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Infrastructure, services and urban development

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Workshop 3 report: Infrastructure, services and urban development

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ABSTRACT

Workshop 3 looked at the way transport services interact with infrastructure and the spatial environment and the implications of this for both the governance and planning of transport. A wide range of papers covered issues such as the measurement of outcomes on efficiency, effectiveness and sustainability, the value of public transport, activity and mode choice, the planning and governance of public transport, and the effect of external shocks on mobility and planning. These drew on examples from Asia, Europe, Africa, Australia and South America and from countries at different stages of development with a discussion of both theoretical and empirical approaches as well as applications of policy. This report draws a wide range of conclusions from the examples considered with suggestions for both research and policy.

1. Introduction

Transport services rely on infrastructure and those infrastructures determine the way in which the services are provided in an urban or regional space. This means that the development of infrastructure plays a major role in the quality that can be provided by transport services in both dense urban contexts as well as in more sparsely populated areas. The interdependence between spatial planning, infrastructure development, and transport service development has been a major topic in Thredbo conferences in the last decade. Workshop 3 looks at these interdependencies and works towards an integrated approach that links the three elements.

The governance of these three elements, the set of rules (cultural, legal and contractual) under which policies are formed, and decisions are made between the various stakeholders, is generally organized in a fragmented manner. For example, housing estates are not developed in places where public transport is readily available, or infrastructure is not available on those routes that could have the most ridership. A major topic of Workshop 3 is to see how an analysis of and decision-making for these three elements can be tied together better and be valued differently.

The call for papers for the workshop recognised the need to work towards planning equity in accessibility and how that is dependent on all three elements presented above. The workshop examined what the “good outcomes” for “all” entail, what forms of governance are best suited to define acceptable outcomes, and what is needed from the practitioner and research community to achieve this. This includes studies on how minimum service levels should be interpreted and operationalised for different contexts. What is a “sufficient” level of

minimum service and are there objective criteria and frameworks for arriving at this answer? Intricately linked to this is the question of who pays for the minimum service, especially if costs of provision are not fully recoverable, and on what basis. If alternative funding strategies exist and have been implemented, how have these been carried out and what lessons they might hold for other contexts. It is important to see examples both from countries that have implemented such reforms, as well as countries that have tried it but for some reason chosen to reduce it.

Environmental sustainability is an essential element of any initiatives. Several cities are working with climate policies that encourage strong car reduction measures (for example zero-emission zones, parking management strategies, tolls etc). Such measures are often based on the “polluter pays” principle. However, such measures might have unintended consequences, for example to groups who have a functional need for the car but are already at risk of social exclusion. It might also affect service structures. What experiences exist from cities that have introduced such measures? How can measures be designed in order to reduce unintended effects?

2. Presentations

In total 17 papers were presented, grouped along five themes:

- Measuring outcomes on efficiency, effectiveness and sustainability,
- The value of public transport,
- Activity and mode choice,
- Planning and governance of public transport, and
- External shocks mobility and planning.

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Workshop participants came from Australia, Austria, Brazil, France, India, Japan, Mozambique, the Netherlands, Norway, Saudi Arabia, Singapore, Taiwan, and the United Kingdom. The remainder of this section summarises the key take-aways of these papers and the discussions in the workshop on the themes.

2.1. Measuring of outcomes

The sections on measuring outcomes showed in three examples the variety of how to evaluate various public transport options. The article by [Yen, Mulley, Chen, and Lee \(2024\)](#) takes an operational perspective and shows an evaluation between services in this case looking at the internal efficiency of the services. The analysis of bus services in Taiwan emphasises the comparative analysis between services in order to optimise the overall efficiency of the bus service system.

[Arioli et al. \(2024\)](#) evaluate the investment costs against the externalities of various modes. The two articles show different approaches to measuring outcomes. The Brazilian article does emphasise the value a bus service system as whole has in creating public value. The articles together show how, dependent of the level of analysis and dependent on the questions asked, different approaches can be taken to either internally or externally optimise for bus service delivery.

2.2. The value of public transport

[Yen et al. \(2024b\)](#) focus on the value of a station in the neighbourhood for the overall network of railway services. It looks at the development of real estate value through the addition of new railway lines in a network, comparing two different approaches of measuring the effect on real estate value. The paper's outcome in terms of the limited effect of metro investments on real estate value was discussed, as it was not aligned with earlier analysis in literature. One comment suggested that the relative closeness to construction of the real estate included in the analysis might have an effect. [Sanko and Yamamoto \(2024\)](#) analyse a particular situation in which various parallel services between Osaka and Kobe in Japan allowed for an analysis of the bonus value that travellers attach to rail services. In the literature, a great deal of attention is given to that so-called rail bonus. The empirical analysis of the bonus in this paper showed it to be relatively limited compared to what is generally accepted in the literature, even though the paper still analyses a bonus of 10 % of a ticket price.

