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Connections 2015

Transport & ICT

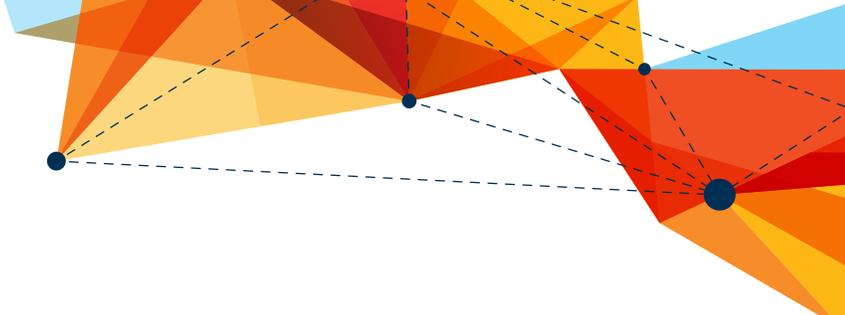


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Want to Keep Tourists Away? Keep Flying Solo

A Lesson from Small Caribbean States

Cecilia Briceño-Garmendia, Heinrich Bofinger, Diana Cubas, and Maria Florencia Millán-Placci

The island states of the eastern Caribbean are wastefully competing with each other for the lucrative, yet stagnant, stay-over tourist trade by “flying solo”: separately building long-haul airports and agreeing to expensive bilateral subsidy deals with airlines.¹ Instead, they could vastly increase their tourist revenue and lower their costs through collaboration to remove barriers to inter-island travel. The linchpin of such joint efforts would be a hub-and-spoke airline system that funnels stay-over tourists to the edge of the region and then allows them to easily fly to their final destination.



Cruise Ships vs. Stay-Over Tourists

The overall contribution of tourism to the eastern Caribbean economies ranges from about 22% in Grenada to 65% in Antigua and Barbuda. However, more than two-thirds of the tourists in the region are cruise-ship passengers, whose on-shore spending may be as little as one-tenth the consumption of stay-over visitors (those who use on-shore lodging and typically arrive by air). The region’s relatively untapped stay-over market is a potentially huge economic opportunity waiting to be grabbed.

Coordinated Local Air Transport Is Key

Air transport is the critical pipeline for hotel arrivals in the eastern Caribbean and generally for other small, “sea locked” economies. But no single OECS country is as strong a draw for stay-over tourists as

one of the larger Caribbean destinations, including the Dominican Republic, Puerto Rico, Cuba, and Jamaica. Without a strong inter-island air service in the eastern Caribbean, international arrivals to individual OECS states are not likely to generate much of the potential boost in stay-overs that is available. Hence, for each OECS country to build its own international airport to capture the stay-over market is inefficient and mutually destructive. Yet that is the current trend.

The region is far better suited to a hub-and-spoke system in which international arrivals could be concentrated in a couple of hubs outside the edges of the region (say, in Jamaica on the north and Barbados or Trinidad on the south). From there, a network of regional airlines whose schedules are coordinated with international arrivals would distribute the tourists to their final destinations throughout the region.

¹ The countries covered here are members of the Organisation of Eastern Caribbean States (OECS): Antigua and Barbuda; Commonwealth of Dominica; Grenada; Montserrat; St. Kitts and Nevis; St. Lucia; and St. Vincent and the Grenadines. For technical reasons, the data here exclude Montserrat.

However, no such local airline network exists. The inter-island system consists essentially of one carrier, LIAT, which is plagued by low revenues, frequent equipment problems, and both thin and unreliable schedules. For example, flying to St. Kitts from any other OECS country can take 4–9 hours, or even overnight travel, and up to two connections. Hence, the binding constraint on efficiently boosting stay-over tourism in the region is the lack of an extensive local spoke system that integrates frequent inter-island flights with international arrivals at regional hubs.

Heading Down the Wrong Runway

The lack of good local air service is driving each country in the region to fight on its own for a greater share of the stay-over market.

OECS states are currently served by two international air hubs: Antigua in the north and Barbados, just outside the southern edge of the region. Trinidad also serves as a connection point. However, three other OECS countries under review—Grenada, St. Kitts and Nevis, and St. Lucia—also handle wide-body aircraft. Hence each relies on direct or semi-direct long-distance flights in the absence of an adequate inter-island connectivity system anchored in two hubs. Unfortunately, both Grenada and St. Lucia have considerable excess capacity in their air terminals (with utilization rates below 50 percent), significantly raising their overheads.

Other OECS countries are starting to follow this model, likewise locking themselves into excess-capacity infrastructure investments to bypass a dysfunctional inter-island air system. St. Vincent is building a new airport with an annual capacity of 1.4 million passengers, yet it had less than 150,000 passengers in 2013. Dominica is considering options for a new airport or extending its main runway into the ocean.

The overbuilding helps drive each OECS country to secure for itself a minimum flow of tourists. Bilateral agreements with international airlines, includ-

ing subsidies that guarantee the airlines a minimum amount of traffic, have become a common practice.

In 2012, the net fiscal effect of these agreements for OECS states ranged up to 0.2% of GDP, or up to 1% of tax revenues and up to 0.3% of public debt. These payments are ultimately an indirect government subsidy to the hotel industry that captures the stay-over visitors. If the region instead developed a more efficient and coordinated air travel system, the need for such subsidies could be reduced and the funds redirected.

Getting Cleared for Takeoff

An efficient hub-and-spoke system would

- Better attract stay-over tourists to the region by pooling arrivals from long-haul flights into local loads that would make the inter-island transport system more sustainable; and
- Allow the OECS countries to negotiate with airlines as one block from a position of greater market strength.

The benefits could spill beyond the tourist industry by allowing a better matching of supply with demand during the low tourist season, when inter-island business and government travel drive the demand.

With a robust hub-and-spoke air service in place—along with other regional moves to create a seamless inter-island travel experience, including the build-up of ferry services, smoothing luggage transfers, and easing customs and immigration procedures—each OECS country can anticipate rising tourist revenues that will drive and support other tourist infrastructure improvements.

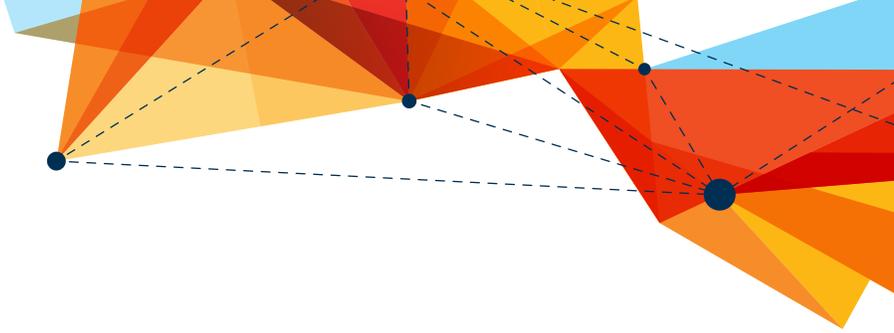
In sum, the best way for OECS countries to capture more of the highly valuable stay-over tourist market is to stop competing with one another and instead cooperate in overcoming the small size of their economies and their isolation. It is time for OECS countries to stop flying solo.

► For more information on this topic:

<https://openknowledge.worldbank.org/handle/10986/20080>

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The notes are available at <http://www.worldbank.org/transport/connections>



Mapping Manila Transit

A New Approach to Solving Old Challenges

Holly Krambeck

Whether they attempt to build jeepney stops, expand transit access, or improve bus routes, transit projects across much of the developing world are often hampered by (1) the lack of accurate transit maps and data and (2) the weak capacity of transit agencies to acquire and use such data. To address the twin aspects of this long-standing challenge, the World Bank, in collaboration with the Philippines and Australian Aid, developed both a methodology and a suite of open-source software applications based on free, internationally supported open data standards. The solutions have allowed the quick, low-cost production of transit maps; and they have empowered the agencies—and potentially businesses and the rest of government—for the first time to make ambitious planning and investment decisions based on accurate, comprehensive transit data. The global applicability of this approach has been demonstrated by its adoption in six other developing countries to date.



No Data, No Maps, Less Progress

“Detailed and accurate maps are so fundamental to sound urban planning, so essential to making smart decisions about where to build the next library, clinic or bus station, that it’s hard to believe how often they don’t exist,” says Joana Mikulsi of the nonprofit Next City. The high cost and technical complexity of conventional data collection and mapping have been a perennial barrier to improving transit services in developing countries.

The Manila Challenge

Nearly 70 percent of all trips made by the 12 million residents of metropolitan Manila (officially,

Metro Manila) are via public transit. Yet until 2012, Manila had no map of its transit system—hence, no efficient way for passengers to locate routes or transfers or for transport planners to know whether transit services were reaching target populations.

In 2012, the World Bank and the Philippines Department of Transportation and Communications (DOTC) began an experiment—to develop Manila’s first multimodal transit map by way of a simple, inexpensive, and replicable methodology for collecting and maintaining transit service data.¹

Transit databases are not new. But acquiring, using, and maintaining them in conventional fashion is impractical for transit systems with limited budgets and technical capacity. The World Bank team need-

¹ The Manila program was developed with the support of Australian Aid and Korea’s ICT4D Trust Fund.

ed to devise a way for Manila to map its system and maintain the database at low cost, with minimal technical demands and with seamless cross-agency collaboration.

The Manila Solution

In support of its institutional capacity building, the World Bank team devised a technical solution relying on three “open transport” principles:

- **Open data standards**—the team adopted an open international standard for transit service data, the General Transit Feed Specification (GTFS), a well-documented, clearly defined standard that benefits from a global community of practitioners who voluntarily contribute improvements and innovative solutions.
- **Open-source software**—the team supported development of an open-source mobile phone application, TransitWand, with which transit agency staff members could generate route data in the GTFS format at substantially lower cost than with conventional methods.
- **Open data**—after a media-intensive launch, the DOTC made its GTFS data publicly available on its website, supporting the growth in local third-party applications to help passengers more easily and effectively navigate the system. Opening the data creates accountability for data maintenance.

By minimizing the time and expertise required to build and maintain a database from scratch, these technical solutions enormously reduced the traditional barriers to sustained mapping initiatives in Manila.

The project also included substantial institutional assistance to overcome the financial, coordination, and sustainability hurdles associated with the pursuit of such an initiative in a developing country.

What the Map Showed

The resulting transit map for Metro Manila showed that the number of transit routes—nearly 1,000—was almost double the existing official estimates. The discrepancy between official and actual routes revealed to trans-

port planners where the true demand for service was. And for the first time, planners could begin to untangle the decades-old spider web of route redundancies—the data revealed that the ratio of route length to service area for buses and jeepneys was as much as 16 times greater than in cities with comparable populations, such as Beijing, New York, and Singapore.

Bringing It to the Passengers

Through a national competition organized by the World Bank and DOTC, more than 480 local developers competed to create web and mobile trip planning applications for consumers that rely on the GTFS database. Since its release in July 2013, the database has been downloaded more than 14,000 times from the DOTC website for use in such applications. Wide use of such apps makes government agencies more accountable for the accuracy of the data.

The Local and Global Impact

With its newfound ability to document and visualize Metro Manila’s network, the government recently developed a two-year plan to greatly reduce the excess jeepney and bus routes. And plans for a World Bank-financed rapid transit corridor in Manila are using the open-source database to develop the corridor’s feeder network. More generally, the DOTC is now beginning to require vendors to use open-data standards and open-source licenses.

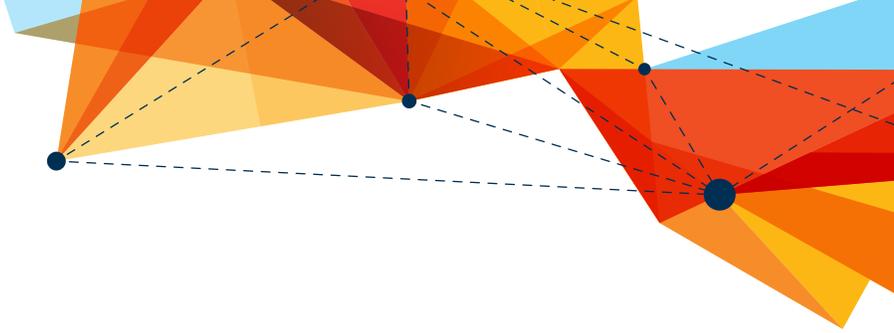
In a significant extension of the Manila initiative, the firm that won the national consumer-app competition has been hired by the DOTC to create a real-time bus tracking system using GTFS data. The contract represents a substantial leap in capacity and initiative and shows how open standards can generate high-quality domestic job opportunities.

