

# BRIEF ACTIONABLE RESEARCH AGENDA ON:

## Infrastructure

# EfD

Environment for Development

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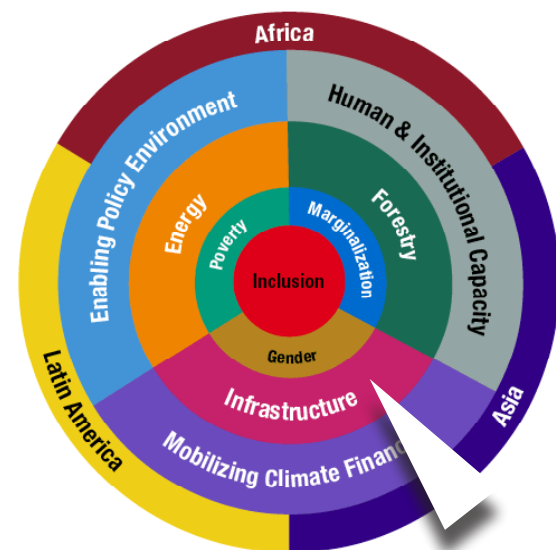
■ Infrastructure, both hard (Transport) and soft (Digital), are considered catalysts of economic growth. The provision for low-carbon infrastructure, in light of public private partnerships is part of a larger initiative to identify the most promising research issues to support an actionable low-carbon transition in the Global South.

**Aim:** To establish the implications of expanding and improving digital and transport infrastructure, including the effects on energy use, greenhouse gas (GHG) reduction, and equal access to such infrastructure for women and other marginalized groups.

**Background:** Investments in new digital and transport infrastructure have broader economic effects as result of complementary demands for other goods and services and their linkages to other sectors of the economy. In particular, they have direct effects on energy use. Although they are intended to provide net social, economic and environmental benefits, and to enhance educational and business opportunities for women, children and the poor, investment in both types of infrastructure can have unintended negative consequences. The nature, direction and extent of these positive and negative impacts, and the avenues by which they work, are disputed.

A new energy-efficient infrastructure will induce further demand for other goods and services. For example, better roads encourage more cars and more driving; they reduce the cost of mining and increase the risk of deforestation in previously closed areas. Better digital systems encourage users to spend more time online and to find new uses for the technology. Both are likely to increase income per capita, inducing greater consumption of energy sources, with the accompanying increase in carbon emissions. In effect, new and more efficient technologies may increase rather than diminish energy use, and impose unintended costs on the environment and society. Economists call these unintended consequences “rebound effects.”

In the Global South, many beneficial digital technologies are comparatively simple. For instance, smart phones (which can be charged using solar power) enhance banking and business by offering internet access. Moreover, because these benefits can be felt in the home, are comparatively cheap, and do not require physical strength, they may particularly accrue to women and children. However, with increasing access to the electricity grid, it is likely that digital demands for electricity will increase as well.



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## Opportunities for High-Impact Research

Regarding digitalization, a number of policy relevant questions will need to be answered. One is whether and how investment in digital technologies can help the transition to a low-carbon economy. If so, there are questions of how the process should be funded, including the role of public-private partnerships.

There are many issues that affect people's choices to use digital technology. In countries that have scarce foreign exchange resources, digital technology may be more expensive, and governments more prone to impose digital taxes. How sensitive consumers are to prices will affect the rate of uptake of technology and should be a primary topic for investigation.

Since the rate of uptake of digital technology is affected by age and education, it is important to understand the implications of a country's demographics. A contrasting issue arises with the elderly or illiterate, who may be left behind if they are less able to use technology. In addition, some communities face a greater risk of online crime because of low education levels or poor facilities to investigate digital fraud. Research is needed to identify disadvantaged groups facing unintended risks from digitalization and to develop strategies to minimize these risks.

Digital communications and services can offer an alternative to people who have trouble getting access to education, health information, and business opportunities because of poor transport infrastructure. The research question is how to maximize the benefits of virtualization. For instance, where conventional broadband is unavailable, satellite communication offers an option that should be explored.

Digitalization will affect energy supply and demand, but the overall direction of the effect is not clear. While virtual economic activity may reduce demand for energy for travel, technology is likely to increase demand for electricity. Research should include the direction and duration of initial trends, and the extent of rebound effects. Also important will be the effects on fluctuations in power demand – the variation in demand for electricity between peak and off-peak times.

The ecosystem-wide implications of digitalization will help determine its effects on a LCT. Research on the carbon/energy footprint of digital technologies is mixed. What is needed is analysis of the energy demands of the technology over its full life cycle. The life cycle includes operating and maintaining cell phone towers, as well as the recycling or disposal of old digital equipment, phones, and computers.

Turning to transportation, as incomes rise in developing countries, demand for private vehicles is expected to rise. If a LCT is to be achieved, this demand will need to be met by electric vehicles, or countered by improvements in public transport. Improvements to transport infrastructure (roads, rail and air) also will be needed. These prospects bring a number of questions for researchers.

Funding for transportation infrastructure raises many questions. Public transport may be





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owned by government (local or central), or operated via private/public partnerships (PPPs). In developed countries, PPPs have been shown to have benefits, including reduced fiscal pressure on public agencies, greater efficiency, and increased transparency through open bidding processes. A question is whether PPPs can improve the quality of transportation, while still minimizing costs, in countries that have less transparent bidding processes.

Another question is how much the public will use new transport infrastructure. LCT impacts will depend in part on how much driving increases on new roads versus how many drivers switch to improved urban light rail in urban areas and to regular bus service in both urban and rural areas. In addition, research is needed on the different impacts of transportation infrastructure on women, as well as on poor people, who are more likely to depend on public transportation than on cars.

While the transition to low-carbon transport is encouraged for the global benefits it provides, it imposes costs, including external costs that will be borne locally. One type of cost is that taxes will be imposed to promote low-carbon transport, including providing subsidies for lower-carbon transportation. Money spent on subsidies is not available for local social welfare or poverty alleviation programs. Close attention is needed to the nature and size of the costs, who will bear them, and how those who are harmed can be compensated.

In addressing these research opportunities, a number of general directions and issues should be borne in mind.

New infrastructure can do more than assist a LCT; it can also help transform production systems as a whole. An example is the use of digital technology to monitor inventories and demand, in order to respond with “just in time” production, which is more efficient in terms of both business profitability and consumer welfare.

Both pricing and contractual systems are important in encouraging households and businesses to adopt new technologies. Research questions include how the structure of contracts (such as those used when selling bandwidth to cell phone companies, or when selling airtime and data to cell phone users) affect the use of digital technologies.

In multi-cultural societies, improvements in digital communication and ease of movement may reduce the isolation of communities. While beneficial in many ways, this can also threaten minority cultures.

High-quality research will depend on the collection of high-quality data over time, and on the design of suitable studies. This seems a suitable area for the use of Randomized Control Trials, in which some people or places receive an innovation in infrastructure, while a comparison is conducted of those left in the status quo.

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