[Rathogwa and Onderwater \(2024\)](#) develop a first version of a dynamic model linking various policy goals to analyse the overall effect of transport policy on a wider set of values. The model includes safety and security, travel time, connectivity, travel costs, integration, environmental effects and reliability, to provide a basis for a more integrated analysis of policy options for transport. The paper emphasises the possible beneficial effects of more integrated ticketing and fares. A further paper based on South African experience, but using a range of international evidence, looked at the potential for using non-fare revenue, such as that generated by retail establishments in railway stations, to support the financial position of rail operators ([Shah & Onderwater, 2024](#)). The paper presented by [Hauger \(2024\)](#) provides a reference class analysis of an additional high-speed rail stop in the Oslo area. This approach allows for evaluation of various options on a much wider set of values compared with more traditional approaches.

These papers all provide specific analytical tools to evaluate transport options, like adding stations or replacing modes, on their wider value to society. Classic analyses of both public transport service changes as well as public transport infrastructure development look narrowly at either the business case of the investment or slightly wider at patronage in terms of the number of users.

The papers in this section all emphasise that the value of public transport can also be found elsewhere than in transport itself. And that currently we don't have well developed analytical tools for including those other values in the decision-making. Key questions are how do we

include the real estate value increase that can be a consequence of public transport development into its evaluation? Or how do we include lower maintenance cost of public transport infrastructure, as compared to cost of car infrastructure? Both on the cost side as well as on the revenue side our current tools struggle to widen the analysis over boundaries of a single service, multiple services, multiple public transport modes, public and private mode investments or the mobility system as a whole. New approaches like system dynamics or reference class estimating provide a great basis to develop new approaches that widen the perspective.

2.3. Activity and mode choice

[Rose and Pellegrini \(2024\)](#) focus on the same question as the prior presentations: what value to focus on. However, the paper takes a position on the way in which transport modelling is done. The authors claim that the focus is far too much on the transport part and "the human" should be put back into the modelling. They propose to shift to activity-based modelling to realise that shift, in which transport would be just a part of a total utility model.

Three questions came up in the discussion. Are we still expecting the humans to make "homo economicus" decisions, while we know they are more often satisficers than maximisers? And what impact does this have on how to align the way that we make transport infrastructure and service decisions with this wider perspective? Finally, the question was on how to deal with multitasking? That last point was the current focus of the research outlined in the paper and data gathering was underway.

[Lee \(2024\)](#) presents a choice model for travel to school. This showed the paradox that the more polluted the environment, the more likely parents would choose to bring their children to school using a car, contributing to the smog. It showed that sometimes challenging policy can be with internal positive feedback loops.

[Shibayama et al. \(2024\)](#) presents a broader evaluation of mobility that goes beyond the traditional focus on limiting travel time. From a perspective on how to look at the key values of mobility, he presented ways in which to evaluate mobility poverty. Generally, these are combinations of indicators, like the SUMI indicators (Traffic safety, Modal split, Noise pollution, Air quality, Congestion, Particle emissions, Access to mobility). In rural areas and for public transport, frequency of service and distance to stops are important categories of indicators. The presentation looked also at other indicators as applied to mobility poverty in Austria, Mobiscore in Belgium, public transport accessibility score in Malmö. The discussion focused on the extent to which this was broadening the perspective but still putting transport first.

On modelling mobility activity and mode choice, we see the tendency to look beyond the travel. This block presented several ways, in modelling, evaluating and policy approaches to widen the perspective. It is a clear vector in the development of policy thinking, however, much still needs to be done.

2.4. Planning and governance of public transport

[Guihery \(2024\)](#) analyses the reestablishment of a railway line in Südtirol, an independent region in Italy. It takes a "system innovation approach" perspective, including not just the hard institutions (like the legal system) in the analysis, but also the soft institutions, stakeholder interactions and learning. Planning and governance of public transport is often seen as the formal structures and decision-making, whereas Guihery draws attention to the informal structures. The paper presents factors that support and those that hinder public transport innovations. A major factor in this case was the mobilisation of those in favour, in an environment where funding was available. The railway played a major role against depopulation, a process that had been going on in the region. The decentralisation proved successful, in line with examples from other countries (like the Netherlands and Germany), and was used as the basis for a similar project in France.