Beyond the Philippines, transport agencies and NGOs in Brazil, China, Egypt, Mexico, Mongolia, and Vietnam are using open standards so they can apply the Manila project tools to their own needs. The project is thus demonstrating that one city’s investment based on open-transport principles can be applied globally—in international development, a very powerful concept.

► For more information on this topic:
http://bit.ly/OpenTransport_Draft

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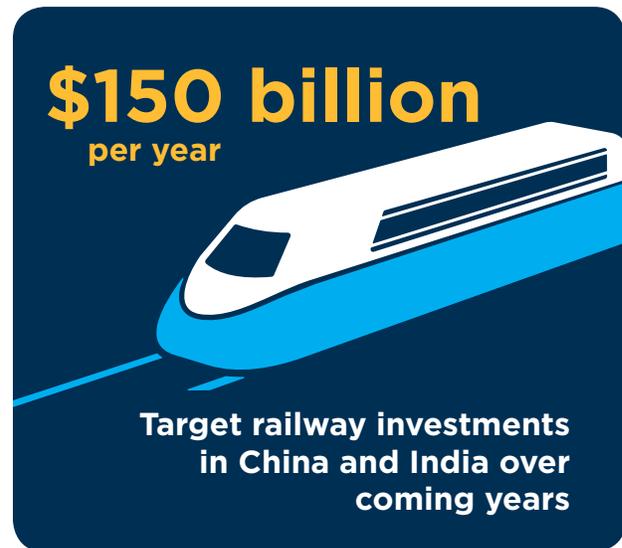
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Keys to Attracting Private Capital for Railway Development

Martha Lawrence and Gerald Ollivier

Two of the largest railway systems in the world—China’s and India’s—have intensified their focus on the private sector as an indispensable source of capital to help them enlarge their rail capacity. They will find promising options if they recognize the common characteristics of successful efforts, both in their railways and elsewhere: profitability, manageable risks shared appropriately, and shared gains. Even unprofitable rail activities, such as commuter transit, can attract private capital if adequate public subsidies are in place.



The Activity Must Yield Profits

Private sector investors want to make money. If the activity is inherently profitable—rail car (wagon) operations in Russia, station development in the Hong Kong SAR metro, or freight transport in the United States—private investors will naturally be attracted to it. If the activity is not inherently profitable, then private investment will hinge on sufficient and reliable long-term government subsidies.

Risks: Must Be Manageable...

Private sector investors are willing to take risks if they believe that

- They can understand the risks;
- The risks will be well managed; and
- The returns will be sufficient.

Investors will typically pay a premium to obtain management control of an enterprise because that assures them that they have the right to manage the risks to their investment.

...and Appropriately Shared

The public sector is typically best able to manage risks such as those associated with land acquisition and government actions, while the private sector usually excels at reducing risks through, for example, marketing and customer relations. Successful collaborations between the public and private sectors share the risks so that the party best able to manage them has the responsibility and incentive to do so.

Gains Must Accrue to Both Parties

If the participation of both the public and private sectors is to be sustainable, the activity must generate value for both parties. The public sector may benefit from the private sector's expertise, whether in marketing, cost efficiency, technological know-how, or financial capacity. The private sector may benefit from the public sector's existing assets, knowledgeable staff, access to resources, or grant of an exclusive right to operate services. In any case, when the deal doesn't work well for both parties, it usually falls apart.

Successful International Experience

Successful private investment in railways has a long and broad history. Four avenues of private investment have been especially important, separately or in some combination: (1) provision of specific rail assets and services, (2) public-private partnerships, (3) leveraging the commercial value of railway assets, and (4) financing railway companies.

Providing assets and services

In a number of countries, private business rents to the railway some specific physical assets, such as rolling stock, which saves the railway from having to finance those assets itself.

For example, in 2003, Russia began allowing the private sector to rent freight wagons to the railway, making it profitable through a change in tariff rules. The new policy created a vibrant market in which the private sector provided \$50 billion toward replacing the railway's large stock of very old wagons; about 85 percent of freight wagons in Russia are now privately owned.

In addition, the private sector can sell services to the railway, such as track maintenance. In that case, the investor deploys its own equipment and facilities, finances the working capital involved, and provides the labor.

Public-private partnerships (PPPs)

In successful PPPs, the private sector makes money by accomplishing the objectives of the public sector. PPPs work best when outputs are clearly specified and monitored.

For example, Vale S.A., one of the world's largest metals and mining companies, pays fees to governments in Brazil, Malawi, and Mozambique for the right to operate railways in those countries for several decades and is responsible for supplying and maintaining the railway infrastructure and rolling stock.

Leveraging railway assets

Railway right-of-way and real estate are assets that can be leased to or jointly developed with the private sector. For example, through its subsidiary, RailTel, Indian Railway sells access to telecom and other commercial customers over about 42,000 kilometers of fiber optic cable running along its right-of-way.

The Hong Kong SAR metro, MTR, leases retail and advertising space within its stations, where it also develops residential and commercial projects. In 2013, these activities generated an operating profit of \$1.1 billion, not counting the extra passenger traffic generated by the property development. Urban transit operators in China are exploring this financing model.

Financing railway companies

Private investors buy bonds and equity shares in railways when the underlying business is profitable. Examples include vertically integrated railways in China, Japan, and North America and train operators in Europe and Australia.

In China, for example, Guangshen Railway profitably carries passengers and freight between Guanzhou and Hong Kong. Shares in the company were first listed on the New York and Hong Kong stock exchanges in 1996, raising a net of CNY 4.2 billion (\$526 million).

Attracting Private Capital

In sum, private investors in railways, as with any investment, seek a return that is commensurate with the associated risk.

A variety of approaches to packaging railway assets, including those discussed here, can provide a return, mitigate risks, and thus attract private sector investment to the railway sector.

► **For more information on this topic:**
<http://documents.worldbank.org/curated/en/2014/08/20143729/private-capital-railway-development>

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Advancing Development with Mobile Phone Locational Data

Improving the Effectiveness of Assistance

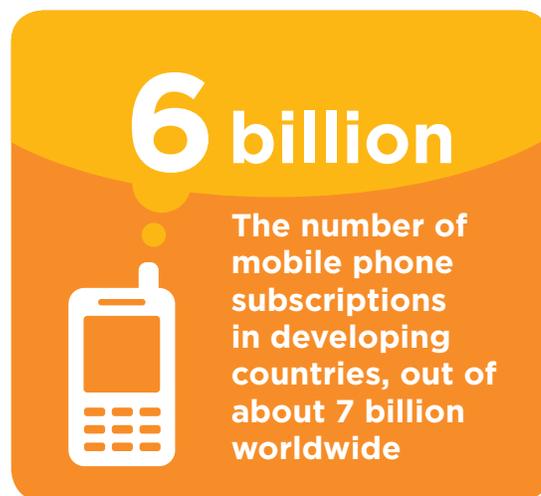
Ryan Haddad, Tim Kelly, Teemu Leinonen, and Vesa Saarinen

Mobile phones, and especially smartphones, are opening new ways to assess and improve assistance and the delivery of basic services in the developing world. Each year, developing countries see an annual gain of about 500 million new smartphones, virtually all of which generate not only call data records but also, with their GPS and Wi-Fi capabilities, a rich set of more precise data on location and movement. The rapid diffusion of the phones and the locational data they generate are helping fuel the “science of delivery”—the evidence-based, experimental approach to project assessment and improvement.

The technology is finding an expanding variety of uses. Recent examples involving transport and logistics include:

- Transit route mapping in Abidjan;
- Supply chain management for community health workers in Malawi;
- Transport planning in Côte d’Ivoire; and
- Malaria tracking in Kenya

A notable and more impromptu use arose after a tsunami hit Japan in March 2011. Health care authorities used call data records (CDRs) generated by mobile phones to track the evacuation from the vicinity of the damaged Fukushima nuclear power plant. They then meshed the CDRs with health records to optimize the delivery of needed emergency health treatment.



Phone Data and the Science of Delivery

Commenting on the concept of “delivery science,” a 2013 World Bank blog post noted that during the several years it takes to prepare, implement, and evaluate a project “the world has moved on, problems mutate and practitioners need real-time data to learn as they do and respond to shifting client priorities. There is value ... in real-time learning and adaptive iteration.”

Mobile phones, and applications that run on them, have shown a remarkable capacity to provide

project learning and adaption. The technology embedded in smartphones, including global positioning system (GPS) sensors, Wi-Fi capabilities, and cameras, allows users to generate information in the field—such as when gathering survey data or monitoring project activities—that is automatically tagged with locational data.

The locational capabilities are speeding a trend toward quantification and measurement that underlies the emerging science of service delivery. They also advance the ability to predict outcomes and

thus support rapid adaption of programs, which is particularly important for responding to epidemics.

Mobile Survey Applications

Typically, data collected in the field are updated and edited offline before they are uploaded into central databases. But computerized data collection and editing was often prohibitively expensive for developing countries before the advent of mobile phones, particularly smartphones with their touchscreens and extensive user options.

However, in Manila, where no mass transit routes had been previously mapped, a World Bank project in cooperation with the Philippines government developed a mobile phone application to automatically collect route data from the field while avoiding the costs of offline editing. Employing an open-data, open-source software system, the app allowed transit staff members simply to ride the routes and allow the GPS capability of the phone to generate route coordinates that were simultaneously transmitted to the database (see *Connections* Note #2).

Another software system, CommTrack, provides inventory and logistics management and is widely used to improve the distribution of medications and medical equipment. In Malawi, Health Surveillance Assistants (HSAs) carry and prescribe a pre-defined list of medicines, which they receive from health centers. Using cStock, a CommTrack app, the HSAs report their prescriptions and stock levels to the health centers via their mobile phones, which reduces wasted trips by HSAs to health centers that do not have the supplies they need.

Call Data Records

Locational data can also be collected passively in the form of CDRs, which are very large, complex sets of data. The records include the time and duration of each call and the approximate location of the user, which can be derived by triangulation between the cell towers with which the caller was communicating.

The potential value of passively collected CDRs is often much higher than actively collected survey data, if only because the sample sizes are so much larger and unit costs lower.

For example, to help deal with the overburdened road and transit networks in Abidjan, Côte d'Ivoire, IBM's AllAboard project analyzed 500,000 CDRs generated over a period of five months. Locational data indicated the origins and destinations of much of the travel flow in the city, and an optimization model suggested how to reduce waiting and travel times on mass transit routes. The result was four new bus routes and the extension of an existing bus route, collectively expected to cut travel time by 10 percent.

In Kenya, researchers mapped every call or text message made from more than 14 million mobile phones and combined the information with knowledge of the regional incidence of malaria in the country. The results, published in 2012, represented the largest study to date of the interaction of human travel patterns and the spread of malaria.

The researchers found that they could estimate the probability that a particular person was carrying malaria parasites and could map the movements of carriers to identify source areas. Thus, besides mapping and predicting malaria movement, the data identified locations to be targeted for malaria control and elimination. The potential applications of the technique to other diseases, notably Ebola, are promising.

