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# Effectiveness of transport sector interventions in low- and middle-income countries: an evidence and gap map

Denny John, Howard White and Nina Blöndal

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## Title of the EGM

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Effectiveness of transport sector interventions in low- and middle-income countries: an evidence and gap map

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## Background

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***“Most effective economic fact of our times is not the development of manufacturing industries but that of the transport services.” – Dr Marshall***

Transportation has been identified as a ‘lifeline’ of a nation, and its increased use and expansion in the 20<sup>th</sup> century revolution has influenced the pace and growth of economic development of many countries (Banister & Berechman, 2003; Rodrigue, Notteboom & Shaw, 2013).

Although there is no separate Sustainable Development Goal (SDG) for transport, of the 17 Sustainable Development Goals (SDGs), seven (Goals 2, 3, 7, 9, 11, 12 and 13) include one or more targets that addresses transport, both rural and urban; and 4 (Goals 2, 3, 9 and 11) make specific reference to transport and infrastructure (United Nations, 2015). According to the Institute of Transportation and Development Policy (ITPD), ‘this elevation of transport in SDGs recognizes it as a key tool in reducing emissions, improving equity, and reducing poverty’. Analysis of these goals identifies the following key aspects of transport in the SDGs: access (urban, rural, affordable for all), road safety, fuel type/efficiency; quality, reliable, resilient, and sustainable infrastructure; regional and trans-border transport; sustainable urban transport for all; reduce vehicle emissions/air pollution in cities; reform fossil-fuel subsidies; rural/urban logistics, supply chain efficiency; and mitigation and adaption of climate change.

The need for sustaining and supporting the rapid economic and social development of low- and middle-income countries (LMICs) presents a range of challenges for the transport system in any country. A network of effective transportation makes the market more competitive while the system widens the opportunities for suppliers and buyers and improves the allocation process of goods and services (Kapoor, 2012). A combination of public and private entities provides transport across various LMICs. Most highways, ports and inland waterways, roads, and railways are owned and operated by state, but urban transport (such as highways) and airports could be built under private public partnerships. The provision of transport infrastructure calls for state intervention to ensure long term economic development.

The expansion of transport in LMICs has brought out both positive and negative effects. The impact of transport on economic growth and trade, population shifts and mobility needs, and poverty alleviation, have been the positive effects, whereas the over-dependency of fossil fuels, pollution, road traffic injuries, over-crowding in cities, and its public transport, accidents, destruction of local enterprises, and the spread of disease are the negative effects. A mapping will provide a comprehensive overview of existing knowledge in the area of transport and its effectiveness in LMICs. The map will guide programme managers to high quality evidence and inform targeted commissioning of future research (Snilstveit, Vojtkova, Bhavsar, Stevenson, & Gaarder, 2016).

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## Existing EGMs

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A map of evidence maps conducted in low- and middle-income countries identified no EGM conducted around transportation (Phillips, 2017).

The following systematic reviews have been identified:

Cepeda, M., Schoufour, J., Freak-Poli, R., Koolhaas, C.M., Dhana, K., Bramer, W.M., & Franco, O.H. (2017). Levels of ambient air pollution according to mode of transport: A systematic review. *Lancet Public Health*; 2:e23-34.

Pridmore, A., Ahlgren, C., Hampshire, K., & Smith, A. (2017). *Evidence review of the potential wider impacts of climate change mitigation options: Transport sector*. UK: The Scottish Government.

Hine, J., Abedin, M., Stevens, R.J., Airey, T., & Anderson, T. (2016). *Does the extension of the rural road network have a positive impact on poverty reduction and resilience for the rural areas served? If so, how, and if not why not? A systematic review*. London: EPPI-Centre, Social Science Research Unit, UCL Institute of Education, University College, London

Mardani, A., Zavadskas, E.K., Khalifah, Z., Jusoh, A., & Nor, Khalil. (2016). Multi criteria decision-making techniques in transportation systems: A systematic review of the state of the art literature. *Transport*, 31 (3), 359-385

Brown, V., Diomedes, B.Z., Moodie, M., Lennert Veerman J., & Carter R (2016). A systematic review of economic analyses of active transport interventions that include physical activity benefits. *Transport Policy*; 45: 190-208

Hugging, H., Glensor, K., & Lah, O. (2014). Need for a holistic assessment of urban mobility measures-Review of existing methods and design of a simplified approach. *Transportation Research Procedia*, 4:3-13

Starkey, P., & Hine, J. (2014). *Poverty and sustainable transport: How transport affects poor people with policy implications for poverty reduction: A literature review*. UN-Habitat, Overseas Development Institute (ODI), & SLoCaT

Fraser, S.D.S., & Lock, K. (2011). Cycling for transport and public health: A systematic review of the effect of the environment on cycling. *The European Journal of Public Health*. 1-6. Doi: 10.1093/eurpub/ckq145

Cavill, N., Kahlmeier, S., Rutter, H., Racioppi, F., & Oja, P. (2008). Economic analyses of transport infrastructure and policies including health effects related to cycling and walking: A systematic review. *Transport Policy*, Vol. 15: 291-304.

