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Innovative responses to urban transportation: current practice in Australian cities

Authored by

Jago Dodson, RMIT University

Carey Curtis, University of Melbourne

David Ashmore, RMIT University and Swinburne University

Ian Woodcock, Swinburne University

Stephen Kovacs, Curtin University

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Authors

Jago Dodson, RMIT University
Carey Curtis, University of Melbourne
David Ashmore, RMIT University and Swinburne University
Ian Woodcock, Swinburne University
Stephen Kovacs, Curtin University

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Executive summary

Key points

- **There is extensive theorisation and knowledge of innovation systems internationally; however, the application of this knowledge to urban transport issues is less developed.**
- **Innovations are occurring in urban transport systems internationally across multiple domains, including technological advances as well as policy and institutional development.**
- **Recent analysis highlights the role of the state in fostering transport innovations and the institutional context for innovation.**
- **Passive and active responses to innovations in Australian urban transport systems are uneven and fragmented.**
- **There are many opportunities for Australia's urban transport policy and the regulatory institutional environment to better respond to innovations, including through greater coordination around agreed national goals, institutional design for innovation, and greater effort to engender cross-sectoral innovation practices.**

The study

This study responds to the brief issued by AHURI to investigate urban transport innovations in Australian cities, identify policy responses to these innovations, and chart possible policy directions arising. Scoping projects undertaken by AHURI involve 'evidence mapping' that assesses the current extent and range of current evidence, identify further research or policy development possibilities or priorities, and identify gaps in the evidence base.

This project's project scope required an investigation of how Australian urban transport programs and policies are responding to changes in transport technology, travel patterns, environmental imperatives and spatial development dynamics in order to offer guidance about future directions and options.

Four research questions guided the approach:

1. How are large-scale processes of technological, economic, social and environmental change affecting travel patterns and transport systems in Australian cities?
2. What strategic approaches to configuring infrastructure, technology, regulation and design are Australian metropolitan transport programs and policies adopting?
3. How do Australian metropolitan transport programs and policies compare to relevant international examples in terms of strategic approaches to technological, economic, social and environmental changes?
4. What forward positions should Australian metropolitan transport programs and policies consider in response to drivers of major transport system change and what further research is needed to inform this positioning?

The research was conducted through a desk-based review of the international literature on innovation, transport innovations, and on Australian state planning and transport policy (focussing on New South Wales, Victoria and Western Australia) and institutional settings. This work was conducted over 2019 and 2020.

A Project Reference Group (PRG) was established that included invited representatives from state and federal agencies. This group met twice over the course of the project to consider project directions. The PRG is not responsible for the content of this research report.

Two workshops were held with professional transport planning experts from state and local government and the private sector in Victoria and Western Australia. The purpose of the workshops was to seek responses on the framing of the project, and on the challenges and future directions for policy. These workshops provided useful feedback on the study direction. The workshop participants bear no responsibility for the content of this research report.

The study was ambitious in scope but limited by the extent of resources provided. In this respect, the study can be classed as exploratory. The conclusions of the study identify a sizeable agenda set for researchers and policy analysts seeking to further advance understandings of innovations—both at the international and national levels.

Key findings

Defining innovation

There is an extensive and growing literature on innovation that seeks to define, record and explain instances of innovation, and the underlying social dynamics that make societies, social subgroups, institutions or industry sectors innovative. Innovation debates also intersect with wider social scientific discussions, including literatures on transitions, socio-technical relationships, economic institutions and business practices.

Most transport technologies have existed in precursor form for long periods prior to their widespread application. Identifying what is new in a recent transport technology is thus not clear-cut. Critically, the value of innovation is not only about newness and novelty as such, but the creation of new value propositions for regulators, providers and travellers.

In transport, such value propositions for regulators include enhanced ability to meet overarching policy goals such as:

- reduced emissions and congestion
- increased efficiency or productivity
- greater accessibility and social equity.

For transport providers, the value proposition includes:

- greater efficiency
- greater capacity
- greater market share.

