly being considered in the evaluation of transport projects, especially in those areas which are already supplied with high-quality transport options (Kim and Sultana,

2015). Social equity in the transport sector is related to the allocation of benefits among social groups based on their willingness or capability to pay for a specific service (Welch and Mishra, 2013). This, in turn, depends on a combination of factors related to the economic, psycho-social, cultural, and socio-institutional contexts (Nahiduzzaman et al., 2021; Sagaris and Tiznado-Aitken, 2021). As a policy objective, the gap for disadvantaged social groups (sometimes referred to as vulnerable groups or communities of concern) should be addressed and reduced. Women are the most numerous of the vulnerable groups: the gender gap in mobility is a relevant and multifaceted topic, which -although subject of numerous works and projects- still lies unresolved (Lecompte and Juan Pablo, 2017; Gimenez-Nadal et al., 2020; González-Sánchez et al., 2021). Litman (2021) further specifies vertical equity with respect to need and ability as "*equity in mobility*", and vertical equity with regard to income and social class as "*socioeconomic equity*". The latter is the main concern of transport equity researchers, and the concept is related to concepts like social disadvantage, exclusion, justice, and sustainability.

Horizontal equity, also defined spatial equity, assumes equal abilities between individuals or groups and aims at maximizing two objectives: the improvement of general accessibility and the achievement of an equal distribution of accessibility among regions (Ortega et al, 2012). Some studies approach the concept of horizontal equity to study the uniformity of benefits distribution among geographical regions, establishing a link with the concept of accessibility. Still, they often fail to state or assess whether all residents require the same level of access to these benefits (Foth et al., 2013). Other authors investigate the impact of transport investments in terms of spatial equity, debating the effectiveness of transport projects in reducing inequality and enhancing local competitiveness (Monzón et al., 2013; Cavallaro et al., 2020).

Whereas the scientific debate on equity impacts of transport projects is limited but sparkling, it is harder to appraise equity goals expressed in transport plans. Indeed, when coming to the practice, they are not only more difficult to measure, but also receive less political backing and can lead to difficult and even counterproductive policy decisions, attempting trade-offs between equity and other transport goals (Manaugh and El-Geneidy, 2012). In Section 3, we deepen the interactions between the concepts of equity, fairness, accessibility, and others that have been included in the galaxy of equity by transport-related literature.

3. Equity in transport: a wider perspective

The concept of equity is strongly related to justice, fairness, and accessibility (Ortega et al., 2014), and can thus be approached with a wider perspective. In a recent literature review, Zhang and Zhao (2021) warn against the excessive proliferation of different concepts used to describe the role of transport in the marginalization and exclusion of social groups. Among them, they identify transport-related exclusion and transport poverty as most common ones. In this vein, transport equity can be seen as how transport accessibility is equitably distributed among social groups and members (Van Wee and Roser, 2013), thus extending further compared to the topic of accessibility itself and straying into the political philosophy of justice (Martens, 2012; Pereira et al., 2017).

The concept of justice facilitates the reconceptualization of transport equity into the equitable distribution of accessibility to achieve equality of social opportunities; it promotes a view of mobility as a field of institution-mediated distribution and providing a response to the challenging and ambiguous conceptual boundary between (in)equality and (in)equity (Zhang and Zhao, 2021). Despite an expanding number of publications explore equity in transport planning and appraisal through justice and ethics theories and principles (Davoudi and Brooks, 2014; Martens, 2016; Mullen et al., 2014), there is no single definition of justice itself and -just like the concept of equity- the academic literature tends to overlap moral and political ideas referring to distributive justice (how benefits and burdens are distributed in society), to procedural justice (fairness of decision and distribution processes), and to which rights and entitlements deserve recognition. According to Pereira et al. (2017), the word equity refers to specific elements of a broader concept of justice; however, scholars tend not to draw a clear distinction between the two ideas, and equity and justice can be used interchangeably. Other authors, however, note that recent efforts shed light on the conceptual difference between transport justice and equity (Martens, 2020; Vanoutrive and Cooper, 2019). In general, scholars argue that the concept of "transport justice" suggests a society-based approach, stressing the role of bottom-up efforts in avoiding distributive unfairness through multi-actor participation and negotiation processes, whereas "transport equity" calls for an authority-centric approach to distribution of benefits and burdens, thus emphasising the role of governments in favoring equitable distribution through expert decisions and choices (Karner et al., 2020). A further debate on the centrality of procedural justice versus authority-centric approaches to the concept of equity can be found in Bullard (1994, 2004), Cavallaro and Maino (2014), and Doran et al. (2021).

Equality, as discussed in section 2, requires opening a further caveat within the discussion on the relation

between equity and fairness. Equality is generally adopted to indicate sameness (van Wee & Geurs, 2011), and thus it is not a sufficient condition for achieving fairness (Pereira et al., 2017). On the contrary, equity always implies a moral judgment, and fairness comes at the cost of deliberately treating individuals and social groups differently according to their characteristics, at times even limiting some of their individual liberties (Rawls, 1999; Sen, 2009; Pereira et al., 2017). Whereas scholars still have to agree upon a univocal and unambiguous definition of both the concepts of equity and justice or fairness, their strong interrelation emerges distinctively (Konow et al., 2019).