Outlook for Use of Phones and Locational Data

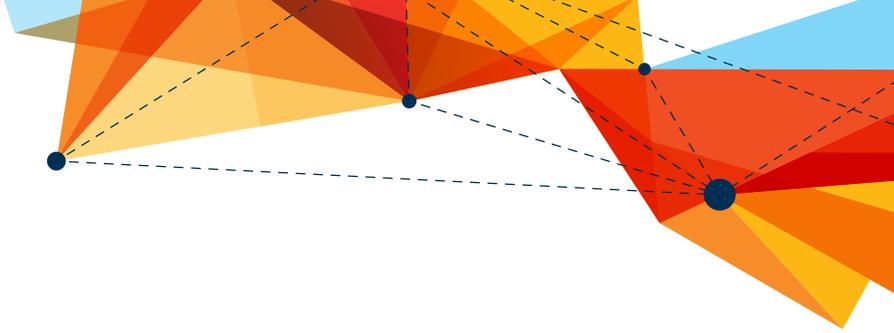
As smartphones and mobile broadband service become more affordable in lower-income countries, as they already are in the advanced economies, they will become increasingly useful in the drive to improve public service delivery.

Moreover, satellite-based positioning capabilities are improving as other countries and regions—including China, the European Union, and Russia—begin to build systems to complement the existing U.S. system. Access to multiple systems can improve connectivity, overcome bottlenecks in data traffic, and make the locational data generated by smartphones more precise.

► For more information on this topic:
<https://openknowledge.worldbank.org/handle/10986/19316>

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The Broad Reach of Green Design

Incorporating Environmental Sustainability in Aviation Facilities

Christopher De Serio, Craig Ridgley, and Darin Cusack

A World Bank series of projects to improve aviation operations in four Pacific island countries is demonstrating that the concept of “green design” goes beyond energy efficiency to the wider goal of environmental sustainability. The aviation program is reducing impacts on a broad spectrum of concerns, including solid waste management and water quality, by designing with the full lifecycle of all project assets in mind.

8-10%

The estimated share of air transport's CO2 emissions coming from inefficiencies in airport infrastructure



The Pacific Aviation Investment Program

Begun in 2012, the Pacific Aviation Investment Program is financing improvements to the air transport infrastructure of four Pacific island countries—Kiribati, Samoa (except terminals), Tonga, and Tuvalu. The goal is to enhance aviation safety, security, and operations in an environmentally sensitive manner through runway rehabilitation and the redesign of terminals, navigation aids, runway lighting, and other elements of airport operations.

The islands import diesel fuel to generate electricity, so energy savings were especially important for their effect in reducing harmful emissions. But the broader aspects of environmental sustainability were also important. The principal opportunities for the project to advance these goals emerged in four areas:

- Design of the terminals
- Airfield lighting
- Paving
- Solid waste management during construction

Terminal Design

The project is refurbishing the terminals at Tarawa in Kiribati and at Fua'amotu and Vava'u in Tonga; and building new terminals at Kiritimati in Kiribati and at Funafuti in Tuvalu. The following elements were incorporated in the designs for all the terminals:

- Polypropylene, a nontoxic and completely recyclable plastic, for all internal plumbing and drainage pipes
- Energy efficient lighting
- Standard environmentally acceptable hydraulic fittings and piping to minimize maintenance
- Fitting the roofs for future additions of solar power panels (current grid capacity cannot support the use of solar power)

Existing terminals

Design for the existing terminals focused on adaptive re-use to extend their serviceable life and maximize the benefit of their embodied energy, as follows:

- Enhanced natural ventilation rather than mechanical air conditioning
- Translucent skylights to reduce energy demands for lighting

- New roofs and concrete slabs and blocks designed to reduce internal air temperatures

New terminals

Designing new terminals affords some additional opportunities:

- Rainfall collection for use at the terminal as well as for the rest of the island
- Water-saving bathroom fittings
- Use of recycled or sustainably sourced hardwoods

Airfield Lighting

Replacing incandescent lighting with light emitting diode (LED) lights for airfield ground lighting provides major energy savings. The advantages of LED lighting include

- Power savings of up to 75 percent;¹ and
- Average life expectancies of 35,000–50,000 hours versus only 5,000 hours for incandescents.²

The savings also boost the potential for solar power.

Paving

Runway paving imposes a significant carbon burden on the atmosphere. The airports' runways and ancillary areas are being repaved with asphalt that contains a special wax additive; and in Tonga, the aggregate being used in the asphalt is locally sourced coral instead of imported rock aggregate. These features reduce the carbon footprint of the paving in the following ways.

Wax additive

- Allows for manufacture of the asphalt at lower temperatures and with less energy.³

- Significantly improves the asphalt's water resistance and reduces oxidation, which in turn increase its service life and negate the need for sealers.

Coral aggregates

Aggregate, used in asphalt and concrete to provide strength and bulk, typically consists of gravel from rock. To obtain aggregate of sufficient quality, Tonga must import it over great distances by barge. The paving designs for the Tonga airports were therefore modified to instead allow use of coral aggregates from licensed quarries in the island's interior.

The coral, a carbonate material more porous than rock, produces a superior asphalt. Its porosity significantly increases the strength of its adhesion with the bitumen binder. The stronger bonding together with the greater oxidation resistance of carbonate material greatly improves the service life of the asphalt.

Solid Waste Management

Islands lack adequate land area for waste disposal. The project took an aggressive stance toward waste management, requiring suppliers to remove all packaging and contractors to remove their equipment at the end of the project. Further, all airports accumulate a significant amount of redundant, obsolete, or unserviceable equipment. The project thus also requires the export and safe disposal or recycling of such gear, whether or not it was present before the start of the project. Tuvalu presents a unique opportunity for disposing of waste during construction: Because all paving aggregates will be imported from Fiji by barge, the Tuvalu government is investigating how to use the returning barges for the removal of recyclable waste on the island, which has been uneconomic to export.

¹ <http://energy.gov/energysaver/articles/lighting-choices-save-you-money>

² <http://emerald.ts.odu.edu/Apps/FAAUDCA.nsf/Nettey8472FullProposal.pdf?OpenFileResource>

³ <http://www.fhwa.dot.gov/pavement/asphalt/wma.cfm>

► For more information on this topic:

<http://documents.worldbank.org/curated/en/2011/11/15496050/east-asia-pacific-pacific-aviation-investment-project-east-asia-pacific-pacific-aviation-investment-project>
and
<http://documents.worldbank.org/curated/en/2014/02/19012250/samoa-aviation-investment-project>

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Boosting Mass Transit through Entrepreneurship

Going beyond Subsidies to Reduce the Public Transport Funding Gap

Daniel Pulido and Irene Portabales

Most of the world's urban mass transit systems cannot cover operating costs, let alone capital expenses, through farebox revenues. On average, 25% of metro operating expenditures are not funded by farebox income. With limited public subsidies, as well as obstacles to raising fares and political sensitivities to road user taxes, metro systems have been increasingly pursuing income from commercial activities connected with their operations. Metro systems that earn commercial income—such as from advertising, naming rights, and especially real estate activities—are making inroads in their operating deficits. Commercial revenue in some systems is nearing 20% of fare revenue. Although reforms of transit financing structures remain high on the policy agenda, a review of ancillary income streams of metro systems around the world shows that a more entrepreneurial approach to tapping their commercial potential can help them narrow their funding gap.



Lots of Infrastructure, Great Potential

The number of cities with a commuter rail system, or metro, continues to grow. Today, metro systems comprise about 9,000 transit stations and 11,000 kilometers of rail line. These facilities represent an enormous opportunity for the owners and operators to generate income from their associated commercial potential, including advertising, space leasing, and real estate development.

There are no approaches to raising commercial revenues that are valid for all cases. Each system must develop the business models and commercial revenue streams and that best fit their infrastructures.

Recent experience

Commercial activity by metro systems is concentrated in advanced economies, with many of the

most lucrative in Asia. But systems in the developing world are increasingly looking at ways to increase their nontariff revenues. Most initiatives are executed in collaboration with the private sector or other transport systems.

Advertising

Advertising on urban rail systems is widespread, but some initiatives show that it has a larger potential. The Mexico City government has announced a renegotiation of its contract with a private advertising management company to increase revenue from more than 70,000 advertising spaces.

A new generation of advertising technology—a series of synchronized in-tunnel video display panels—is now in several systems and will soon be launched in Madrid for revenue estimated at \$500,000 per year.

Leasing of Commercial Space

Underpricing may also be a feature of space rentals. Franchising consultants say that the Rio de Janeiro and São Paulo metros have been leasing commercial space at 30% to 60% below shopping center rates. In response to such concerns, the state of São Paulo pushed to increase the share of nonfare revenue in the business model for the city's Line 6.

Naming Rights

Dubai's transit authority has earned more than \$540 million since 2010 from the sale of naming rights for 13 metro stations and from leasing retail space inside its stations. The authority says the revenues cover 60% of the network's operating costs, and it aims to have the revenues fully cover costs by 2017. A similar deal in Mumbai for 12 stations will raise \$250,000 to \$1 million per year for five years.

In some cases, naming rights include amenities for passengers, such as remodeling a station or the supply of mobile phone coverage or free Wi-Fi.

Merchandising

The merchandising potential of a metro is exemplified by the London Underground's logo and "Mind the Gap" slogan. The London Transport Museum earns about \$4 million annually from the sale of official merchandise. The Madrid metro has started selling branded merchandise, and a private company has started selling goods in the São Paulo metro with logos licensed by the transit system.

Consulting Services and Technology Sales

Operators in the developing world are now entering the consultancy and technology licensing markets. Delhi's metro system is advising other systems in India. Santiago's system is helping the Panama City system evaluate business opportunities, and it also licensed its fare card technology for use there. Some systems are selling access to their tunnels for the placement of fiber-optic cable.

Land Value Capture

Placement of transit stations greatly increases the value of the surrounding land, much of it owned by the transit authority. The authority may tax the private

users of that land, but other methods of capturing the rise in value often provide far greater returns. These methods include selling or leasing the land, charging developers for the right to build taller buildings, and participating in urban redevelopment projects.

For rail operators in Tokyo (Tokyu) and Hong Kong (MTR), the profit contribution of property and commercial developments exceeds that of transit operations.

The strategy has been hard to replicate in the developing world, although in Latin America, São Paulo sold additional construction rights (known as CEPACs) to private developers, to mobilize about \$100 million for Line 4 of the city metro.

The Broader Agenda

Experience shows that transit agencies in developing countries can become more entrepreneurial. For example, nonfare revenues of Santiago's metro are 17% of fare revenues, higher than the average of 5–6% for Brazil and Mexico.

A metro system's potential to mobilize commercial revenue can be enlarged through the development of business plans and strategic partnerships with the private sector.

Going further, however, will depend on making commercial activity a part of transit system planning from the beginning, embedding it in the mission and objectives of the transit agency. The revenues will not be immediate, especially on new metro systems, but they can become a steady and significant long-term source of income if handled appropriately.

Even then, tapping into commercial revenue sources will not be the last stop on the journey to financial stability for many of the developing world's metro systems. Closing the gap between farebox revenues and system expenses will certainly require the implementation of more comprehensive reforms of urban transport institutions, tariffs, and financing.

► For more information on this topic:

http://www-wds.worldbank.org/external/default/WDSContentServer/WDS/IB/2014/11/04/000333037_20141104220722/Rendered/PDF/922500WP0Box380REPORTOCOMINGOINODEC.pdf

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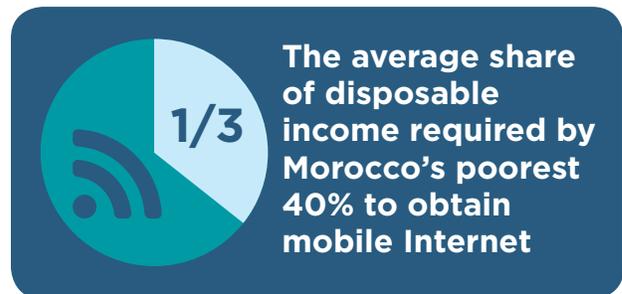
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Key Pathways to High-Speed Internet in the Middle East and North Africa

Spurring Competition and Building New Networks

Natalija Gelvanovska, Michel Rogy, and Carlo Maria Rossotto

Most countries of the Middle East and North Africa (MENA) region are falling behind in their quest to develop high-speed Internet for rapid socioeconomic development. Despite young adults' rising use of social networking tools and solid progress in a few countries, most of the region's Internet remains hobbled by monopolized, inadequate infrastructure; weak investment incentives; and high costs. High-speed (broadband) Internet can drive economic and social transformations. To realize that potential, a recent World Bank study finds that MENA countries must pursue a three-pronged approach: (1) Reduce costs by fully liberalizing access to the existing Internet infrastructure. (2) Support the resulting competition with independent national regulators working within a harmonized regional framework of regulation. (3) Promote investments in new fiber-optic networks and other ultrafast broadband infrastructure (including Long-Term Evolution or LTE) alongside existing technologies.¹ With these measures, plus aggressive strategies for sharing public works infrastructure and subsidies for rural access, MENA can leapfrog its current information and communication bottlenecks.