For passengers or users, the value proposition includes:

- increased usefulness
- increased accessibility
- increased inclusivity
- increased comfort
- increased convenience
- increased safety
- reduced price.

Innovation in transport technology is temporally and spatially conditioned: what is seen as innovative in one place may not be seen the same way in another place.

A first step in examining innovation responses involved the need to define and identify the key drivers of innovation in transport policy. Drivers of innovation establish background pressures on transport systems that motivate adoption of new technologies or regulatory or institutional arrangements. Defining these was critical to ensuring that:

- a comprehensive framework of innovation was established that could be used to examine international and national practices
- the study was purposively grounded in the challenges that confront Australian transport planners.

In considering a holistic view of drivers of innovation, given the above understanding, the project defined these as:

- the social, economic, environmental and institutional conditions that generate market and policy demand for innovation
- the dynamic response between this demand and suppliers.

A multiplicity of drivers of innovation were identified, including:

- technology
- social and environmental imperatives
- demand behaviour—of markets or individuals
- resource constraints—land, public and private capital
- regulatory gaps
- political imperatives.

The drivers of innovation exert influence on 'domains of innovation'. These domains are socio-technical sub-sectors of the overall transport system in which new technologies, regulations or strategic frameworks emerge and are applied. Innovation was thus framed under five 'domains of innovation':

- Transport platforms
- Influencing travel behaviour
- Urban structures
- Climate change and pricing
- Infrastructure procurement.

These five domains were considered to be the specific domains that were manifested as a consequence of the exploration of the drivers of innovation.

The analysis of international practice and of current and emerging Australian transport policy at federal and state jurisdictions was conducted using the five domains of innovation as a framing device. Here innovation can be summarised as undergoing a sequence of phases:

adoption → policy response → stabilisation

Each phase may include both private sector and public sector intervention—with public sector intervention taking place via planning, design or regulation—and these phases are noted in the review of both international and national practice.

International practice

Innovation domain: Transport service platforms

There is a great deal of diversity in transport service platforms, whether they are operating systems, large conglomerate information systems, or specific applications (such as Uber). Digital platforms have become prominent as mechanisms for coordinating service delivery, including integrated mobility services, car-sharing, ride-hailing and micro-mobility vehicles. In some jurisdictions, multimodal platforms known as 'Mobility as a Service' (MaaS) are being deployed. Further platforms are also being developed to provide autonomous vehicles, although these are not in generalised use at present.

Key issues relating to MaaS include:

- the governance of coordinating a multiplicity of stakeholders and service providers at different levels of the decision-making process
- ownership of the platform
- selection of modes to be offered in a MaaS package
- whether full coverage can be provided in ex-urban areas
- segmentation by groups and modes and issues of cross-subsidy.

Key issues for ride-hailing include the potential for quasi-monopolistic control of the platform, the avoidance of regulation and safety, and the degree to which services may be able to meet community service obligations in outer suburban and regional areas.

Key issues for car-sharing schemes typically relate to their integration within sustainable transport systems and access to public road space for parking. The geographic distribution of vehicles in car-sharing schemes indicates a dependence on relatively good public transport.

For micro-mobility, there are issues of definition, which lead to uncertainty and variation in licensing and regulation; the extent to which these modes are integrated with other modes in a MaaS platform is also of interest.

Autonomous (or driverless) vehicles (AVs) have been subject to a large degree of speculation in recent years as various automotive manufacturers compete to deliver a viable wholly autonomous vehicle to market. There is considerable uncertainty as to their technological viability, their operation within urban transport systems, their effects on travel behaviour and the institutional arrangements that should accompany their adoption. There are mixed views regarding their benefits and drawbacks for car dependency, increased distances travelled, urban expansion, reduced mass public transport use and their compatibility with complex urban environments with high levels of pedestrian activity. The timing of driverless car availability and rollout remains unclear.

