

High-Speed Rail, Equity and Inclusion

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1. Introduction

Today, the question of inequality related to transport systems is becoming an issue that governments, at the different territorial scales, should confront in order to find solutions and restrict the consequences. In 2015 the OECD (Centre for Opportunity and Equality) platform was developed with the aim of fostering policies on trends, causes, and consequences of inequalities [1].

Church et al. (2000) [2] introduced seven factors limiting the mobility of socially excluded users, which are as follows: physical exclusion, i.e., physical barriers, such as lack of disabled facilities or timetable information, limiting accessibility to transport services; geographical exclusion which prevents people from accessing transport services, especially those living in rural or peripheral urban areas; exclusion from facilities, which concerns the low accessibility connected with facilities, such as shops, schools, healthcare or leisure services; economic exclusion which represents the high monetary costs of travel inhibiting access to facilities or employment and thus having an impact on incomes; time-based exclusion which refers to other demands on time, such as combined work, household and childcare duties, reducing the time available for travel; fear-based exclusion which deals with the fears for personal safety precluding the use of public spaces and/or transport services; and space exclusion which is the security or space management preventing given groups having access to public spaces, such as first class waiting rooms at stations.

Lucas [3] proposed the definition of a “transport poor user” as one to whom some condition may apply, such as: when he/she has no transport alternative which suits his/her physical conditions and capabilities; when the actual transport alternatives do not serve destinations where the user can fulfill his/her daily activity needs; or when the weekly amount of money spent on transport results in the family income falling below the poverty threshold. Moreover, when the user is pushed to spend a long time travelling, causing time poverty and/or social isolation, and when factors such as danger and safety characterize the travel conditions of the user.

It is important to clarify that not all socially excluded people are poor and that not all social exclusions concern poor accessibility to transport facilities and services. However, in all countries, low-income people have fewer transport alternatives in addition to having low-quality transport services that offer travel with little comfort and low security [4]. There is an extensive literature on the wider socioeconomic inequality aspects of transport. In the book by Vasconcellos [5], the idea that traditional transport planning has generated an unfair distribution of accessibility is supported and suggestions for new measures towards an equitable and sustainable urban environment are proposed.

Banister’s research shows [6] that “today’s transport policy benefits the rich more than the poor. But it is the better-off who are travelling faster and further, leaving the poor in the slow lane and closer to home”. The poor choose the bus more frequently and they



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walk more, while the rich choose the car more frequently and go by train. Investments in transportation systems should be more oriented to the limitation of this disparity, while, instead they “exacerbate it!”.

Equity assessment is fundamental in transport planning and infrastructure investment for the identification of the effects on society and the environment. It is therefore important to estimate the costs and benefits for different groups of the population.

Equity in transport is not only a question of fair social distribution of costs and benefits, but it is also essential in everyday life to guarantee the mobility of care-givers and front-line workers (i.e., medical care personnel, care-givers, supermarket and logistic workers). Therefore, if equity issues are not seriously addressed, this poses a major challenge in the assessment of transport investments. It is not only a question of travel time savings or cost affordability for lower income groups of the population, but also a question of having access to the key services and goods required for the survival of many population groups. A lack of affordable and accessible public transport has a serious effect on low-income households and reduces people’s ability to find work, according to campaigners. When planning transport systems in developing countries, one of the main challenges is to evaluate the proportion of income spent by poorer households on transport as well as in understanding transport patterns in relation to residential location, travel distance, and travel mode. High real estate prices in urban centers often force low-income households in developing countries to live farther out in the periphery, with consequences for the way urban agglomerations develop and with subsequent effects on the levels of motorization, congestion, local air pollution, physical activity, and the expansion of urban poverty.

In today’s conversations about climate change, a main concern is that, as urban residents’ incomes rise, they will tend to choose automobiles as their main mode of transport. The paradox is that in many emerging cities, low-income urban residents are still too poor to afford public transport. Relatively high fares mean that public transport is beyond the reach of the 20% at the bottom of the income pyramid and that public transport cannot meet its social objectives. This is the case, for instance, in cities such as Sao Paulo or Rio de Janeiro. The same applies to Mumbai, Mexico City, and Manila, where poor people have to spend more than a fifth of their income on transport (see figure below). This is a huge obstacle to their efforts to climb out of poverty (<https://blogs.worldbank.org/transport/public-transport-affordable>) (accessed on 31 March 2022).