Heath, G.W., Brownson, R.C., Kruger, J., Miles, R., Powell, K.E., Ramsey, L.T. & Task Force on Community Preventive Services (2006). The effectiveness of urban design and land use and transport policies and practices to increase physical activity: A systematic review. *Journal of Physical Activity and Health*, 3, Suppl 1, S55-S76

Morrison, D.S., Petticrew, M., & Thomson, H. (2003). What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. *J Epidemiol Community Health*; 57: 327-333

Ongoing:

Gupta, M., Menon, G., Devkar, G., & Thomson, H. (2016). *Regulatory and road engineering interventions for preventing road traffic injuries and fatalities among vulnerable road users in low- and middle-income countries*. DFID-Cochrane Public Health Group

Gupta, M., Menon, G., Garimella, S., & Jha, S. (2016). *The effects of transport infrastructure and logistics interventions on women's participation in formal labour markets in low- and middle-income countries*. Campbell Collaboration

Silva, E., Roseetti, R.J.F., Kokkinogenis, Z., & Pinto, J. (2016). *A systematic review protocol on shared transportation*. Information Systems & Technologies (CISTI), 11<sup>th</sup> Iberian Conference

In addition the following traditional literature reviews in the area of transport have been identified:

Crisp, R., Gore, T., & McCarthy, L. (2017). *Addressing transport barriers to work in low income neighbourhoods*. Sheffield, UK: Centre for Regional Economic and Social Research, Sheffield Hallam University, doi: 10.7190/cresr.2017.3465773384

Anciaees, P.R., Jones, P., & Mindell, J.S. (2014). *The value of the barrier effect of roads and railways: A literature review*. Working Paper 03. London: UCL

Titheridge, H., Christie, N., Mackett, R., Hernandez, D.O., & Ye, R. (2014). *Transport and poverty: A review of the evidence*. UCL Transport Institute, University College London: London, UK.

Xia, T., Zhang, Y., Crabb, S., & Shah, P. (2013). Cobenefits of replacing car trips with alternative transportation: A review of evidence and methodological issues. *Journal of Environmental and Public Health*. Vol 2013.

Markovich, J., & Lucas, K. (2011). *The social and distributional impacts of transport: A literature review*. Working Paper No. 1055. Transport Studies Unit. School of Geography and the Environment, University of Oxford.

Jennings, G. (2015). Public Transport interventions and transport justice in South Africa: A literature and policy review. Proceedings of the 34<sup>th</sup> Southern African Transport Conference (SATC 2015). ISBN Number: 978-1-920017-63-7

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## **Suggested dimensions**

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The EGM will have two primary dimensions: interventions (rows) and outcomes (columns). Additional dimensions will be:

- Population (Age, Geographical location, Employment status, Income, Gender)
- Geography: Region, country
- Systematic review quality (low, moderate, high)
- Type of primary study (RCT, non-RCT, Cost-effectiveness, Cost-benefit, Economic Impact, Equity Analysis)
- Status of study (completed, ongoing)

In the hard copy of the EGM, multiple 2x2 representations of the EGM will be reported. A copy of the coding form will be included as an annex to the protocol and the main EGM report as per Campbell Collaboration guidelines for EGMs.

In the online version, selected additional dimensions will be possible to use as a filter. The online version will include references to included studies and brief summaries of each study based on the abstract (for impact evaluation studies) or plain language summary (for systematic reviews) provided for it.

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## **Intervention(s) or problem**

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In order to define the scope of the review, the author team reviewed various policy documents. Using exploratory searches the authors identified the various modes of transport and their classification relevant to the LMIC context. The following modes of transport were identified:

- a) Roads (highways, and rural roads including feeder roads, logging roads, and forest harvesting roads. Cycle lanes are included here)
- b) Railways and trams (both over ground and underground for mass transportation and bulk transport of energy and related commodities)
- c) Ports, shipping and inland waterways
- d) Civil aviation (restricted to commercial and cargo)

The EGM will include any intervention aiming to construct, improve, maintain or affect the use of transportation in low- and middle-income countries in the above categories of modes of transport. Broadly, there are three policies that have contributed to improving transport networks; infrastructure investments, price instruments, and regulations (Berg, Deichmann, Liu & Selod, 2017). The infrastructure investments entail building new transport infrastructure (e.g. roads, railways, ports, or airports), upgrading existing links and technology, or improving transport services. The price incentives include subsidies or taxes to influence mode choice and transport behaviour (e.g. student fare reductions, tolls, parking fares, fuel taxes, and clean transport subsidies). The regulations include rules to directly reduce emissions (such as fuel emission standards, or driving restrictions) or to organise the transport sector (for example, freight, taxis or buses) or the construction of infrastructure. Some policy interventions may affect supply, such as infrastructure investments, whereas others target demand, as do subsidies for transport.