Innovation domain: Influencing travel behaviour

Many innovations seek to influence travel behaviour, typically to reduce reliance on private cars. This includes explicit behavioural modification programs, such as TravelSmart, or may involve wider policy frames that reduce the convenience or raise the cost of car use relative to other modes.

The understanding of factors underpinning car dependence relative to other modes is a well-established domain. Broadly, cars are understood to offer a more convenient option that is artificially under-priced relative to other modes. However, there is a body of literature that recognises that car use is determined by institutional, environmental design, as well as individual factors.

Good quality public-transport network planning can improve the quality of service experienced by users and, in turn, support patronage growth. Although there is wide variance internationally in terms of the quality of service provided by public transport, new approaches in a specific jurisdiction may be seen as innovation even if they are already part of normal operations elsewhere.

Despite continuing telecommunications technology improvements, telecommuting had not been adopted by large numbers of employees prior to the COVID-19 pandemic. There is now substantial evidence that the COVID-19 experience resulted in large proportions of employees and employers experiencing telecommuting, with significant proportions keen to utilise it for a much greater proportion of work practices. While this 'experiment' may lead to sizeable changes in practice, the extent and durability of such shifts is difficult to predict.

Innovation domain: Urban structures

Urban structure influences urban travel patterns through the locational differentiation of land uses and transport accessibility. An urban structure that requires longer commuting distances to access employment may be less efficient than one where commuting is shorter. Various consequences arise from inefficient urban structure. The problem of labour market 'spatial mismatch' has been long understood, while issues of transport accessibility and disadvantage are also well known. Inefficient urban structures are also known to compromise urban productivity.

Efforts to manage urban structure often involve coordination of transport and land-use planning around key nodes within metropolitan areas, around which activities are focussed and to which efficient transport services are provided—such as heavy rail. These efforts may be considered innovative in relation to prevailing patterns, but they face impediments such as:

- the complications associated with ongoing car-dependent travel
- the task of coordinating and regulating land-use activities
- institutional and political support.

The expansion of metropolitan areas typically requires consideration of infrastructure servicing. In many jurisdictions, metropolitan expansion through urban development proceeds in advance of infrastructure. Basic infrastructure servicing is typically ensured but less effort is often dedicated to public transport provision. Much policy focus has been on paratransit services and like services in recent decades, and there is evidence of regular efforts to generate innovation in this area. However, a stable viable model of urban fringe and ex-urban demand-responsive transit is not yet confirmed as established, apart from very specialist tasks such as disability mobility.

Innovation domain: Climate change and pricing

Transport debates have considered who should bear the negative costs of transport infrastructure as experienced through various forms of pollution, including greenhouse gas emissions. Innovation in this domain includes:

- electric vehicle uptake
- road pricing
- improved parking-pricing regimes and regulation.

However, these areas face policy and institutional challenges that limit the pace of current change.

Across the globe, there are numerous incentives currently in place to encourage the uptake of electric vehicles. These cover purchase rebates, tax exemptions and tax credits. They also cover incentives that range from access to bus lanes to waivers on fees—parking, toll roads, user charging. The magnitude of the financial incentive is driven by the vehicle type and the size of the battery. Some countries not only incentivise the purchase of EVs, but also conversions of hybrids and conventional cars to EV, as well as fuel cell vehicles.

The major impediments to the adoption of EVs are the lifecycle cost of ownership driven largely by battery prices, and the significant degree to which charging infrastructure will be needed to overcome the relatively limited kilometre range of EVs, to enable the space to move away from what might be seen as the 'safer' options of hybrid technologies, or just cleaner fuel.

Efforts to reduce battery costs and the distribution network are ongoing globally, but in order to achieve economies of scale and render EV technology a genuine consumer choice, purchasing incentives are needed in the form of:

- exemption from taxes
- road-user charging
- capital grants.