In the international literature, little has been written on the relationship between long-distance rail transport, such as High-Speed Rail (HSR), and social equity assessment. This SI has attempted to fill this gap.

2. High-Speed Rail and Social Inclusion: What Does the Recent Literature Propose?

Chinese as well as Italian case studies have been recently published in the international literature. In these case countries, HSR has been subject to a social equity investigation by local research groups. Methods and methodologies supporting their research provide a contribution to policy makers and investors in these infrastructures.

In China, for example, Jin et al. [7] analysed the effect of HSR on economic growth as well as on economic disparity between 2002–2016. They demonstrated that the economic growth was mainly due to the advantages of the HSR in improving accessibility to sources of work, suppliers, and customers. Moreover, they showed that HSR increased the economic disparities between small-medium and large-mega cities, favouring developed cities rather than less-developed and developing ones, increasing the economic disparities.

Ren et al. [8] investigated how the deployment of HSR networks could lead to the exclusion of users in some socioeconomic categories. Indeed, their research demonstrated that passengers with low income and lower levels of education, and passengers in central and western China, were more likely to choose conventional trains w.r.t. HSR.

Zhan et al. [9] proposed a railway timetable based on the needs of passengers, applying variable prices to train tickets to promote low-income passengers’ trips, minimize total

journey cost, ensure that the railway company's revenue was not less than a specified value, and that social equity was maintained at a level expected by the government. Their results showed that the proposed framework could give convenient timetables for passengers and revenues for the railway company, improving social equity by reducing the disparities between passengers belonging to different income categories in China.

Zhang et al. [10] found that in China the development of HSR contributed to regional economic equity through the improvement of accessibility and connectivity. Economic equality was more influenced by accessibility rather than by the frequency of service. Furthermore, the evolution of a province's economic equity could be influenced not only by the HSR attributes, but also by the characteristics of neighboring provinces.

Recent contributions from Italy showed that, on average, HSR in Italy contributed to a significant increase in transport accessibility for the zones along the HSR network, while only marginally for the others (Cascetta et al., 2020) [11]. Regional equity effects were estimated, and the result was that HSR in Italy decreased equity in terms of users' travel time accessibility, increasing the differences between the zones served by HSR and those not served. In the work by Pagliara et al. [12] the need to face the issue of equity and HSR was stressed as a *conditio sine qua non* in any transport project.

3. Contributions in This SI

In the paper by Kaizuka [13], Vietnam's proposed North–South Express Railway (NSER) was considered as a case study. The future CO₂ emissions generated by the NSER were computed. The study found that the HSR could emit more CO₂ per end-to-end journey than a plane, that even in per-capita terms the emissions could be worse depending on the seat fill rate, and that the market size of Vietnam's central provinces would present significant challenges in ensuring that the railway was efficient enough to outperform the plane in ridership terms. This result showed that both the outstanding impacts of coal and other fossil fuel use in the energy mix and the potential link between environmental performance and regional inequality which made up the hidden costs in HSR projects, and the exacerbated risks to the environment posed by inequality.

In the work by Ngoc and Nishiuchi [14] the impact of HSR on social equity was analyzed across the population of four cities representing the northern, central, and southern areas of Vietnam. In general, the high price of HSR represented one of the main constraints for choosing HSR over inter-city buses and conventional trains. Low-income groups would likely, w.r.t. higher income groups, use more an inter-city bus or conventional train, after introducing HSR. The findings revealed the fact that social inequity might occur, with the low-income group being especially vulnerable, due to the existence of HSR in the future. Moreover, the interest of users towards inter-city buses and conventional trains varied among the four cities before and after the presence of HSR.

Indeed, low-income groups in Vinh and Nha Trang would not use HSR, as they preferred to use inter-city buses.

The work by Pagliara [15] dealt with an economic analysis with the objective of integrating equity within the evaluation of transport projects, specifically high-speed rail projects. The consumer surplus was conceived as a monetized measure of both direct and indirect benefits for all zones, and for all socioeconomic categories served and not served by HSR, respectively. The added value was that of rethinking these two shares in the computation of the total net present value as equity measures of the project itself. Specifically, the distribution of the HSR benefits among the different groups or zones in a given study area could be computed, and a comparison of the values for each zone of the study area and for each category made possible to assess the effects of equity between zones/categories.

