

Unraveling the Complexity of Urban Transport Behavior: A Qualitative Review of Factors Influencing Mode Choice in Developed and Developing Regions

Deepthi Swamy¹, Sibel Eker^{1,2}

¹ International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, ² Radboud University, Nijmegen, Netherlands



What determines transport mode choices of individuals and societies, and how?

Why is human behavior important in the context of transport sector decarbonization?

The Importance of Demand-side Strategies: IPCC estimates *significant mitigation potential of individual and societal behavior* in transport sector (~5.8 GtCO₂e by 2050)

What **individual, social, and infrastructural factors influence the adoption of low-carbon urban transport** options?

Need for Integrating Human Behavior in Energy and Climate Modeling: Studies *across multiple disciplines* have attempted to synthesize the key drivers of such behaviors. Recent modeling studies have tried to incorporate the drivers for mode choice to improve the *realism of demand-side mitigation scenarios*.

How do these factors **interact and vary** across different **regions and demographic groups**?

Gap in Current Behavioral Reviews: Existing *literature lacks focus on interactions between individual, social, and contextual factors* during energy transitions. Additionally, most studies *focus on high-income countries*, neglecting the growing energy demands of emerging economies.

Methods

Qualitative review of 55 studies from developed and developing countries, to investigate significant factors affecting urban mobility choices – **individual** (e.g., socio-economic, demographic, psychological, cognitive), **social** (e.g., norms, influence), **infrastructural** (e.g., built environment, public transport service quality, policies and incentives)

Examines four urban transport mode choices: **private motorized vehicles (cars and 2-wheelers), public transport, non-motorized transport (cycling and walking), Electric Vehicle preferences.**

Examines **interactions between factors** such as income levels, age, social norms, public transport service quality etc. using **causal mapping of relationships in Vensim.**

Preliminary Insights and Conclusions

Determinants of travel behavior **differ by context and region and influence each other.**

Causal mapping enables the understanding of **mutual interactions of factors and feedbacks** in behavior, to identify points of **policy intervention** for effective adoption of sustainable mobility options.

In developed countries, **past conventional car use** reduces intention (and behavior) to switch to public transport, through **reinforced habits**. Policies **reducing public transport service price** (e.g., provision of a free travel card) can **dampen the effect of habit**.

In developing countries, **financial incentive** policies (e.g., car subsidies, elimination of import levies through domestic manufacturing) and **high-income levels** of population are significantly associated with increases in both **conventional car and two-wheeler ownership**.

In both developed and developing countries, the **intention to use/switch to public transport is reinforced by the influence of social norms of sustainable mobility**. High levels of public transport **service quality** (i.e., ease of use, connectivity, and safety), can **reinforce these norms** by improving individual's perceived self-efficacy of behavior, thereby **reducing the intention-behavior gap, and increasing public transport adoption in society.**

Key references

1. Clayton, S., Devine-Wright, P., Stern, P. C., Whitmarsh, L., Carrico, A., Steg, L., ... Bonnes, M. (2015). Psychological realism and global climate change. *Nature Climate Change*, 5(7), 649-656.
2. IEA. (2022). *Transport*. Retrieved from IEA, Paris: <https://www.iea.org/reports/transport>
3. IPCC. (2022). *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Retrieved from Cambridge University Press, Cambridge, UK and New York, NY, USA.
4. Javad, A., Gholami, H., & Bontang, S. (2020). Determinants of low-carbon transport mode adoption: systematic review of reviews. *Environmental Research Letters*, 15(10), 103002. doi:10.1088/1748-9326/ab3032
5. McCollum, D. L., Wilson, C., Petricola, H., Rameta, K., Krey, V., Riahi, K., ... Fujimura, S. (2017). Improving the behavioral realism of global integrated assessment models: An application to consumer vehicle choices. *Transportation Research Part D: Transport and Environment*, 53, 323-342. doi:10.1016/j.trd.2016.04.003
6. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I. C., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), 1-69. doi:10.1186/s13642-021-01626-4
7. Senik, M., Zhang, J., & Fujimura, A. (2007). Motorization in Asia: 14 countries and three metropolitan areas. *IATIS research*, 31(1), 46-58.
8. Van Acker, V., Goetsch, P., & Wilson, F. (2016). Key research themes on travel behavior, mobility, and sustainable urban mobility. *International Journal of Sustainable Transportation*, 10(1), 25-32. doi:10.1080/15568118.2013.821003

This research work (under preparation for publication) has received funding from the European Union's Horizon 2020 - Climate Energy and Mobility programme, under the WorldTrans project (grant agreement no. 1010816461). For more information, please contact Deepthi Swamy (swamy@iiasa.ac.at) or Sibel Eker (eker@iiasa.ac.at).

