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## Effectiveness of transportation in low and middle-income countries: An Evidence and Gap Map

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## SCOPE OF THE EVIDENCE AND GAP MAP

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Full name: Social and economic effects of transportation in low- and middle-income countries: An evidence and gap map

Short name: Effects of transportation in low-and middle-income countries: An evidence and gap map

The map will cover all forms of transport, such as roads, railways, civil aviation, ports and inland water transport, and urban transport, and also cover a broad range of populations, such as rural and urban, general population, specific population (e.g. women, disabled etc.).

The map will show studies estimating effects using modelling, cost-benefit analysis and impact evaluation.

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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. The world of transportation is not only too large but of great scope, diversity and complexity, and transport remains an essential part of many aspects of life.

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 adaptation 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.

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## **OBJECTIVE**

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The purpose of this project is to map the existing evidence – and lack thereof – on the effects of interventions that aim to improve transportation in low- and middle-income countries.

Specifically, the objectives of the map are to:

- a) Develop a clear framework of interventions and outcomes related to effects of transportation and various modes of transport in low- and middle-income countries

- b) Map available systematic reviews and primary studies of the social and economic effects of interventions aimed at improving transportation in low- and middle-income countries in this framework, with an overview provided in a summary report.
- c) Provide database entries of included studies which summarize the intervention, context, study design, and main findings.

The output of the project will be an evidence and gap map (EGM) for all forms of transport, such as roads, railways (including mass transportation and bulk transport of energy and related commodities), civil aviation, ports and inland water transport, and urban transport.

### **Evidence and gap maps**

While systematic reviews aim to identify, assess and summarise research findings from studies on a (narrow) research question, the objective of evidence and gap maps (EGMs) is to provide a picture of the completeness (i.e. evidence and gaps) of existing research literature on a given topic. Typically, EGMs have a broader scope than systematic reviews. Another important difference between EGMs and systematic reviews is the manner in which they are disseminated. Systematic reviews are disseminated as technical reports, journal articles or plain language summary, where the answer to the research question is the key issue for readers. EGMs can also be disseminated as a report or an article, but the more user-friendly EGMs display its results in an interactive matrix. Identified studies are plotted in the matrix, so that the user can find evidence, or lack thereof, for his or her particular topic of interest, at a glance (see <http://gapmaps.3ieimpact.org/evidence-maps/forest-conservation-gap-map> for an example of an EGM matrix).

EGMs and systematic reviews share many methodological aspects, such as a predefined scope, selection criteria and search strategies. Screening and selection processes are also quite similar in EGMs and systematic reviews. Both approaches aim to summarise and identify every relevant study that falls within the scope, while being open and transparent.

### ***Scope***

The systematic review of effectiveness of interventions typically ask a question like: “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”

(Hine, et. al. 2016). The scope of systematic review of effects of interventions is usually narrowed down to specific populations, interventions, comparisons and outcomes. EGMs, on the other hand, have a much broader scope and ask questions like: “Examining the evidence base for forest conservation interventions” (Puri, et. al. 2016).

### ***Selection criteria and search strategies***

Both EGMs and systematic reviews have predefined scope i.e. inclusion and exclusion criteria describing eligible study designs, populations, interventions and outcomes. Both systematic reviews and EGMs use comprehensive search strategies to increase the likelihood of identifying all relevant studies within the scope.

### ***Processing the literature***

The important aspects of literature screening and selection processes in both EGMs and systematic reviews are the independent eligibility assessment as a method to reduce the risk of selection bias. Once the body of evidence has been identified and retrieved in full reports, the similarities between EGMs and systematic reviews become fewer.

The authors of systematic reviews extract data, assess study quality for each included study, and finally combine the findings of the studies in meta-analyses when possible and assess the overall quality of the evidence. Whereas, EGM authors limit their contents processing to coding each included study according to a predefined and piloted coding scheme.

To summarise, EGMs display the completeness of research literature on a broad topic, while systematic reviews answer specific research questions.

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## **EXISTING REVIEWS**

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

Traditional reviews in the area of transport are:

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/crest.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.

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

Huging, 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

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## INTERVENTIONS

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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 its classification in relevance 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)
- b) Urban transport (for example, footpaths, pavements, and arterial roads)
- c) Railways (for mass transportation and bulk transport of energy and related commodities)
- d) Ports and inland waterways
- e) Civil aviation (restricted to commercial and cargo)

The EGM will include any intervention aiming to construct, improve, maintain or affect the use of transportation systems 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. Investments entail building new transport infrastructure (e.g. roads, railways, ports, or airports), upgrading existing links and technology, or improving transport services. 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). 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 transport subsidies.