The theoretical case for road-pricing schemes is well established but such schemes tend to face public opposition. Road pricing remains a domain that is open to innovation, not only in relation to technologies that provide for less intrusive road-use recording but also to institutional models and the potential to advocate for the wider benefits that would accrue from price signals that reduce road use at the same time as raise funds for broader environmental and transport objectives that could secure popular support for scheme introduction—if communicated effectively.

There remains potential for innovation in the domain of car parking pricing in terms of technologies, regulations and institutional models. However, this needs to be understood within the generalised framework of support for automobile travel, as parking is a consequence of wider settings, even if it is often the most prominent.

Innovation domain: Infrastructure procurement

Infrastructure procurement focusses on value capture and public-private partnerships (PPPs). If implemented carefully, value-capture models can be a robust financing alternative that could effectively support sustainable urban development and generate revenue for transport schemes. They have been successfully deployed in international jurisdictions.

Australian transport policy

This study has observed that policy discussion about transport innovation in Australia is focussed predominantly on current transport modes—rather than emerging modes—and on land-use planning to facilitate sustainable transport. This sees a continuation of practices set in the late-1990s. In each of the three states (NSW, VIC and WA) where conventional strategic urban planning and transport planning documents policy documents were analysed, the main focus is on domains of:

- **Influencing travel behaviour**—by seeking to lessen car dependency and suggest measures to improve public transport in order to address declining use by this mode
- **Urban structure**—looking to develop activity centres that are integrated with transport so that they lessen commuting.

All three states are seeking to expand their public transport networks, with an increasing focus on orbital lines and new routes serving destinations outside the CBD. There is also recognition of the importance of supporting active modes of travel via lanes and paths for cyclists and pedestrians. Other innovation domains are covered, but not consistently across states. This includes a focus on encouraging telecommuting, and on emerging transport modes: MaaS, ride-hailing, car-sharing options and AVs. NSW also includes a focus on micro-mobility.

The ability to properly implement this new urban agenda continues to be impeded by governance and regulatory barriers. These limit the ability to holistically integrate transport and land-use planning and align new land development with timely provision of infrastructure.

Constraints relate to the lack of road-user charging and patchy implementation of maximum parking ratios. The former will emerge as a critical issue as we transition to EVs and AVs. EVs will erode fuel excise revenues and without road-user charging there is likely to be less shared use of AV fleets. For the immediate future, parking caps and levies are an important demand-side response to foster development intensification of 'activity centres' while protecting their amenity. The failure to recover infrastructure costs through 'land-value capture' is another symptom of this underlying governance problem. None of the three states has a comprehensive approach to this funding mechanism, despite its endorsement by Infrastructure Australia (IA) at the federal level.

Regarding new mobility technologies and business models, the formal government and emerging policy documents show potential to 'disrupt' the private car model and reflect innovation in thinking, but the observed impacts remain muted and there is difficulty in operationalising many of the recommendations. There is a growing level of understanding regarding the potential for automated and on-demand public transport to improve accessibility to —and reduce operating costs of—transit systems. However, concrete steps to support this transition appear largely confined to NSW (of the three states that were investigated).

Forward positions

Policy development options

A key conclusion of this study is that the Australian urban transport sector lacks a coherent overarching framework for an innovation system, despite regular references to innovation in policies. The principal approach is of market-initiated innovation with regulatory anticipation and oversight at adoption. Key national agencies such as the Transport and Infrastructure Council (TIC) and the National Transport Commission (NTC) refer to innovation but their operational approach does not explicitly reflect international knowledge and practice in terms of technological innovation systems, sustainability transitions or public sector innovation practice. Infrastructure agencies such as Infrastructure Australia (IA) and Infrastructure Victoria (IV) focus on innovation through domain lenses, typically with a 'reform' perspective in terms of evolutionary policy development rather than an innovation system lens. This is not intended as a criticism of the agencies; they have been established to serve a function and as far as we have ascertained do so effectively within the parameters set. Rather, this observation points to the potential opportunity costs of further system development that could occur if a more formal and explicit framework for an Australian transport innovation system were to be adopted.