We reframe Berg et al.'s three categories (infrastructure, prices, and regulations) a bit more broadly as infrastructure, incentives and institutions.

So, the intervention categories are each mode of transport, and the sub-categories in each case those just mentioned, i.e. infrastructure, information and incentives (which is broader than price mechanism) and institutions (which is broader than regulation). Table 1 shows the resulting set of intervention categories.

**Table 1: Intervention categories and sub-categories**

Category	Sub-categories	Examples
Road	Infrastructure	Construction and upgrading of roads, and highways Infrastructure maintenance
	Incentives	Road pricing and tolls Subsidies and taxes
	Institutions (including regulations)	Road legislation and agencies Vehicle and driving regulations Public private partnership (PPP)
Rail and trams	Infrastructure	Construction and upgrading Maintenance
	Incentives	Pricing structure Subsidies to rail operators
	Institutions (including regulations)	Regulatory framework Public private partnership (PPP) Nationalisation/privatisation
Ports, shipping and waterways	Infrastructure	Port and inland waterway construction and rehabilitation including modernization Maintenance
	Incentives	Tolls and other charges Taxes and subsidies
	Institutions (including regulations)	Port authorities
Civil Aviation	Infrastructure	Airports
	Incentives	Taxes and subsidies
	Institutions (including regulations)	Airport authorities

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## Population

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The target population are populations living in low- and middle-income countries.

Populations sub-groups of interest include: Rural/Urban, Women, Disabled, Older population, Employed, region, country. The online map will contain filters so that just the evidence satisfying that criterion is shown (see below).

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## Outcomes

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The outcomes are listed in outcome domains ordered along the causal chain (Table 2). Each domain has a number of sub-domains.

**Table 2: EGM outcomes**

Domain	Sub-domain
Transport	Infrastructure quantity Service frequency / traffic volumes Access to transport Efficiency including transaction costs, VOC, congestion and travel times
Economic and Social Development	Poverty Economic growth and development (including market access, productivity, trade, firm location and performance and employment) Access to social service facilities Cultural effects
Safety	Safety assessments Accidents and deaths
Environmental and environmental health	Sustainability Environmental impact including air pollution Spread of diseases
Economic and equity analysis	Cost effectiveness, CBA Economic impact Transport justice/equity <sup>1</sup>

While, cost benefit/benefit-cost analysis is an exercise to determine the social welfare effects of transport sector interventions in comparison to costs, economic impact analysis is an exercise to determine how a transport intervention project or policy affects the amount and type of economic activity in a region.

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<sup>1</sup> Transportation equity or justice usually refers to the fairness with which the impacts of transportation such as benefits and costs are distributed. Horizontal equity, also called fairness and egalitarianism, is concerned with the distribution of impacts between individuals and groups considered equal in ability and need; vertical equity is concerned with the distribution of impacts between individuals and groups that differ in abilities and needs, for example by income or social class (also called social justice, environmental justice and social inclusion) or in transportation ability and need otherwise known as universal design (Litman, 2018)

In addition, if included studies report costs related to the costs of transport infrastructure, their cost-effectiveness or cost-benefits, and/or economic impact and/or transport justice/equity these will be reported as well.

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## **Study designs**

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The EGM will include randomised controlled trials (RCTs), and non-randomised controlled trials, such as propensity score matching.

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## **Stakeholder engagement**

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The framework presented here will be further developed through the following process:

Stage 1: Initial framework to be constructed through review of strategy and policy documents, and discussions through external consultations through, (i) Meeting with Transportation experts (e.g. IIT-Delhi, TERI, CEPT), (ii) Discussions with Transport academics from India, and other LMICs, and (iii) Discussion with DFID staff.

Stage 2: Piloting framework with 10 included studies. The framework will be finalized once the first 10 studies are coded. The protocol will be revised at this point.

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## **References**

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Banister, D., & Berechman, J. (2003). *Transport investment and economic development*. UK: Routledge Books

Berg, C.N., Deichmann, U., Liu, Y., & Selod, H. (2017). Transport policies and development. *The Journal of Development Studies*, 53:4, 465-480. doi: 10.1080/00220388.2016.1199857

Ducruet, C. (2017). Transport Networks. *The International Encyclopedia of Geography*. 1–7.