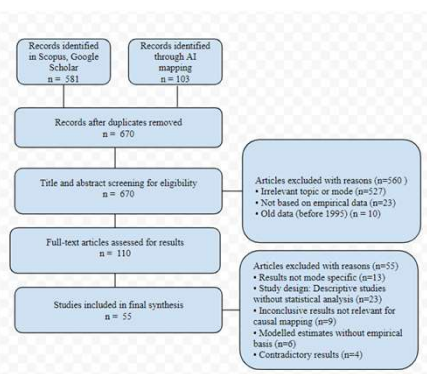


Fig. 1: PRISMA Screening Process

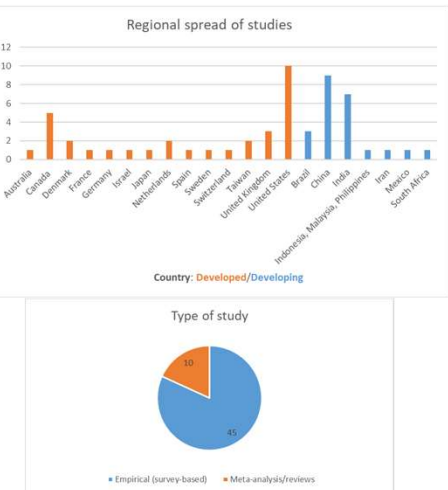


Fig. 2: Profile of Studies

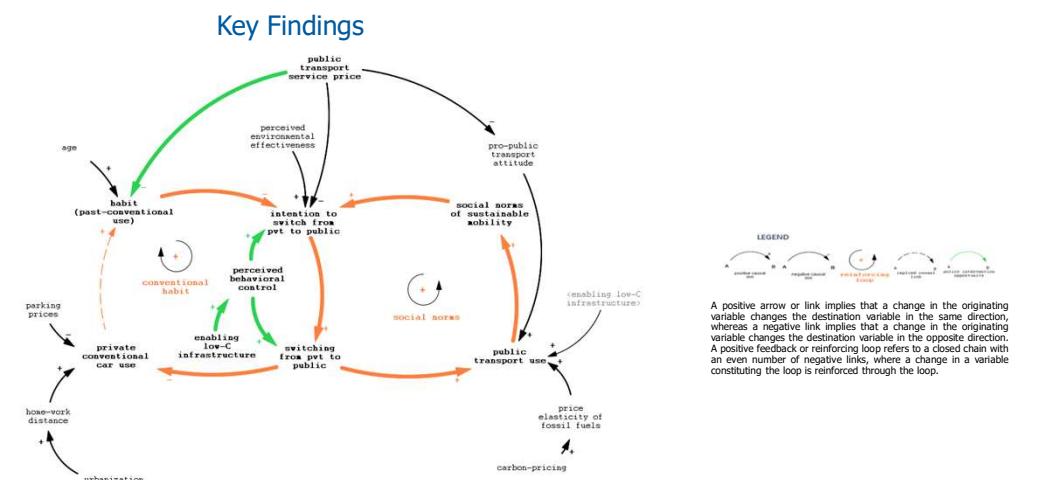


Fig. 3(a): Factors Affecting Private and Public Transport Mode Choices in Developed Countries

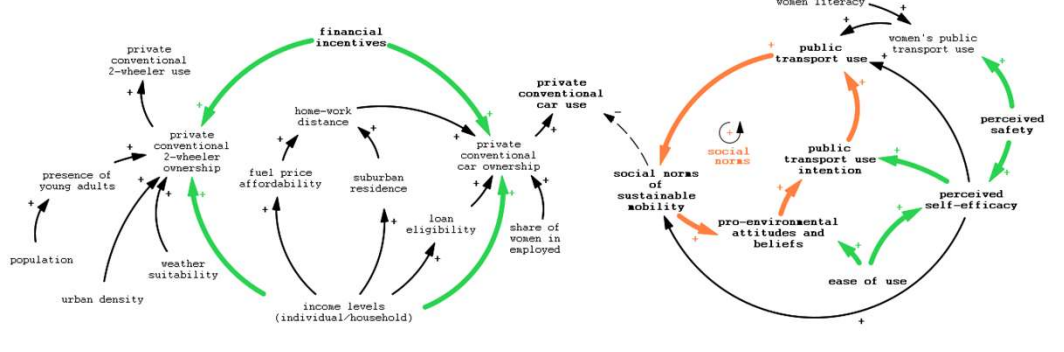


Fig. 3 (b): Factors Affecting Private and Public Transport Mode Choices in Developing Countries