4. Further Perspectives

The manuscripts published in this SI represent only a small contribution to the research on this topic. The Guest Editors think that there is still a lot to investigate about HSR and

the equity issue, and many questions remain unsolved; the state-of-the art (in terms of qualitative and quantitative methods) has not yet been reached. There is a need to acquire an in-depth understanding about the motivations as to why HSR is still not an inclusive transport alternative, and to identify stimulating lessons and directions for future research to drive the knowledge about HSR and social equity into practice for those countries where these services exist. We hope that this SI will encourage a new wave of research in this direction, extending the analysis also into other countries.

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References

1. OECD Income Inequality, Social Inclusion and Mobility. *ITF Round Table Report 164*. 2017. Available online: <https://www.itf-oecd.org/income-inequality-social-inclusion-and-mobility-roundtable> (accessed on 31 March 2022).
2. Church, A.; Frost, M.; Sullivan, K. Transport and social exclusion in London. *Transp. Policy* **2000**, *7*, 195–205. [CrossRef]
3. Lucas, K. Transport poverty and inequalities. *Eur. Transp. Res. Rev.* **2018**, *10*, 17. [CrossRef]
4. Lucas, K.; Mattioli, G.; Verlinghieri, E.; Guzman, A. Transport poverty and its adverse social consequences. In *Proceedings of the Institution of Civil Engineers—Transport*; Thomas Telford Ltd.: London, UK, 2016; Volume 169, pp. 353–365.
5. Vasconcellos, E. *Urban Transport, Environment, and Equity: The Case for Developing Countries*; Earthscan Publications: London, UK, 2001.
6. Banister, D. *Inequality in Transport*; Alexandrine Press: Abingdon, UK, 2018.
7. Jin, M.; Lin, K.-C.; Shi, W.; Lee, P.T.-W.; Li, K.X. Impacts of High-Speed Railways on Economic Growth and Disparity in China. *Transp. Res. Part A Policy Pract.* **2020**, *138*, 158–171. [CrossRef]
8. Ren, X.; Chen, Z.; Wang, F.; Dan, T.; Wang, W.; Guo, X.; Liu, C. Impact of high-speed rail on social equity in China: Evidence from a mode choice survey. *Transp. Res. Part A Policy Pract.* **2020**, *138*, 422–441. [CrossRef]
9. Zhan, S.; Wong, S.C.; Lo, S.M. Social equity-based timetabling and ticket pricing for high-speed railways. *Transp. Res. Part A Policy Pract.* **2020**, *137*, 165–186. [CrossRef]
10. Zhang, F.; Yang, Z.; Jiao, J.; Liu, W.; Wu, W. The effects of high-speed rail development on regional equity in China. *Transp. Res. Part A Policy Pract.* **2020**, *141*, 180–202. [CrossRef]
11. Cascetta, E.; Cartenì, A.; Henke, I.; Pagliara, F. Economic growth, transport accessibility and regional equity impacts of high-speed railways in Italy: Ten years ex post evaluation and future perspectives. *Transp. Res. Part A Policy Pract.* **2020**, *139*, 412–428. [CrossRef] [PubMed]
12. Pagliara, F.; Hayashi, Y.; Ram, K.E.S. Deriving Policies from Land Use—Transport Interactions for Sustainable High-Speed Rail Development in Asia. In *Frontiers in High-Speed Rail Development*; Hayashi, Y., Rothengatter, W., Ram, K.E.S., Eds.; Asian Development Bank Institute: Tokyo, Japan, 2021; pp. 235–253.
13. Kaizuka, J. Even Electric Trains Use Coal: Fixed and Relative Costs, Hidden Factors and Income Inequality in HSR Projects with Reference to Vietnam’s North–South Express Railway. *Sustainability* **2021**, *13*, 13563. [CrossRef]
14. Ngoc, A.M.; Nishiuchi, H. Impact of High-Speed Rail on Social Equity—Insights from a Stated Preference Survey in Vietnam. *Sustainability* **2022**, *14*, 602. [CrossRef]
15. Pagliara, F. Consumer’s Surplus: An Equity Measure of High Speed Rail Investments. *Sustainability* **2021**, *13*, 4537. [CrossRef]