White, H., Welch, V., Pigott, T., Marshall, Z., Snilstveit, B., Mathew, C. & Littell, J. (2018). Campbell Collaboration checklist for evidence and gap maps: Conduct standards -Title and protocol checklist. DRAFT Version 1.2 (11 April 2018). [www.campbellcollaboration.org](http://www.campbellcollaboration.org)

Kapoor, M. (2012). *Vision 2020: Transport. Prepared for the Planning Commission*. New Delhi, India: Planning Commission, Government of India

Litman, T. (2018). *Evaluating transportation equity: Guidance for incorporating distributional impact in transportation planning*. Canada: Victoria Transport Policy Institute

Phillips, D., Coffey, C., Tsoli, S., Stevenson, J., Waddington, H., Evers, J., White, H., & Snilstveit, B. (2017). *A map of evidence maps relating to sustainable development in low- and middle-income countries, 3ie Evidence Gap Map Report 10*. London: International Initiative for Impact Evaluation (3ie).

Puri, J., Nath, M., Bhatia, R., & Glew, L. (2016). *Examining the evidence base for forest conservation interventions, Evidence Gap Map Report 4*. New Delhi: International Initiative for Impact Evaluation (3ie)

Rodrigue, Jean-Paul., Notteboom, T., & Shaw, J. (2013). *The Sage Handbook of Transport Studies*. UK: Sage Publications

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## Evidence and gap map authors

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### Lead EGM author:

Name:	Denny John
Title:	Evidence Synthesis Specialist
Affiliation:	Campbell Collaboration
Address:	2 <sup>nd</sup> Floor, West Wing, ISID Complex, Vasant Kunj
City, State, Province or County:	New Delhi, Delhi
Post code:	110070
Country:	India
Phone:	+91-9987021553
Email:	djohn@campbellcollaboration.org

### Co-authors:

Name:	Howard White
Title:	CEO
Affiliation:	Campbell Collaboration
Address:	2 <sup>nd</sup> Floor, West Wing, ISID Complex, Vasant Kunj
City, State, Province or County:	New Delhi, Delhi
Post code:	110070
Country:	India
Phone:	+91 11 4323 9494 / 2613 9494
Email:	hwhite@campbellcollaboration.org

Name:	Nina Blöndal
Title:	Consultant
Country:	Denmark
Email:	ninablondal@gmail.com

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## **Roles and responsibilities**

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### ***Content expertise:***

Nina Blöndal has conducted several impact evaluations of transport interventions and authored a chapter on transport impact evaluation for the ADB Guidebook. Dr. Howard White co-edited a special issue of the Journal of Development Effectiveness on infrastructure impact evaluations including contributing a paper on mixed methods in infrastructure studies.

### ***Systematic review method expertise:***

Howard White and Denny John authors are experienced systematic reviewers which means that they are proficient in conducting various processes in an EGM, such as screening, quality assessment and coding.

Denny John will manage the process of screening, coding and quality assessing primary studies and systematic reviews. He has more than 6 years of experience as a systematic review author, as well as formal training. Additionally, he will also manage the component specific to economic evidence related to the topic. Denny John will also interact with transport researchers, and policy makers in India and other developing countries for developing the framework, validating the protocol, and providing critical comments to the final EGM document.

Howard White will provide technical support for the conducting the review.

### ***EGM methods expertise:***

Howard White as CEO provides technical and strategic support for the development of EGM in Campbell library. Previously, he has initiated and led the development of EGM during his association with 3ie. Denny John is currently co-author of 2 ongoing EGM registered with Campbell library. He has experience of conducting economic evaluations and systematic reviews of economic evaluation studies.

### ***Information retrieval expertise:***

The authors will be supported by information retrieval specialist, Dr. John Eyers, on an as-needed basis. John Eyers is a trained information retrieval specialist and has experience of supporting over 50 systematic reviews in social sciences areas.

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## **Funding**

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This EGM is supported by the UK Department of International Development (DFID) under its support for the Centre for Excellence for Development Impact and Learning (CEDIL). The protocol will be submitted in January 2019. The draft map will be ready in March 2019, and the final map by May 2019.

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## **Potential conflicts of interest**

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No conflicts of interest

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## **Preliminary timeframe**

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### **Phase 1: Systematic reviews**

- 31 January 2019: Protocol and Literature search completed
- 15 February 2019: Study inclusion completed
- 28 February 2019: Quality assessment and coding completed
- 31 March 2019: Draft EGM submitted
- 30 April 2019: Final EGM submitted

### **Phase 2: Impact evaluation studies**

- 31 January 2019: Literature search completed
- 15 February 2019: Titles and abstracts screened
- 28 February 2019: Full text reports screened and coding completed
- 31 March 2019: Draft EGM submitted
- 30 April 2019: Final EGM submitted