Table 1 lists the intervention sub-categories under each of these headings.

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

Transport infrastructure construction and rehabilitation	Trunk roads Rural roads & footbridges Rail inc. mass urban transport systems Air Sea/ports
Regulatory framework including pricing policy	Transport pricing and taxation Licencing regulations and restrictions

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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, Mode of transport (roads, urban transport, railways, ports and waterways, and civil aviation), region, country. The online map will contain filters so just the evidence satisfying that criterion is shown (see below).

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## **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)
- Mode of transport (roads, urban transport, railways, ports and inland waterways, and civil aviation)
- Geography: Region, country
- Systematic review quality (low, moderate, high)
- Type of primary study (RCT, non-RCT, Costs, Cost effectiveness/Cost-benefits, modeling)
- 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 EGM report.

In the online version, the 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 primary studies) or plain language summary (for systematic reviews) provided for it.

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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**

Sustainability	<p>Self-reliance</p> <p>Accountability,</p> <p>Environmental impact: deforestation, biodiversity loss</p>
Poverty reduction	<p>Income poverty measures</p> <p>Non-income poverty measures</p>
Growth	<p>Increase in productivity</p> <p>Trade volume</p> <p>Lowering of trade costs</p> <p>Better market access</p> <p>Rural connectivity</p>
Economic activity and income	<p>Per capita GDP</p> <p>Income diversification inc. agricultural diversification</p> <p>Income from public works</p> <p>Employment</p> <p>Displacement</p>
Education & Health	<p>Educational opportunities and choices (greater school choice)</p> <p>Access to healthcare and social services (e.g. vaccination rates, attendance at hospitals etc.)</p> <p>Quality of facilities</p> <p>Air-pollution</p> <p>Road injuries &amp; fatalities</p> <p>Spread of infectious diseases (e.g. HIV/AIDS)</p>
Firm location	<p>Reallocation of manufacturing along transport network</p> <p>Geographical spread in urban, rural, and remote areas</p>
Transport efficiency	<p>Travel time</p> <p>Access to markets</p> <p>Transport costs (Cost of roads, savings in vehicle operating costs (VOC))</p> <p>Traffic congestion</p>

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

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## STUDY DESIGNS

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The EGM will include randomised controlled trials (RCTs), non-randomised controlled trials, studies reporting economic evidence (costs, cost benefit, cost effectiveness), modeling, and systematic reviews of effects of interventions.

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## PROCESS FOR DEVELOPING THE FRAMEWORK

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

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

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).

United Nations. (2015). *Review of Developments in transport in Asia and the Pacific*. Bangkok: United Nations ESCAP (Economic and Social Commission for Asia and the Pacific)

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## EVIDENCE AND GAP MAP AUTHORS

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**ROLES AND RESPONSIBILITIES**

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- ***Content expertise:***

Dr. Howard White is the CEO of Campbell Collaboration. Previously he was the founding Executive Director of the International Initiative for Impact Evaluation (3ie) and before that led the impact evaluation programme of the World Bank's Independent Evaluation Group. He started his career as an academic researcher at the Institute of Social Studies in The Hague, and the Institute of Development Studies, University of Sussex.

- ***Systematic review method expertise:***

Both the 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.

Mr. John will manage the process of screening, coding and quality assessing primary studies and systematic reviews. Mr. John has more than 5 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. Mr. John would 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.

Dr. White will provide technical support for the conducting the review. Also, Dr. White would engage with transport researchers and policy makers in UK and other European countries with substantial experience of research on transport on LMICs. Dr. White would support Mr. John in linking with relevant stakeholders for supporting the framework and protocol development, and review of final EGM.

- ***EGM methods expertise:***

Dr. 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.

Mr. John is currently co-author of an ongoing EGM registered with Campbell library. He has experience of conducting economic evaluation 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. Dr. 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 draft map should be ready in January 2018, and the final map by March 2018.

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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

- 30 November 2017: Protocol and Literature search completed
- 31 December 2017: Study inclusion completed
- 31 January 2018: Quality assessment and coding completed
- 28 February 2018: Draft EGM submitted
- 31 March 2018: Final EGM submitted

### Phase 2: Primary studies

- 30 November 2017: Literature search completed
  - 31 December 2017: Titles and abstracts screened
  - 31 January 2018: Full text reports screened and coding completed
  - 28 February 2018: Draft EGM submitted
  - 31 March 2018: Final EGM submitted
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