Broadband Is Transformative

As the “always on” high-speed connection to the Internet, broadband allows web connections to be used in ways that are a powerful driver of sustainable economic growth—including job creation and skills development—as well as democracy and social reform. But with only some exceptions, countries in the MENA region are notably falling behind in the availability and use of this economically and socially transformative technology.

¹ The region encompasses 19 countries: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine (West Bank and Gaza Strip), Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen. The World Bank is conducting similar reviews for two other regions in the world (South Asia, and Central and Eastern Europe).

Bottled-Up Broadband

Three sets of factors are blocking the development of broadband service in the MENA region: (1) a lack of competition, (2) a fragmented regional market, and (3) a lack of incentives to both fully employ existing networks and build new ones that allow faster service. The consequence is generally slow Internet service with patchy coverage, high prices, and consequently low penetration of usage.

Competition to build networks (facilities-based competition) has been the decisive force in countries with advanced telecommunications markets. Thus, developing economies with competition in mobile Internet facilities and service have quickly reached usage levels similar to those of the advanced economies. Besides triggering private investment, competition boosts quality and

lowers prices. Indeed, the most competitive mobile broadband markets in the MENA region have the lowest prices. Nonetheless, in most MENA countries, one-half or less of the population uses mobile broadband, and less than one-fourth uses wired (fixed) broadband.

Competing in a Unified Market

The region overall has lagged in opening up its telecommunications markets. In contrast, the European Union accomplished that in 1998, and newer members of the EU have had to comply. Lithuania, for example, now has more than 100 facilities-based Internet service providers (ISPs). In contrast, in the MENA region, only Bahrain and Jordan have implemented full liberalization, and most countries do not allow their ISPs to be facilities-based (to reach the final client with their own infrastructure). Other reforms must accompany the removal of barriers to entry: Independent national regulatory authorities must be strengthened, or established where they do not exist; and countries should collaborate on creating a harmonized regulatory framework that would allow investors to consider the MENA region as a single market.

Leapfrogging Existing Networks

These regulatory reforms are critical for a well-functioning telecommunications market. But in the MENA countries in the emerging and developing phase of broadband development, regulatory liberalization will support a second core objective—promoting investment in new infrastructure.

These countries have a great opportunity to quickly deploy new broadband Internet networks, leapfrogging their legacy infrastructure with fiber-optic and other high-speed technologies. Romania, Latvia, and Lithuania are examples of this breakthrough phenomenon. They inherited decrepit, obsolete networks from the Soviet era. But in just a few years under market liberalization, they have surpassed the western European countries in some performance indicators, including deployment of high-speed broadband Internet. Today, for example, the ultra-fast “fiber to the home” technology reaches more households in Lithuania than in Germany.

Bringing in Fiber

In many instances, fiber-optic technology will be indispensable to widening high-speed Internet access, as it is most effective for aggregating increasing data traffic and thereby reducing average costs. Without it, broadband services are unlikely to be viable outside of major cities.

Broadband plans in MENA countries generally do not take a systematic approach to reducing the costs of infrastructure deployment. Deployment strategies involving utilities, railways, and public works projects—for example, laying fiber cables alongside oil pipelines and railways, on power lines, and while digging new roads—can significantly reduce costs and accelerate rollout, as can work in conjunction with real estate development. These options introduce a much-needed alternative or complement to the infrastructure provided by incumbent telecom operators.

Mixing Fixed and Mobile Connections

Markets for mobile broadband are much more competitive than those for fixed broadband. Hence, mobile phone users constitute the majority of broadband customers in the MENA region, and mobile access is generally considered to promise the quickest expansion of service. Nonetheless, even by 2017, data traffic generated from mobile networks is expected to represent only about one-fourth of the traffic from fixed broadband connections.

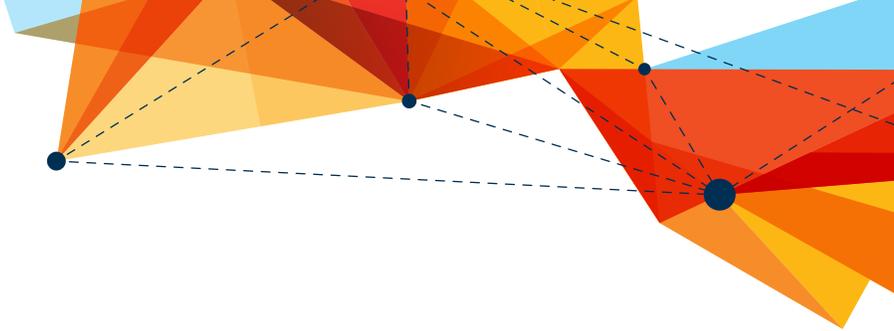
Despite the region’s urban character, the demand for broadband in rural and remote areas is important and is being increasingly addressed with mobile broadband. A significant increase in rural access can be expected by simply letting market forces develop. However, adequate geographic reach, speed, and affordability will also require a combination of supply and demand policies, including coverage obligations for operators and subsidies for broadband development and use.

With the liberalization of competition and innovative strategies for adding infrastructure, fixed and mobile broadband technologies will ultimately

► For more information on this topic:
<http://www-wds.worldbank.org/XXXXXXXXXX.pdf>

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Reducing Greenhouse Gases

GHG Analysis in Transport

Andreas Kopp

The World Bank is applying to transport initiatives a new and distinctive method of greenhouse gas (GHG) analysis as part of its comprehensive GHG accounting policy.

In transport, choices by travelers determine usage—and a fundamental trend in much of the world is strongly boosting GHG emissions: the massive rise in motorization as household

incomes and technical advances make it affordable. This tendency will push transport fuel emissions much higher unless projects sharply expand the opportunities and incentives for users to adopt low-emission modes.

The World Bank's GHG analysis for transport shows whether a given transport project can help lower the trajectory of the sector's GHG emissions. A central feature is an estimate of the wider social costs of emissions under various modes—for example, air pollution and accidents—as well as climate change. Including them greatly increases the demonstrated benefit of emissions-reducing projects and thus will also help accelerate the move to a sustainable transport sector.

Unlike other sectors, transport requires a behavior-oriented method of GHG accounting. In activities such as manufacturing and power generation, the project itself can largely determine the emissions outcome. In transport, choices by users determine outcomes. Modes and use of transport continually change—witness the rising use of fuel-efficient cars, car sharing, and, in some parts of the world, nonmotorized transport. GHG analysis in transport must therefore understand how user behavior will evolve both with and without a proposed project.

Targeting Motorized Transport

Transport policy itself must confront a fundamental trend in areas where average household income

23%  **Transport's share of GHG emissions from fuel—projected to become much larger without expanding low-emissions mobility**

moves above a lower middle-income threshold: a massive increase in motorization (including a switch to larger vehicles when fuel efficiency makes it affordable). The trend is strongly raising the growth trajectory of GHG emissions. Without policy action, the transport sector's share of GHG emissions from fuel will rise much higher—perhaps to more than half by midcentury.

Technology innovations are necessary, but alone they cannot halt the prospective rise in GHG emissions. Automobile travel, attractive to consumers individually, causes problems for all, particularly in cities: the exponential rise of time lost in traffic, the high health costs of local air pollution, and road accidents that take a global toll of 1.2 million lives each year.

To address these trends effectively, GHG analysis must be able to realistically show how emissions and other costs associated with motorized transport can be avoided without damaging transport's essential role in development, trade, and the functioning of cities.

GHG Analysis Fuels Smart Investment

Transport infrastructure and the commercial and residential patterns it shapes are long lived. Therefore, the modes of travel established by today's transport investments will largely be fixed for the next 50 to 70 years. An essential element of transport-specific GHG analysis is a long-term view that accounts for the evolving constraints on fossil fuel supplies, costs, and usage as well as other aspects of user choice.

By evaluating a project against a baseline that accounts for the long-term picture, GHG analysis can show whether a particular investment—whether in road traffic flow, mass transit, inland waterways, or freight and passenger railways—can realistically cut emissions over a given period. It will be especially influential in low-income countries with relatively little infrastructure, where it can help inform a strategy of lower-emissions transport investments that will produce major savings as economic development progresses.

Likewise, in the case of a country with a highly developed road sector, the analysis can help sort out which investments will or will not help cut motor vehicle emissions. In areas with congested traffic, emissions per vehicle-kilometer are extremely high. GHG analysis can support projects in these areas if they can be shown to improve traffic flow without simultaneously inducing more traffic and higher emissions—a bounce-back that will likely follow in the absence of measures to induce the use of alternative modes.

The Analysis Embeds Carbon Costs

To cut emissions in practice, investments in low-emission modes must often include a demand management component. Will drivers shift to mass transit? Inducing the shift will require a price signal to users that reflects the total costs of GHG emissions.

To that end, the World Bank has defined a path of current and future carbon prices reflecting the locality-based social costs of carbon—congestion, pollution, and accidents as well as climate change. The new method of analyzing GHG emissions in transport quantifies the user response to such prices. It can thus identify the policy signals needed to induce shifts in mode and technologies that will achieve targeted reductions in GHG emissions.

Ultimately, the GHG analysis quantifies the monetary benefits of lowered emissions over a given period with a calculation that multiplies the physical reduction by the social cost of carbon. The closer the project comes to attaining this value added, the greater will be the internal rate of return.

Leading the Way To a Low-Emission Transport Portfolio

Quantifying the social value of carbon reductions gives transport investments a much larger role in policies to mitigate climate change. The pivotal fact is that the wider social costs encompassed in the GHG analysis (the effects of congestion, local air pollution, and road safety risks) are much larger for a given locale than climate effects alone. Accounting for them gives a critical boost to the benefit-cost ratio of emission-reducing projects. That is why allocating transport investments on the basis of such a broad measure of value added should be effective not only in reducing GHG emissions, but also in accelerating the transition to a sustainable transport sector.

► For more information on this topic:
<http://www.worldbank.org/en/topic/transport/brief/low-emission-transport>

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Challenges and Opportunities in Urban Transport Projects

Career Reflections of Two World Bank Specialists

Ajay Kumar and Sam Zimmerman¹

Problems or even failure in transport initiatives are more likely for projects set in the urban areas of developing countries. Connecting a rural village to an all-weather road or restoring a section of national highway is usually straightforward. Costs are modest, institutional issues limited, and the benefits obvious. In contrast, urban transport is not a single mode governed by a single agency but a collection of modes with varied administrative boundaries and many private sector stakeholders. Successful urban transport strategies reflect an understanding of linkages among transport, land use, and environmental factors. Working out the complex local challenges requires social, political, and technical capacities often in short supply in developing countries. And even when a project manages to attain its physical objectives, the civil and governmental capacity needed for sustainability often remains underdeveloped. The institutional frictions and gaps point to the elements of the way forward on urban projects: thoroughly understand the local context, then build broad public consensus around the value of better transport and the value of institutional arrangements to sustain it.



The number of countries in which the World Bank supports urban transport solutions

What Makes Them So Difficult?

Every World Bank team helping with an urban transport project has had a meeting with the country's Secretary or Minister of Transport. The meeting often begins with the client asking, "Why are urban transport projects so difficult? Why have we failed in the past? And how can you help us?"

The difficulties of urban transport projects can be summarized in four categories: high political and news media exposure; the influence of the sec-

tor—the large size of its workforce and the political strength of its patrons; weak governance; and physical and social complexity.