[Behrens et al. \(2024\)](#) discusses the key challenges of the rail reform

in South Africa. After 2015, rail service in the country declined and came to a standstill in the COVID period starting in 2020, with rapid deterioration of the network as a consequence. Also here, like in Süd Tirol, services are starting up again, but for the whole of the country and with far less funding available. Growth is slow and has reached nowhere near the 2015 levels. The country is now considering decentralisation, and the article relies on the positive effects that have been achieved in many countries, including Czechia, France, Netherlands, Sweden and United Kingdom in Europe, but also Argentina and Brazil, New Zealand, and Japan.

Holmgren and Hansson (2024) take a more classical perspective looking at the effects of governance change in Sweden. It is clear that the reforms did not reach the expected positive effect on costs, supply, demand and prices. Demand is up overall, and cost and supply are up, mostly as an effect of a more competitive focus in regulation, following European regulation. A decentralisation led, as could be expected, to higher costs, as local policy makers could directly link local requirements to subsidies and deliver on local demands. Overall, prices are up, demand is up overall, but only in selected counties. The exact result of competitive tendering is still to be researched.

Guzella and Almeida (2024) analyse how other public values, like the health of the population, could be supported by public transport. The paper described how Brazil has many locations with limited access to health facilities. That challenge could be addressed by extending the number of facilities or improving the quality of public transport, so people can reach the existing (and possible new) facilities more easily. The paper focuses mostly on the number of facilities, their accessibility and the investments needed for improvement, with less attention given to the potential of public transport to provide an alternative.

The overall picture in this part was focusing on the effects of governance changes in the public transport sector, in particular rail, and the possible effects. With a single case study focusing on decentralisation of specific rail services to regional level, often combined with tendering to the private sector, having a general positive effect. The in-depth analysis in Süd Tirol emphasised a number of factors that can help make it a success. The Swedish paper showed that the positive effect is not general, for example costs can go up.

2.5. External shocks mobility and planning

Nakamura and Shibayama (2024) use stated preference research to see the effect that various restrictions on mobility due to external events had on the use of different modes. The paper compares the willingness of people to travel to shop, eat at a restaurant or go to a football match, comparing reactions to the Covid-19 pandemic, congestion, extreme weather announcements and the willingness to change behaviours because of greenhouse gas emissions. The research was carried out in Japan, Germany and England and allowed for a cross comparison, which showed some of the cultural differences in the reaction, for example, to extreme weather.

Salazar-Ferro et al. (2024) looked at the case of Trotros, a type of minibus, in Ghana. The paper assesses the potential to reduce the emissions of this major form of public transport in many African countries, by switching toward electric vehicles. The article compares what major change this would mean in terms of ownership, costs and how, given the funding available, change will be hard to realise. Different options of electrification of the vehicles are discussed, including the shift to a separation of ownership of vehicles and their operation. Given the scale of the problem and the difficulties of shifting to a new technology it might be simpler to change to a different form of public transport provision using larger vehicles. Here the questions of governance and regulation again come to the fore.

Das et al. (2024) examines the link between governance and better first and last mile connections in the development of the metro in Bengaluru. The complex landscape on governance with many stakeholders makes planning difficult but it was clear that the value of the metro lies

not just in the system itself but in the link with other modes. Realising this shows the need for participatory roles of end-users in both the planning and governance of new infrastructure but how can this be achieved?

The papers in this part of the discussion reinforced the view that policy evaluation on the old narrative was inadequate in a world where transport justice was becoming more important, in which relating transport to a range of social provisions such as healthcare or education is a new priority and in which transport has to respond to a range of external shocks with unknown impacts on both mobility and mode choice. This will differ between metropolitan urban and rural settings and between more and less developed countries. Government budgets and funding as well as governance and decision making have to be able to respond to a situation in which traditional structures and boundaries are no longer appropriate.

3. Outcomes

Transport systems cannot be considered in isolation from the societal functions they support; therefore, the planning of transport infrastructure must be integrated with that of social infrastructure—such as healthcare—to ensure equitable and effective service provision. Addressing issues of transport justice requires careful consideration of governance structures, particularly in determining the appropriate level of government involvement and the mechanisms for sustainable financing. The assessment of transport system performance should encompass both quantitative and qualitative measures, enabling optimization across a range of stakeholder priorities. Moreover, planning processes must account for uncertainty and external shocks by incorporating robust risk management and adaptive capacity. In contexts of mobility poverty, sustainable mobility solutions are essential to promote social inclusion and long-term resilience. Transformative change in transport supply must also contend with constraints including limited physical and human capital, institutional inertia, and behavioral resistance among users. Finally, sustained progress depends on the education of planners, policymakers, and the public, supported by dynamic feedback mechanisms that enable responsive and informed decision-making.