In an effort to transpose the concept of transport equity into tangible and measurable policies, measures and strategies, scholars and administrations consider "accessibility" to be the key to the inclusion of transport equity and/or transport justice objectives. The connection between equity and accessibility is object of numerous contributions and opens some further controversies (Kaza, 2015). The plural understanding of accessibility* shapes researchers' efforts to assess equity levels of situations and equity implications of transport interventions (Carleton and Porter, 2018; Martens et al., 2019). The distinction between person-based, space-based or space-time-based accessibility is still valid (van Wee, 2016). The consistent definition of accessibility -and thus equity- is critical to assess equity in the transport sector. Accessibility is often used to measure transport equity because methods used to assess accessibility -such as indicators- measure the level of access to social, professional, educational, and entertainment opportunities, and allow to explore the trade-off between equity and other conventional transport goals (Manaugh and El-Geneidy, 2012; Murray and Davis, 2001; Walker, 2008). The use of indicators to explore both vertical/social and horizontal/spatial accessibility is a common and expanding approach. Authors often link the concept of social and spatial accessibility to that of equity and to equity goals (Camporeale et al., 2019; Cavallaro et al., 2020; Kim and Sultana, 2015). Table 1 reports some of the most relevant recent studies on equity in transport and shows the different conceptualizations of equity adopted by scholars.

Table 1. Conceptualization of equity in transport: main recent contributions

Contribution	**Discussed topic** (Authors' definition)	**Adopted conceptualization**
Thomopoulos et al., 2009	Flexible equity inclusion in transport appraisal*	Six-principles approach (adapted from Khisty, 1996): A) Egalitarian; B) Equal shares distribution; C) Rawls' principle (more benefits to lowest income groups); D) maximization of average net benefit with a range of X units; E) maximization of average net benefit with a minimum floor of X units; F) maximization of total community benefit (utilitarian approach)
Monzón et al., 2013	Spatial equity	Territorial accessibility along transport corridors (population/GDP, travel time)
Welch and Mishra, 2013	Spatial equity	Transit connectivity measure (density of service and development)
Ortega et al., 2014	Territorial cohesion	Territorial accessibility along transport corridors (population/GDP, travel time)
Kim and Sultana, 2015	Spatial equity/Accessibility	Territorial accessibility along transport corridors (population/GDP, travel time)
Pagliara et al., 2016	Spatial equity	RP+SP method to study territorial impacts of high-speed rail projects (access/egress travel time and costs, onboard travel time, fares)
Di Ciommo and Shiftan, 2017	Equity	Accessibility to key activities, travel affordability, access to transport
Camporeale et al., 2019	Horizontal and vertical equity	Satisfaction of needs of vulnerable categories, exacerbating social inclusion. Mathematical model based on adaptation of the Transit Network Design Problem, with inclusion of equity in transit network planning
Martens et al., 2019	Equity	Different dimensions of equity in transport, each assessed for every population group (income, ethnicity, gender, age, mode choice, residency): mobility/accessibility, pollution, safety, health
Cavallaro et al., 2020	Spatial and social equity	Equity impacts of high-speed rail: territorial accessibility (spatial approach, considering number of travel options, travel time and population) + social benefits distribution (travel costs under different conditions)
Litman, 2021	Equity	Horizontal equity, divided in a fair share of resources (i.e., fairness or equality) and external costs Vertical equity, divided in inclusivity (vertical equity with regard to need and ability), affordability (vertical equity with regard to income), social justice

* The authors propose a wide ramification of the concept of equity, illustrating the spectrum of terminology used by scholars and practitioners and highlighting that different equity types express different principles and thus correspond to diverse objectives, despite all referring to a common term.

A widely accepted general definition defines accessibility as the "potential of opportunities for interaction" (Hansen, 1959); however, similarly to the concept of equity, the definition of accessibility is still subject to controversies (Martens et al., 2019).

In the next paragraph, we discuss the consequences on transport planning and projects evaluation of the still unclear definition of equity, as well as the importance of equity considerations within transport planning and projects, also in relation to the sustainable mobility paradigm and to sustainability goals and policy objectives (Banister, 2008; Trudeau, 2018).

4. Including equity evaluation in transport planning

The implications of the confused approach to equity in transport planning contribute to a general lack of ability of transport plans and projects to include and effectively ensure the pursuit of equity goals. This is especially true for their monitoring and evaluation tools. Although mentioning equity is common for transport planning, the equity goal itself is often vague (Martens et al., 2012). Moreover, most plans fail to explain how to measure it or how to include performance measures to pursue the expressed target (Foth et al., 2013; Manaugh and El-Geneidy, 2012). According to Sinha and Labi (2007), without a proper definition of performance criteria, it is not possible to achieve a correct evaluation of the target. The uncertainty around the concept of equity in transport plans can be reconducted to the confusion in the theoretical framework and definitions discussed in this paper, and to the difficulty in transposing into practice the abstract debate on the topic (Preston, 2009).