High Exposure

The concentration of economic, political, and media power in a large urban area makes it a focus of any political agenda. In that environment, a significant local transport issue gets widely reported and sparks interest. The sensitivities are heightened by the entrenched nature of interests that have obtained rights to the operation of the area's transport systems.

Power of the Status Quo

In the capital city of one developing country, for example, 100,000 minibuses and 200,000 commercial motorcycles provide direct employment to

¹ Ajay Kumar, Lead Transport Economist, is retiring this year after 20 years of work on transport projects at the World Bank. Sam Zimmerman is a consultant and was an urban transport advisor at the World Bank until his retirement in 2009. These comments are adapted from their recent paper "Lessons in Design and Implementation of World Bank Urban Transport Projects: What Makes It So Difficult?"

more than 500,000 people. That numerical strength confers the power to combat transportation plans through organized action. In addition, ownership of vehicles and licenses gives many officials a financial interest in the informal transport sector or a political interest through their ability to distribute patronage.

Weak Institutional Capacity

Typically the governments involved have little capacity to effectively plan, implement, and manage urban transport. Road projects proceed at cross purposes with rapid transit plans. Attempts to remedy congestion—the most visible impact of urbanization—will favor new roads instead of better traffic management. Instead of creating low-cost bus capacity or improving sidewalks, government will propose high-cost systems (rail, ring roads, fly-overs) in the mistaken belief that it is the only way to ameliorate congestion.

Physical and Social Complexity

Land problems and resettlement issues in high-density urban areas are well known. Moreover, a single project will usually impinge on multiple travel modes, stakeholders, goals, and agencies. Unless the project staff successfully develops approaches to each dimension, the project is unlikely to produce the desired results. Nonetheless, overburdening a single operation with a multitude of long-term goals is often a recipe for failure.

Creating Political Will

A political champion, or broad “political will,” is hard to find for projects whose benefits are spread across a wide and unorganized section of the population. In this context, what would be the best approach to develop transformational projects with a long-term impact?

Engaging Citizens

People are affected by the location and use of transport even when they themselves are not users, and hence they are highly sensitive to any changes in the system or in the policies governing it.

That sensitivity is the key to creating political will. Demonstrating the value of the potential benefits and nurturing an atmosphere of common good can

mobilize public opinion in the service of reform. It can even create champions.

The Case for Creating Broad Consensus

The gestation period of transport projects often goes beyond a political term. The support created by engaging diverse stakeholders in planning and design can assure that project ownership goes beyond immediate political interests and terms in office.

Creating popular support will never be easy. Urban transport reform means changing an industry that supports as much as 20% of a city’s population and affords considerable opportunities for rent seeking.

To generate consensus, the project must build capacity at the governmental level and it must engage citizens. Building capacity enables government staff to become a project’s champions, defend it in internal discussions, and actually become change agents. It also enables them to properly inform the political leadership.

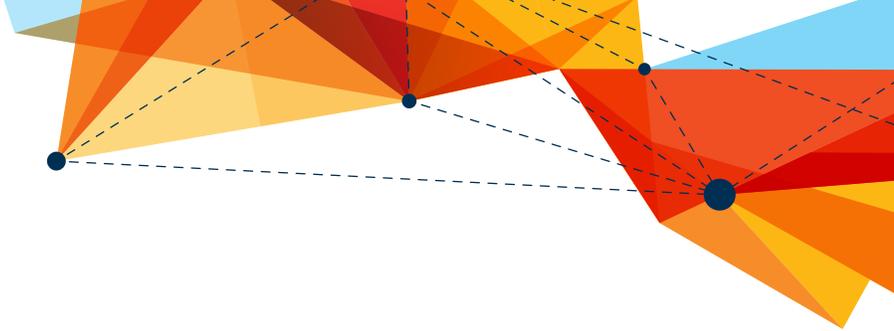
The citizens’ level should be engaged in numerous ways, such as by forming a citizen board; conducting regular public consultations; using social marketing; and providing interactive social media to gain feedback.

Summary: Some Key Lessons

- Understand local politics and local conditions. Then look for the best fit in the local context, not best global practice.
- Pursue institutional coordination across space and functions.
- Consult and engage with the community. That helps surface and balance diverse views in a climate of rational discourse.
- Focus on fundamental needs. Walking and taking the bus are the dominant modes of travel in most of the World Bank’s client cities, especially for the poor and women, and improving those modes should often be the first order of business.
- Do not be carried away by “flavor of the month” agendas.
- Help build the public sector capacity for transit planning and management.

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Advance Funding for Infrastructure PPPs

Cautions from Two Road Projects in Peru

Michel Kerf

Public private partnerships (PPPs) for infrastructure projects require substantial initial funding that private operators in developing countries can rarely obtain in the domestic market. In 2005, in the context of two important road projects, the government of Peru introduced a financial innovation with two goals: improve the access of the projects' concessionaires to the international financial markets and book government support as an operating expense rather than debt. The innovations offered distinct advantages to the concessionaires while imposing a significant burden on the government, which has since stopped using them. Nonetheless, the new approach can still be useful in carefully limited instances to help solve the funding problem.

\$826 million

Capital raised in the international financial markets in 2005-06 by concessionaires for two road projects in Peru



Public Financing for Transport PPPs—the PAO

Structural reforms initiated in Peru in the early 1990's led to a period of sustained economic growth in which the government turned to PPPs to generate investments in its airports, sea terminals, and roads. The government provided financial support to the PPPs using, among other instruments, Annual Payments for Works, or PAOs (Pago Anual por Obras). The PAO is a government obligation that, upon successful completion of the project, it will make a fixed number of equal annual payments to the concessionaire to cover construction costs. PAOs were considered to be sovereign debt.

The Innovation—the Unconditional CRPAO

In 2005, the government awarded PPP contracts for two key road projects—IIRSA Norte, linking the coastal and Amazonian ports in the north of Peru;

and a large portion of IIRSA Sur, connecting Peru and Brazil.¹ To increase the attractiveness of these projects to the private sector and also reduce their impact on the public debt, the government took a new approach that would (1) give the projects' private partners greater access to the financial markets and (2) account for government obligations as operating expenses rather than as increases in sovereign debt.

Instead of providing a stream of payments at the end of a project, the government split the road projects into sections. Satisfactory completion of a segment had to be certified by a government regulator, after which the concessionaire received the right to a stream of annual payments for that segment.

That right to a payment stream was satisfied with a series of government obligations called Certificates of Recognition of Rights of Annual Payment for Works, or CRPAOs (Certificados de Reconocimiento de Derechos del Pago Anual por Obras.).

¹ Neither project involved World Bank financing.

Critical Features of the CRPAOs

The CRPAO payment obligation was crafted with four characteristics designed to facilitate market access: they were transferable, unconditional, equal in rank to any other similar government obligation, and subject to cross-default.

First, the CRPAOs were freely transferrable, allowing the concessionaire to sell them or issue securities backed by the payment rights embodied in them. Thus, as work on the road projects moved forward, CRPAOs gave the concessionaire access to private sector funds required to finance additional sections of the project and thereby reduced the initial amount of capital that the concessionaire needed to raise.

Second, the payment rights embodied in the CRPAOs were unconditional—for example, they did not depend on construction of further sections of the project, and they were not affected by any subsequent discovery of a deficiency in the completed section. In short, once it issued a CRPAO, the government could not contest it.

Third, the CRPAO's claim on the government was equal in rank with that of any other CRPAO or similar instruments. Therefore, if the government issued a similar instrument but with stronger payment rights, those rights would also apply to all previously issued CRPAOs.

Fourth, CRPAOs were subject to cross-default: if the government defaulted on any CRPAO, the breach would be considered a default on all other CRPAOs (although payments could not be accelerated beyond the fiscal year of the default).

The CRPAOs were also crafted with the objective of shielding the government's credit rating: the two road concession agreements defined the CRPAOs as current expenses of the government's budget and specified that they were not a sovereign debt of the Republic of Peru.

Effects of the Innovation

The CRPAOs provided clear advantages to the private concessionaires: much less need for initial financing, strong payment guarantees, and reduced risk arising from nonperformance (the regulator's

approval could not be overturned by any subsequent discovery of flaws in performance).

For the government, the CRPAOs were supposed to confer two distinct benefits: (1) generate more competition among bidders for PPP projects by making it easier for private parties to reach financial closure and (2) enable the government to provide financial support to PPPs without adding to the national debt.

In the case of the IIRSA Norte, the CRPAOs had no effect on the bidding because they were fashioned during negotiations with the winning bidder. But they helped the winner mobilize full financing even before the start of construction, backing the issuance of \$213 million of obligations on the New York stock exchange. In the subsequent case of the IIRSA Sur, the number of bids did not appreciably increase, but the CRPAOs enabled the winning bidder to raise \$613 million.

The effort to use the CRPAOs to shield the government's debt did not succeed. In the course of its Article IV consultation with Peru in 2006, the International Monetary Fund found that the CRPAOs were debt instruments. The government then refrained from using CRPAOs on any other projects because of the priority it assigned to reducing public debt.

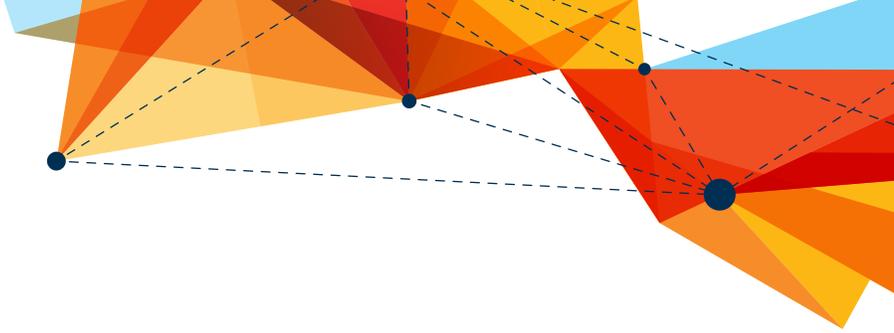
Lessons Learned

The financial power generated by the CRPAOs came at the cost of heightening the construction risks borne by the government. In addition, use of the CRPAOs for some projects might have made other projects less attractive for private operators given the CRPAOs' strong payment and cross-default provisions. Finally, use of the CRPAOs could not avoid adding to the national debt.

The misallocation of construction risks is arguably the most important drawback of the CRPAOs. Because of it, CRPAOs should be used only in rather limited, well-circumscribed circumstances, for example when local financial markets are undeveloped, and mobilizing the required financing might prove particularly challenging because government commitments lack credibility with private investors. The CRPAOs should thus be only a temporary device used to establish or re-establish confidence, not a permanent measure.

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Private Participation in Urban Rail

A Resurgence of Public-Private Partnerships

Daniel Pulido and Fabio Hirschhorn

Cities in the developing world are relying more on public-private partnerships (PPPs) to carry out the most complex and demanding of their public works initiatives—the development of new urban heavy rail, or metros, usually involving underground lines. Most of the world’s metro systems are operated—and were funded and built—by public agencies. But developing country governments are shying away from the high cost and complexity of such systems and are acquiring more experience partnering with the private sector on infrastructure projects. Hence, the PPP approach, tried for metros with mixed results in the 1990s, has become more attractive. In the past five years, 2010-2014, five cities in Latin America and developing Asia have initiated seven new urban heavy rail lines using PPPs. In four of these projects, the PPPs are fully bundled, that is, they encompass design, financing, construction, and operations. It is too early to judge the overall performance of these seven projects, but some recommendations can be drawn from them as well as from earlier urban rail PPPs. The central lessons are the critical importance of a robust planning and management capacity in the public sector partner and the value of strong efficiency incentives for the private sector partners.



The Nature of Infrastructure PPPs

The public sector’s goal in creating PPPs is to obtain expertise, efficiency, and capital. Those benefits do not come cheaply. Managing contracts cannot be delegated, and it is especially difficult on megaprojects such as urban heavy rail. Experience shows that, regardless of the scope of the PPP chosen, it requires a highly capable public sector with a robust institutional framework and a strong management team capable of evaluating options, issues, bids, and contractor performance.