4. Recommendations

4.1. Policy recommendations

Transport policy, while essential, cannot independently resolve the full spectrum of urban and regional development challenges or address structural inequalities. There is a critical need for integrated planning that aligns transport strategies with broader social, economic, and spatial policies, while also recognizing the inherent limitations of public transport policy in isolation.

Embedding the concept of transport justice into policy formation is particularly important in rural and sparsely populated areas, where conventional efficiency-based approaches may fail to capture issues of accessibility and equity. A more holistic understanding of value is required—one that extends beyond traditional metrics such as cost-efficiency or willingness to pay, to include social inclusion, environmental sustainability, and community well-being. Policy interventions must therefore be justified not solely on the grounds of economic efficiency or fiscal balance, but in terms of their broader welfare and distributive impacts.

Moreover, the transferability of policy models across different cultural, institutional, and governance contexts must be approached with caution. Interventions that succeed in one setting may not be effective—or even appropriate—in another, particularly when overly reliant on technological solutions.

These challenges underscore the importance of interdisciplinary approaches in transport planning, drawing on fields such as sociology, political science, public health, and environmental studies to ensure

context-sensitive, equitable, and resilient policy outcomes.

4.2. Research recommendations

Advancements in transport modelling are increasingly leveraging activity-based frameworks, artificial intelligence, and machine learning. To maximize their impact, these tools must not only be technically robust but also informed by interdisciplinary insights, particularly in understanding for whom they are optimized and how they reflect broader societal goals. Collaboration across fields such as urban planning, behavioral science, public health, economics, and data science can enhance the relevance and applicability of models, ensuring they support inclusive and context-sensitive decision-making. Defining “value” in transport planning remains a complex task, necessitating interdisciplinary engagement to develop practical, shared metrics that reflect diverse user needs and policy priorities. The variable success of transport interventions across different levels of government further highlights the need for governance analysis that accounts for institutional structures, funding mechanisms, and political accountability. Understanding responses to shocks—both acute and incremental—also benefits from interdisciplinary perspectives, integrating insights from resilience studies, crisis management, and systems theory. A key challenge is the integration of transport and facility planning within wider spatial, human resource, and energy policies, requiring a nuanced understanding of the interdependencies and limitations of transport interventions. Comparative research, informed by political science, geography, and public administration, can shed light on why some policy measures succeed in particular contexts while others do not, and help to identify the transferable conditions for effective intervention.

4.3. Recommendations for Thredbo 19 conference

This diverse set of papers raised a number of issues that will need to be kept central to discussion at future Thredbo Conferences. Key to this is a changing world in which traditional approaches to planning and delivering transport based solely on markets and efficiency are no longer appropriate as issues of transport justice and governance involving a wider range of stakeholders become more important. Similarly, modelling transport demand and supply cannot be undertaken in isolation from a wider range of spatial planning issues, such as in healthcare and education, which will themselves be different between large metropolitan conurbations, large free-standing cities, towns, and rural areas. Transport can no longer be viewed as just a derived demand but is an integral part of all human activity. Thus, the structure of both planning and analysis has to reflect this with implications for the contractual arrangements under which individual services are provided. The critical elements of this are:

- how to incorporate wider social objectives into the contractual arrangements for transport supply,
- how to reintegrate infrastructure and service provision where unbundling has had unintended negative consequences,
- how to involve a wider representation of all stakeholders including both users and taxpayers into planning and governance to ensure transport justice,
- how to develop modelling and analytical tools to support these changes.

5. Conclusions

The papers and subsequent discussions in Workshop 3 emphasise the

view that transport, and especially public transport, cannot be analysed, planned or governed in isolation. Transport infrastructure and services are an integral part of the social and economic fabric of communities, regions and nations. But the diversity of these communities means that a one-size-fits-all solution will not generate the maximum welfare possible for all citizens. Only by seeing transport as one dimension of activities can we hope to model and analyse the transport dimension effectively. Only by planning transport in the context of a range of services that make up the social infrastructure of a community can we hope to plan and allocate resources effectively and efficiently. Only by understanding the relationship between transport and the spatial structure of a city, town or rural area, its economy and land use, can we ensure the basis of effective policies towards mobility and mode choice. Only by adopting a policy of transport justice can we ensure that there is an appropriate level of accessibility for all citizens. Any specific policy towards transport through direct public sector provision or contractual arrangements with private sector suppliers needs to incorporate these principles. The evidence presented in papers in this Workshop shows what can happen when these basic principles are not applied and provide some examples of good practice in moving towards their adoption.

Declaration of competing interest

None.

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