The relevance of equity within transport planning and its strong link with the theme of sustainability are nowadays widely acknowledged by both institutions and scholars (Attard, 2020; Cavallaro et al., 2020; EC, 1999; EC, 2004; EC, 2006; EC, 2021a; EC, 2021b; Manaugh et al., 2015; McArthur et al., 2019; Sultana et al., 2017). However, the pluralism and confusion still affecting transport equity and its practical pursuit and esteem have direct consequences in the allocation of investments for both transport projects and operations, as authorities and planners promote different measures and approaches to aim at a variety of planning goals (Walker, 2008). The horizontal approach, in particular, may lead to concepts of geographic equity and to the perception that services should be equitable throughout territories, including areas with low patronage potential, thus responding to need rather than density. Patronage goals, on the contrary, aim at the maximization of the system usage. They include goals related to financial return, efficiency, and vehicle trip reduction. An equity policy in this context could provide proportional services to the density of development (e.g., population and jobs), thus representing a compromise between different transport planning objectives but leading to inefficiency in providing infrastructures and services to both dense urban cores and peripheral areas (Walker, 2008).

A simpler approach to the equitable allocation of resources could be that of operating upstream by dividing funds between patronage/efficiency and coverage goals, expressing policy preferences when defining their allocation. Despite equity goals, such as the enhancement of the fundamental role that transit has in providing access to educative and professional opportunities, are solid part of transport planning, they are not always complimentary to the economic and environmental dimensions of sustainability (Currie, 2010). Environmental and economic goals might push planners to focus on increasing transit ridership at the expense of current users and weak categories, as replacing car trips lowers emissions, generates revenues, and can be easily measured (Manaugh and El-Geneidy, 2012).

The difficulty in clearly understanding what is meant by transport equity on the one side, and in measuring opportunities on the other side, hinders the ability of transport researchers and planners to identify locally relevant equity goals, to quantify equity impacts of transport plans and projects, and to stress the relevance of equity issues within wider sustainable mobility policies and investments. Authorities, starting at the European level, have recognized this issue and launched a process of determining planning instruments, indicators, strategies, and policies to successfully pursue and appraise transport equity. Within this effort, a few transport project appraisal methods, designed to include equity issues, have been proposed and -in some cases- integrated into the official assessment processes (Rothengatter, 2019; The World Bank, 2014). Nevertheless, the risk is -until a common, shared framework and unequivocal definitions are set- that transport plans and projects sterilely cite the concept of equity but indulge in effectiveness principles that are not capable of guaranteeing equity objectives in the broadest and most complex sense of the term.

5. Conclusions

So far, transport-related literature has approached the topic of equity from different perspectives, with several studies referring to a narrow idea of equity (often reminding to vertical and horizontal accessibility). Alternatively, other authors raised awareness on the pluralism, confusion and fraught surrounding the concept and trying to untangle the strong relation with other ideas such as justice, fairness, and equality.

The first approach to equity in transport has been widely adopted for the discussion of the territorial implications of transport projects (Cavallaro et al., 2020; Kim and Sultana, 2015; Ortega et al., 2014). When extending the framework and discussing equity in its broadest sense (second approach), it becomes complex to define equity in transport projects and plans (see Section 3). In turn, this means that it is hard to express equity goals, but also that it is difficult to ensure effective measurement and enforcement of equity-related priorities.

As a consequence of this condition, the current practice in project appraisal does not include equity in its evaluations. One of the main evaluative tools for the impacts of transport project is the cost-benefit analysis (CBA). The CBA is a diffused method for the appraisal of transport projects in Western countries, and is mandatory in the EU (EC, 2015). Through its mechanism of monetization, the CBA only considers traditional and effectiveness-oriented evaluation fields, but leaves intangible concepts, goals, and priorities, including those related to equity, unassessed. In this sense, the appropriateness of this unique method for the evaluation of transport projects has been debated (Cavallaro and Nocera, 2022).

Recalling Section 4, to overcome these limits in evaluating equity implications, it is necessary to identify and promote new analysis and assessment methods. These should be able to incorporate equity implications and goals into broader assessment of transport projects and plans, and to manage conflicts that might arise between equity goals and other policy objectives, specifically dependant on how equity is conceived, adopted, and translated into goals and policy. Whereas some countries -and a number of scholars- explored integrated assessment methods to include equity implications (such as the Spatial Integrated Assessment and methods based on multicriteria evaluation), in practice the CBA is still the base of transport project appraisal in western countries (EC, 2021c; The World Bank, 2014). A wider optic in the evaluation of impacts of transport plans and project, however, is critical to ensure that these contribute to the satisfaction of global and local policy goals, not only related to equity and the transport sector in strict terms but also, and most importantly, to social and environmental sustainability.

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