Assessing Earlier Experience

Urban heavy rail systems are highly risky projects, often costing more, starting later, and attracting fewer riders than planned. The risks of underground construction were usually seen as the most threatening; so even when PPPs were used for post-construction operations, building the infrastructure was usually taken on by the public sector. Until 2010, only one new completely underground rail project in the developing world had been a fully bundled PPP (phase 2 of Line 4 in Shenzhen, China).

Concessions to operate existing urban rail lines can deliver good performance and financial sustain-

ability. However, the PPPs of the 1990–2010 period for new urban rail have a mixed record. A couple of them have been successful, but most have fallen short of expectations.

Notably, in the 1990s, Bangkok, Kuala Lumpur, and Manila implemented six PPPs for new urban rail projects. The Manila project was generally successful, but two projects in Kuala Lumpur went bankrupt and had to be bailed out by the government; and the projects in Bangkok faced delays and could not be carried forward as originally intended, generally because of inadequate public sector planning and poor communication with the private sector. A similar experience befell the more recent PPP for the new Delhi Airport Metro Express Line, which was ultimately taken over by the government.

The New Wave of PPP Projects

The developing world's use of PPPs for new metro systems is on the rise. In the past five years, PPPs totaling \$30 billion have been established to install 283 kilometers of rail in five cities—São Paulo; Beijing and Hangzhou; Hyderabad; and Lima. The total rail length is nearly triple that of such projects in the preceding five years, and the average length per project, 40 kilometers, is nearly double. Some of these projects are riskier, too, involving extensive underground construction.

The PPPs in São Paulo (for two lines), Lima, and Hyderabad are fully bundled, whereas in China the job of developing the infrastructure has primarily remained with the public sector. In every case, however, the public sector has partly or entirely assumed some risks, including those related to geological hazards and lower than forecasted ridership. The cost and risks of property acquisition remain mainly with the public sector.

Although the projects include large private investments, especially in rolling stock, government has still had to make initial investments to ensure the projects' financial viability. The São Paulo projects required a change in the federal PPP law to accommodate a public investment in the construction phase.

Their complexity and risks limit the ability of such PPPs to raise long-term commercial financing. The

PPPs in Latin America were able to mobilize private financing ranging from 30% to 50% of capital expenditures (excluding property acquisition), but only with the public sector providing or guaranteeing the financing on the balance.

Lessons from Recent Experience

The longer-term performance of the recent metro PPPs remains to be seen, but the partnership arrangements illustrate three critical needs in such undertakings: (1) to work hard at optimizing the risk-reward balance and making projects sufficiently attractive for the private sector, (2) to minimize the fiscal risk to government by giving concessionaires strong incentives to maximize revenues, and (3) a strong public sector capacity to manage contracts.

First, carrying out all phases of a new metro project involves many specialized firms, so assembling a bid is a formidable task. Each of the fully bundled projects in Latin America received only one bid, and a perception exists that the public sector could have done a better job of addressing the concerns of potential bidders worried about the considerable risks in such projects. The public sector can best get a feel for the market and improve its chances of increasing competition by maintaining a dialogue with all potential firms during the planning and bidding process.

Second, productivity incentives are a good way to attract bidders and eventually promote a more sustainable rail service. They might include sharing revenues from ancillary commercial activities and from ridership above a certain threshold. Such deals are attractive to the private sector and help limit the long-term fiscal risks to government.

Finally, strong management capacity to handle negotiations—as well as renegotiations, which are almost inevitable in these highly complex endeavors—is fundamental to ensure that the benefits of PPPs are realized.

► **For more information on this topic:**

A Tale of Three Cities

<http://www.citiesandclimatechange.org/document/?idItem=154&HPSESSID=6f746c25e0cd6d2f25cef0f63a64215e>

Private Sector Participation in Light Rail-Light Metro Transit

<http://hdl.handle.net/10986/2416>

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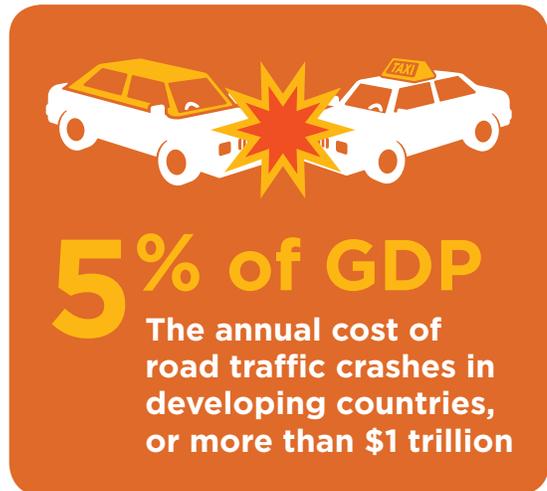
The notes are available at <http://www.worldbank.org/transport/connections>



Reducing Road Deaths an Urgent Development Goal

Dipan Bose

In 2010, more than 100 countries co-sponsored a landmark resolution by the UN General Assembly—a Decade of Action for Road Safety—to stabilize and then reduce forecasted global traffic fatalities by 2020.¹ The goal is ambitious. From 1980 to 2010, road fatalities as a share of population rose about 13% worldwide, but they rose by more than 75% in developing East Asia (including China) and by 66% in South Asia (including India). Awareness and advocacy have strengthened over the past five years, but these data suggest that developing countries, especially in the middle-income group, will fail to attain the 2020 goal set by the Decade of Action. Now midway to the end of that decade, countries are set to meet in Brazil in November to discuss ways to accelerate progress toward the 2020 goal.



Road traffic crashes are a key obstacle to economic development and a burden on public health:

- Road traffic injuries are estimated to cost developing countries 5% of GDP, or more than \$1 trillion per year.
- Worldwide, they now kill about 1.3 million people every year and severely injure another 50 million or more.
- 92% of the annual deaths are in developing countries and half are among motorcyclists, pedestrians, and cyclists.
- For individuals aged 15–29, they are the world's leading cause of death among males and the fourth leading cause among females.

In its “Global Plan” for the Decade of Action, the World Health Organization (WHO) observed a “growing awareness” of the road safety crisis and that “activity at the international level has gained new momentum.” But “even so, current initiatives and levels of investment are inadequate to halt or reverse the predicted rise in road traffic deaths. ... political will and funding levels are far from commensurate with the scale of the problem. ... the crisis requires ambitious vision, increased investment, and better collaboration.”

¹ The resolution gave neither a forecast nor a numerical target for reduction. In its 2013 *Global Status Report on Road Safety*, the World Health Organization projected annual worldwide traffic deaths as rising from 1.3 million in 2011 to 1.9 million by 2020. It noted that steadily reducing the death rate over the decade to 0.9 million—a much more ambitious goal than stabilizing and then reducing—would save 5 million lives by 2020.

More Progress Needed

The 2013 WHO analysis, *Global Status Report on Road Safety*, provided 2010 data to serve as the baseline for measuring progress during the Decade of Action. As it noted, “Strategies exist that are proven to reduce road traffic injuries.” But it emphasized a widespread lack of progress in implementation, particularly in legislation, law enforcement, and the protection of motorcyclists, cyclists, and pedestrians.

Getting Back on Track

Over their 30–40 year history of road safety gains, the best-performing countries increased their institutional—that is, agency—competency and ownership of safety management functions.

The overwhelming challenge in the remainder of the decade is to help build the capacity of national agencies, especially in rapidly motorizing countries, to implement and manage strategic interventions, including in policing, research and data, and safer designs for roads and vehicles.

Road Safety Policing

Enforcement has been one of the least advanced areas of WHO’s Global Plan. Better financing to supply training and equipment can produce faster results, and an association or series of partnerships, set up by and for police, could help fill the gap.

Lead Agency Capacity and Data Management

A competent lead agency for national road safety is needed to establish a country’s good road safety practices. The World Bank’s system for appraising such agencies helps countries strengthen the capacity of their lead agencies to devise and execute action plans, including better management of data on road accidents.

Safer Infrastructure and Safer Vehicles

Existing roads must be modified to improve overall safety and better protect the most vulnerable users—pedestrians, cyclists, and motorcyclists. Likewise, new roads should not be built without such safety features.

The Global New Car Assessment Program (Global NCAP) has raised consumer awareness of vital car safety features, which have begun to appear more frequently in vehicles sold in developing countries. In the remainder of the decade, countries should increase their own capacity to educate consumers, assess vehicle safety needs, and regulate the condition of vehicles on the road.

In the second half of the Decade of Action, the World Bank and other multilateral development banks, will continue to have an important role in supporting progress; but stronger national action, especially in implementation, is more urgent than ever.

World Bank Action

The World Bank has ramped up its funding and focused on supporting stronger road safety management, including enforcement capacity, vehicle safety, data management systems, and engagement with civil societies and the private sector:

- All road projects are to be screened to ensure road safety compliance.
- Road safety lending within World Bank projects has grown from \$55 million in 2006 to \$411 million in 2014.
- More than 70% of the road projects with road safety components have been designed with a multisectoral, safe-systems approach.
- The World Bank supports development of national and regional data observatories, to improve the collection of road injury data.

► **For more information on this topic:**

WHO, *Global Status Report on Road Safety 2013*
http://www.who.int/violence_injury_prevention/road_safety_status/2013/en

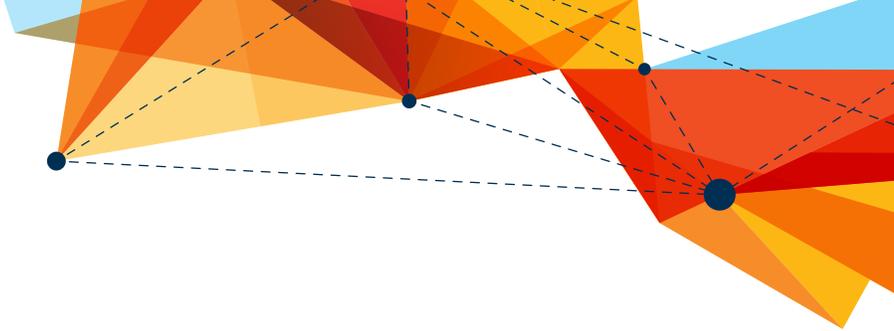
World Bank and IHME, *Transport for Health*
<http://documents.worldbank.org/curated/en/2014/01/19308007/transport-health-global-burden-disease-motorized-road-transport>

WHO, *Global Plan for the Decade of Action for Road Safety 2011–2020*
http://www.who.int/roadsafety/decade_of_action/plan/en/

Global Road Safety Facility
www.worldbank.org/grsf

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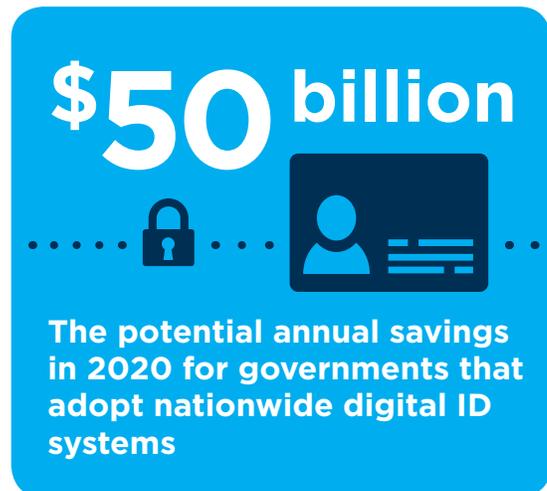
Digital IDs for Development

Access to Identity and Services for All

Mariana Dahan and Randeep Sudan

Lack of personal official identification (ID) prevents people from fully exercising their rights and isolates them socially and economically—voting, legal action, receipt of government benefits, banking, and borrowing are all virtually closed off. The widespread lack of ID in developing countries is a critical stumbling block to national growth. Digital ID, combined with the already extensive use of mobile devices in the developing world, offers a transformative solution to the problem—a simple means for capturing personal ID that can reach far more people; and new, more efficient ways for government and business to reach and serve the population.

Robust digital ID systems can produce huge savings for citizens, government, and business, increase transparency and accountability, and drive innovation. Harnessing their power will require strong political will and leadership, foreign assistance matched with local incentives, and a supportive institutional environment. Trust in data security will be critical to achieving tangible results.