A more formal sustainability focussed innovation framework for Australian urban transport would necessarily need to reflect international knowledge and practice in innovation systems. This might be in relation to technological innovation systems or to wider sustainability transitions thinking. Agencies may wish to also consider the insights emerging from public sector innovation research, such as innovation bureaucracies.

This research has only touched on the potential for sustainability focussed innovation framing for Australian urban transport policy. More investigation is needed to better understand the potential for institutional reform driven by a sustainability focussed innovation framing. This presents a future direction for research.

A national sustainable transport innovation system would also require systematic dialogue to establish shared visions and directions for transport. This would likely require structured modes of deliberation and discussion—including identification of key societal challenges to which transport should respond through innovative change. Currently there are few vehicles for such national conversations that draw together diverse private, government and community stakeholders.

Institutions and practices

Many mechanisms have been identified that can support innovation—such as technological innovation systems—through which thick relationships are formed between private and public actors around sectoral challenges or imperatives. Innovation is often also framed from a spatial perspective via regional innovation ecosystems that activate networks of proximity between innovation actors to drive innovation potential. There is also recognition of the value of a systems- and transition-oriented perspective on innovation, so that collective societal challenges can be identified and 'mission-oriented' sustainability transitions activated that can establish pathways of succession from one technological configuration to a future more sustainable version.

Policy gaps and opportunities

This study has identified an array of innovation domains where there remain considerable knowledge gaps, whether these be in relation to:

- **technology development and adoption**—such as autonomous or electric vehicles
- **institutional questions**—such as the necessary institutional settings to establish generalised road pricing or strengthen activity centre planning in major metropolitan areas.

Each of these domains could benefit from further empirical investigation, as well as policy development attention to consider options and pathways.

Much transport innovation in the international literature is oriented to improving the sustainability of urban transport, whether through:

- reduced fossil-fuel demand
- mitigation of climate change due to vehicle emissions
- encouraging greater use of public and active transport or micro-mobilities.

Despite references to sustainability in some policy documentation, there remains a clear gap in terms of the sustainability framing in Australian urban transport. This gap could be addressed through a sustainability transitions perspective that would incorporate a combination of technological innovation and institutional reform around a national vision for sustainability. However, to initiate this direction would require a national sectoral conversation to be held which, in turn, raises questions of leadership within the sector. In the absence of innovative leadership, it is likely that business as usual will prevail.

The role of the state in urban transport innovation

An important component of the theorisation of, and institutional design for, innovation is the role of the state. This role has been present in much technological innovation but has only relatively recently been recognised as being essential to the development of technological innovation systems and to wider programs of transition towards technological and societal sustainability.

There is a critical need for further elucidation of theories of state framing and fostering of innovation in Australia —including in relation to urban transport. Such theorisation should be both:

- **conceptual**—in terms of a theoretical understanding of the state role in innovation
- **empirical**—in terms of expanding knowledge of the capacities of state actors and agencies to establish institutional, policy and regulatory arrangements that can support urban transport innovation.

Such a theorisation in the Australian context would need to be calibrated to the particular circumstances faced in Australia arising from geographic factors such as:

- the relative isolation of the country's major urban areas from other large urban areas
- the chronic relative national underspend in research and development
- the specific governmental structures and divisions of responsibility in Australia arising from the federal constitution.

The fostering of innovation within a national regulatory and policy system that is overwhelmingly focussed on competition, rather than innovation or sustainability, also deserves appraisal. There is a need to consider what the relevant federal, national (such as the National Federation Reform Council (NFRC), formerly the Council of Australian Governments (COAG) and state responsibilities are in relation to various innovation domains and the institutional frameworks necessary to advance them.

Australian Housing and Urban Research Institute
Level 12, 460 Bourke Street
Melbourne VIC 3000
Australia
+61 3 9660 2300
information@ahuri.edu.au
ahuri.edu.au
twitter.com/AHURI_Research
facebook.com/AHURI.AUS
Australian Housing and Urban Research Institute