Identity: A Fundamental Right and a Gateway to Development

Official identification (ID) is more than a convenience; it is a fundamental human right. It is indispensable for connecting residents to electoral participation, educational opportunities, financial services, health and social welfare benefits, and economic development. It gives people a chance to better communicate with and be recognized by their government while giving governments the opportunity to listen and improve the lives of their citizens.

Yet in the developing world, nearly 2 billion people lack an official ID. The problem imposes a particular

burden on poor rural women, whose lack of an ID often nullifies their legal right to divorce or exert property claims or directly receive government benefits. The expansion of digital mobile phone technology in developing countries has accelerated the emergence of digital identification and the electronic delivery of services. In sub-Saharan Africa, more than half of the population in some countries is without official ID, but more than two-thirds of residents in the region have a mobile phone subscription. Over the past few years, digital IDs have become a game-changer, overcoming the barriers to distributing official ID nationwide and opening the way to digital service delivery as a key development tool.

A digital ID can be established biometrically through a person's facial or optical characteristics or fingerprints, all of which can be verified online, in real time, using a smartphone or other connected device.

In Ghana, a new digital national ID system is using fingerprints for registration. Targeted at the entire population of more than 25 million, the system aims to better connect citizens to government and commercial services.

Benefits for Citizens and Businesses

Full deployment of digital IDs could put a bank account within reach of the 500 million people whose lack of recognized ID excludes them from banking. For social services, a biometric ID system in India allowed the first-ever delivery of social welfare payments directly to all female beneficiaries instead of to one of their male relatives. Pakistan has used digital ID embedded in smart cards to facilitate transfers to poor women and emergency disaster relief.

Modernizing government ID systems is opening the way to the huge efficiency gains in business that come from digital transactions—so long as the data are trusted. In the G20 countries, Internet commerce could be reduced by as much as \$1 trillion per year if trust in digital ID is undermined.

Benefits for Government

Digital ID systems yield gains in efficiency and convenience that could yield global taxpayer savings of up to \$50 billion per year by 2020. Through online transactions and other e-services, digital ID systems also can reduce the corruption and theft in paper-based systems that siphons off entitlement payments from their intended recipients.

Digital ID systems also advance government accountability and transparency. A 2010 biometric census of civil servants in Guinea-Bissau reportedly identified 4,000 nonexistent workers on the public payroll. Nigeria reported eliminating 43,000 “ghost” workers in the first phase of a pilot in 2011 that saved \$67 million. In Botswana, biometric enrollment of pensions and social grants eliminated

waste by identifying duplicate records and deceased beneficiaries.

Harnessing the Power of Digital IDs

Countries seizing the opportunities presented by digital ID must have robust legal and technical frameworks for the protection of data and privacy. Success will depend on government instilling a climate of trust through such systems, and these in turn require strong political commitment and leadership.

A recent study estimated that in 2020 alone, two-thirds, or \$480 billion, of the potential value of digital ID in the European Union is at risk if personal data is not trusted. Moreover, government missteps in addressing trust and handling citizens' data can affect the economy as a whole, threatening revenues and efficiency gains derived from all personal data applications.

Establishing digital ID systems can be costly. An important way for governments to reduce the initial financial burden is to establish public-private partnerships that will create revenue flows and ensure sustainability.

A Global Agenda

Recognizing the transformational potential of 21st-century ID systems for the delivery of basic services to the poor, the World Bank recently launched its Identification for Development (ID4D) agenda. The goal is “making everyone count” by “providing an identity and delivering digital ID-enabled services to all.”

The Digital ID program is a key element of the multisectoral ID4D agenda. The latter is aligned with Sustainable Development Goal 16.9, “legal identity for all, including birth registration,” by 2030. As it pursues ID4D, the World Bank will collaborate with development partners and governments to provide unified technical and financial support to low- and middle-income countries.

- For more information on this topic:
<http://blogs.worldbank.org/ic4d/using-digital-identities-fight-poverty>
<https://www.secureidentityalliance.org/index.php/news-events/news/311-mobile-identity-gsma-sia>

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The Expanding Role for Open Data in Burkina Faso

Program Gains Wider Use in the Transitional Government

Samia Melhem and Axel Rifon Perez

The widening drive to provide open data in the public sector has taken a new turn in Burkina Faso. Open data has always been recognized as an enabler of economic development and government transparency. But in October 2014, when a popular uprising ousted Burkina Faso's long-standing leader and established a transitional government, the country's nascent Burkina Open Data Initiative (BODI) took on new life as an enabler of the transition. With support from the Open Data Initiative and the World Bank, BODI had debuted just four months before the uprising, showcasing about 50 data sets of government information and an app that focused on education. In the months since then, the development of BODI has only accelerated, with more staff, more data sets posted, and new applications launched or planned. Under the transitional government, BODI has expanded with a web page for finding data on government contract awards and a program to help track and manage the country's persistent drought problems. And BODI envisions a polling-place finder and reporting of vote totals as ways to support turnout and transparency for the scheduled October 2015 national elections.



Background

Burkina Faso, one of the world's poorest countries, created an agency, ANPTIC, to promote and oversee the advance of information and communication technology (ICT) within the government. In 2012, ANPTIC asked the World Bank for assistance in developing a program to make important government data sets available online to the public through "open data."

The goals of the request fit into the World Bank's ICT agenda to advance the spread of open government data: increase the capacity for evidence-

based decision making in both the public and private sectors; raise the transparency and accountability of the government; improve the delivery of government services as well as citizen engagement with the government; and build an ICT ecosystem linking the public and private sectors with the international community to help build job growth, innovation, and economic development.

With support from the Trust Fund for Statistical Capacity Building, the World Bank used its "readiness assessment" process to identify some of the challenges facing the country's development of open data.

The pursuit of open data is much more than a simple edict requiring agencies to somehow make their data available to the public. It entails an elaborate and far-reaching change in procedures and possibilities for e-government. At the heart of open data is an internationally recognized set of “open data standards,” freely available technical requirements for electronically organizing various types of data—such as those on budgets and procurement as well as social and economic data on health, education, industry, agriculture, and transport. Use of an open data standard is critical to searching, analyzing, and publishing the data in multiple formats in consistent fashion.¹

The e-government efforts demonstrated that, despite less than 5% of the population having online access, Burkina Faso saw open data as a catalyst. It would stimulate training, job opportunities, and international engagement that could help it attain its development goals by accelerating the country’s entrance into the digital era.

The Launch and Evolution of BODI

At its launch on June 5, 2014, BODI made available about 50 government data sets and an Internet portal for searching them, data.gov.bf. The event also initiated a new app, “Our Schools, Our Data,” which provided information on one rural community of 17 villages and 4,300 students. With training that will boost citizen skills and engagement, residents in other communities will use surveying techniques and editing software to gradually expand the app’s coverage to the entire country.

Since the transitional government began in October 2014, its support for BODI has clearly increased. By the first quarter of 2015, the government’s operat-

ing budget had added 60 employees to the governing agency, ANPTIC, and the number of staff members on the open data team grew to six.

In December, the government launched another portal featuring a searchable database of government procurement offers and contract information.

After a second readiness assessment by the World Bank, Burkina Faso received additional funds for an open data project to advance the country’s adaptation to drought, climate change, and natural disasters.

Next Steps

The open data initiative provides the motivation to provide training that will increase the data literacy skills of the government as well as members of the media, students, community leaders, academicians, and the general public.

For the upcoming election, the interim government has invited the BODI team to investigate the creation of apps that will inform voters of their nearest polling places and enable quick reporting of local election results via text message. The results will be compiled into national results in a central database, where they will be publicly available in close to real time.

Now standing at more than 140, the number of data sets managed and released to the public under open data standards will continue to grow. In the process, government transparency, service quality, and a climate of trust between government and civil society is also likely to grow, along with the country’s digital economy.

► For more information on this topic:

WBG Open data website:

<http://data.worldbank.org/>

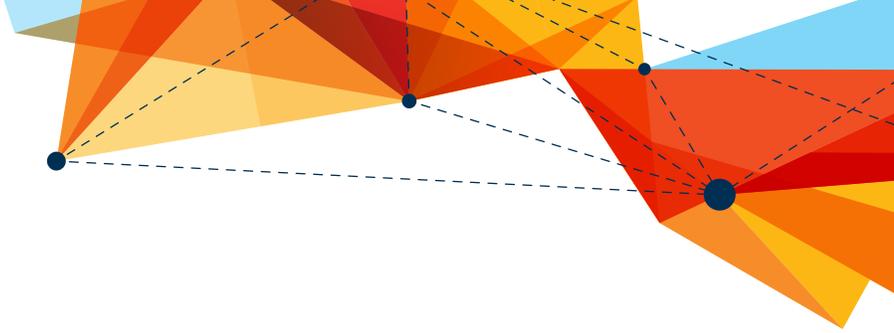
ODRA Toolkit:

<http://opendatatoolkit.worldbank.org/en/odra.html>

¹ As described by the “briefing document” of the Open Contracting Data Standard Project (<http://standard.open-contracting.org/>), a technical standard for assembling open data “provides a ready-made approach to sharing data effectively, allowing the [agency entering the data] to focus on content, completeness, and quality. It dramatically lowers ... cost..., [allowing use of] various [output] formats..., [and] technology tools and services can use the information easily and reliably. [As] technical standards gain wider adoption, global comparisons [of the data] are made possible.”

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Korea's Leap Forward in Green Transport

Changgi Lee, Nak Moon Sung, Sang Dae Choi, Eun Joo Allison Yi, and Sangjoo Lee

Megacities in developing countries suffer from serious traffic congestion, high levels of greenhouse gas (GHG) emissions, and heavy air pollution. These urban areas face a stark dilemma: economic expansion attracts more people and vehicles; but the resulting traffic and pollution hinder further growth while reducing the quality of life for their citizens. Not long ago, Seoul faced a similar conundrum. Choked with pollution and traffic jams, it changed course and helped Korea make a historic transition to green urban transport. It shifted from supply-side policies focused on expanding roadways and metro lines to green demand-side policies focused on creating transit-oriented cities. Today, Seoul boasts a passenger-trip share for metro and bus of more than 60%. Energy consumption in Korea's road sector is lower than in other countries with similar GDP. Congestion costs have been decreasing, and CO2 emissions in the transport sector have been kept under control. This pathbreaking transition was founded on multimodal solutions integrated by information and communication technology (ICT) in a context of strong political leadership and public financing.



From 1980 to 2010, the total length of all roads in Korea more than doubled, and the length of paved roads increased 540%. By 2000, the road density in Seoul (12.9 km/km²) was three to four times greater than in Beijing or Shanghai. From 1980 to 1997, estimated congestion costs in Korea quadrupled, to 18.5 trillion won, or 3.6% of GDP, with Seoul accounting for one-fourth of the costs. Air pollution from road traffic cost an estimated \$13.3 billion in 2006.

The reliance on supply-oriented transportation policies began to lose its appeal, but the path to better transit and less congested roads was not straightforward.

Seoul had been expanding its metro transit network throughout the 1990s and early 2000s, but most of the rise in metro ridership came from former bus riders rather than passenger car drivers. In those years, almost half of the city's 103 bus companies shut down. After a 2002 expansion of the metro network, automobile passenger trips and metro ridership were both higher than in 1996, while bus ridership was lower.

A comprehensive reform in 2004 began a dramatic reversal in the trend. The new strategy drew people out of their cars and into public transport by modernizing and expanding the bus system and integrating it with both metro and a new system of feeder buses.

Multimodal Transport Solutions

The reform in Seoul introduced distance-based fares and free transfers between buses and between bus and metro. The city rearranged bus routes to broaden passenger access, built bus rapid transit (BRT) lanes and transit centers for faster and more reliable service, and introduced shuttle buses connecting remote locations to the main system.

The new multimodal system was supported by innovative ICT that enabled rechargeable transport cards to work with distance-based fares and provided real-time route and schedule information to travelers.

Transfers became more convenient; the speed and reliability of bus service improved; and bus-related accidents and injuries declined by about 25% just one year after the reform. Seoul saw a continuous increase in the number of subway, surface rail, and bus passengers and a drop in the use of cars. The rechargeable transport card has now become a virtually nationwide fare system, and cities continue to make innovative strides in their transit networks.

Key Policies

Seoul's shift to green transport had four fundamental characteristics: (1) multimodalism, (2) use of ICT to integrate the modes, (3) vision and political will, and (4) financial support. These elements also defined green transport policies that spread to other parts of the country.

Multimodalism and ICT

Key elements of multimodalism are land development centered around new or existing transit stations that also become commercial and cultural hubs; a distance-based, free transfer fare system; and a community shuttle-bus system. The system of free transfers and distance-based fares was a pivotal achievement, making each transport mode a branch of the overall integrated system. The community shuttle bus system connects the more remote neighborhoods with metro stations or major bus stations under the same fare and transfer system; it is a major element of Korea's green trans-

port model and currently accounts for about 10% of the country's public transit ridership.

The role of ICT was crucial for the transportation smart card (T-card), which had a catalytic role in the success of the reform. By allowing a distance-based fare system employing free transfers, it brought passengers to buses. Each major city now operates a transportation information system that includes GPS tracking of its buses. Travelers use the information to guide their trips, government uses it to evaluate its transport operations, and bus associations and the smart card company use it to distribute revenue according to distance traveled.

Vision, Political Will, and Financial Support

The reform was the type of high-risk, high-return project that brings immediate opposition. In Seoul, green reform of the public transport system was one of the major pledges of the then-mayor, who was able to get political support from both the government and citizens. Overall, the initial construction and preparation costs for Seoul's revamped bus network probably amounted to about \$100 million. Seoul's government spends about \$200 million per year to cover the operating losses of the bus system, which translates to about \$20 per person.

Lessons and New Challenges

By the early 2000s, Korean transport policy had reached a dead end, unable to stop the rise of highway congestion. The solution began in Seoul, which upgraded and revived the bus system with BRT and neighborhood feeder routes and linked it to rail with ICT. The result was an integrated urban, and ultimately national, mass transit system that could stem the rise of automobile use.

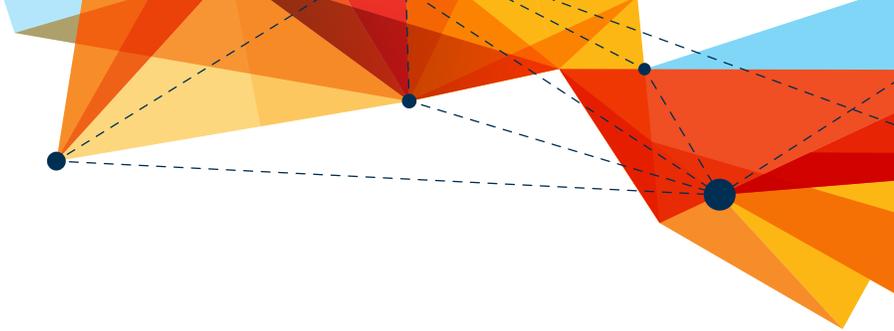
Korea succeeded so well that it has stabilized energy consumption per capita in the road sector. In 2010, Korea took aim at a new 10-year goal with its green transport master plan: reduce GHG emissions by one-third while maintaining its competitiveness.

► For more information on this topic:

Korea Green Growth Partnership:
<http://www.worldbank.org/en/topic/sustainabledevelopment/brief/korea-green-growth-partnership>

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More Climate Finance for Sustainable Transport

Jane O. Ebinger, Nancy Vandycke, and John Allen Rogers

Actions to reduce greenhouse gas (GHG) emissions to stabilize warming at 2°C, as agreed by the international community in 2009, will fall short if they do not include the transport sector. Transport is responsible for around 23% of global carbon dioxide emissions and emissions are expected to rise without further action to curb emission growth and invest in low carbon transport modes. Investment needs are estimated at around \$3 trillion to increase the sustainability of existing and new transport systems and to mitigate climate change over the 2015–35 period. This is in addition to existing annual investments estimated at \$1–2 trillion. Public sector financing while an important catalyst will not be sufficient to meet needs. The actions taken today to send the right policy signals, and establish the enabling institutions and regulations to attract the necessary private finance will be critical to support this transformation. Significant investment opportunities exist in public transport systems, vehicle efficiency improvement, and reducing the need for travel through demand management, regional development policies, and land use planning. As the international community embarks on the road towards CoP 21 in Paris, there is a case to be made for more climate finance flowing towards transport.



GHG emissions are growing faster in transport than in any other sector. On-road passenger and freight activity can be expected to increase worldwide, by 2050 to more than two and a half times the level of activity in 2015, driven principally by urbanization and economic growth in developing countries without strong mitigation action to decouple growth and emission trends.

Large investments are urgently needed to increase the sustainability of existing and new transport systems and mitigate climate change. Making the right choices in transport is all the more important to avoid lock-in to unsustainable growth patterns in the future—today’s fossil-fuel based investments

help lock-in a carbon intensive development path for the long term. Change will require financing from all available sources—public, private, bilateral and multilateral. So far, international climate finance flows to the transport sector has been small relative to other sectors, such as energy.

Incentives for Investment

The multiple benefits that accrue with investments in low-carbon transport systems – such as improved health, air quality, congestion, and jobs - must be factored into decision-making processes. Focusing solely on the high costs of achieving GHG abatement through changes in transport technol-

ogy, like investments in fixed energy infrastructure, fails to recognize the local and global development benefits associated with improved transport systems. Accounting for these benefits sharply increases the incentives to invest into complex transport projects.

For example, policies mandating fuel-efficient vehicles, plus widespread adoption of electric and hybrid vehicles, public transport, more advanced biofuels, and more-efficient freight transportation in the European Union, Brazil, China, India, Mexico, and the United States are estimated to yield the following benefits by 2030¹:

- Eliminate 2.4 billion tons of CO₂ emissions per year
- Save 20,000 lives
- Save 4,700 terawatt-hours of energy
- Yield inflation-adjusted (2010) monetized benefits of \$456 billion

Quantifying the development benefits associated with comprehensive demand-side transport developments at the project and program level is data intensive and requires complex measurement methodologies and frameworks to account for behavioral change and changes in energy consumption associated with millions of mobile emission sources.

Work is needed to develop the economic tools and measurement systems to better account for climate risks and opportunities, and reach consensus on a common framework for sustainable transport. This will help to better inform project developers about green solutions and finance opportunities and harness the gains from building a transport system that is low carbon and resilient.

Opportunities for Climate Finance

Nationwide. National policies influence the speed of transition to a low-carbon, climate resilient transport system. Opportunities to shift investment to lower carbon pathways include reducing

harmful fuel subsidies and introducing pricing for auto use that induces shifts to low-carbon modes. Further gains will come from regulatory simplification; advancing new vehicle technology standards; and implementing maintenance and renovation programs to improve energy efficiency and safety in the existing vehicle fleet.

Cities. Around 70% of the global population will live in cities by 2050 and more than 90% of the increase will be in developing countries, so getting urban transport systems right is critical to avoid locking-in of unsustainable development patterns in the future. This can be supported through investments in improved public transport, urban planning, and car ownership and use. Most generally, funding must move away from focusing solely on a project-based approach to embrace a policy-based measures. This should include “avoid” strategies that reduce the need to travel.

Countryside. In many rural areas of developing countries, building all-weather roads increases incomes, work opportunities, agricultural production, school attendance, and health facility access, thus reducing poverty and mortality rates. Investments are needed to improve the resilience of road networks to short- and long-term climate change.

Freight. Maintaining economic growth while lowering the demand for on-road (and typically fossil-fuel based) freight transport is especially difficult. Emissions can be reduced by investing in industrial node and corridor development to create more efficient supply chains; shifting to rail, waterborne, and multimodal transport; raising efficiency standards on heavy-duty vehicles; and introducing voluntary green-freight approaches such as the U.S. Smartway system. “Avoid” strategies can also reduce the need to travel.

► **For more information on this topic:**

SLoCaT Climate Finance Transport Database:
<http://www.slocat.net/news/1447>

CIF website:
<http://www-cif.climateinvestmentfunds.org/>

¹ World Bank and ClimateWorks Foundation, 2014, Climate-Smart Development, Adding up the benefits of actions that help build prosperity, end poverty and combat climate change.

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Impact Evaluation to Inform and Transform Investments in Transport & ICT

Nancy Vandycke, Arianna Legovini, Aleksandra Liaplina and Vincenzo di Maro

A new World Bank initiative, “Impact Evaluation (IE) — Connect for Impact,” aims to radically transform and better inform the way that transport and information and communications technology (ICT) projects are designed and implemented.

Although multilateral lending to this key strategic sector comprises 29 percent of all global assistance, only 0.4 percent of impact evaluations have had transport as a subject. This initiative aims to fill the gap and bring high quality and valuable feedback to projects — improving design, enabling mid-course corrections, and informing ex-post evaluations.

For the first time, this initiative will offer a systematic sector approach to generating concrete evidence of what works, what does not, where, when and why. It will greatly increase the impact and value-add of investments in transport and ICT projects—which is especially important given global trends toward increasing urbanization, with 70 percent of the world’s population expected to live in cities by 2050.



Introduction

Given their strategic importance to development, why have transport and ICT been so under-represented in impact evaluation? As places that attract infrastructure may differ from those that do not, it has been difficult to estimate the causal impact of investments. As a result, the assessment of investment programs’ outcomes in the transport sector has traditionally relied on descriptive analysis, failing to establish causal impact on job locations, migration patterns, land density, trade and market efficiency. Furthermore, it has been equally difficult to develop the cross-sector data infrastructure needed to measure outcomes.

Yet, the need for impact evaluations in these sectors is even greater now than in the past. ICT has introduced substantial innovations into every walk of life, including transport. And transport systems themselves have grown increasingly multifaceted,

with an increasing portion of multilateral lending addressing more complicated development challenges, such as high-density multi-modal development corridors or urban mobility.

What is Impact Evaluation?

Impact evaluation (IE) demonstrates a causal link between an intervention and its impacts by comparing a treatment group with a control group. IE tests different interventions to identify the most effective treatment, and understand the mechanisms through which an intervention works (or not). This facilitates continuous experimentation and feedback into design and implementation — a real benefit over traditional evaluation. Current efforts in the Transport and ICT sectors build on IE methods developed and refined since early work in health and education, and more recently in sectors such as private sector development, agriculture, energy, and environment.

Impact Evaluation Contributions

Impact evaluations have proven to be an extremely powerful for maximizing returns on investments. The systematic analysis and intellectual rigor involved in IE can also give donors and governments added confidence in their decisions about current and future interventions. The benefits are many. IE's evidence-based approach can improve delivery, increase efficiency, and boost impact. It can also answer many questions regarding which transport and ICT interventions can increase productivity, economic growth, and job creation. In addition, it can help in the design and implementation of interventions to promote environmental-sustainable solutions to transport challenges.

Recent research demonstrates that the “*delivery of projects with impact evaluation is significantly timelier: common delays are avoided and the gap between planned and actual disbursements is reduced by half.*” Greater efficiency means quicker results on the ground, particularly vital in fragile and conflict-affected countries, as well as potential financial savings.

IE results can factor directly into project design. Such feedback can help determine whether adjustments need to be made: such as scaling up a specific intervention that has been very effective, or discontinuing the interventions which have been less so. IE can give policymakers a deeper understanding of design challenges, and the continuous feedback loop can help to better inform project design throughout the project cycle.

IE and the Transport and ICT Agenda

IE evidence can help with a host of new and increasingly large and complex sector challenges. Rapid urbanization will require substantial investments in improved public transport, urban planning, and car ownership and use—as well as in technology to reduce the need to travel. Getting

urban transport systems right will be critical to address growing mobility needs.

High-density corridors, such as highways and national roads, freight and passenger railway links, inland waterways and airport infrastructure, constitute the backbone of a country's transport network. Optimizing the transport network by looking at multimodality and spatial planning can support more efficient supply chains, reduce on-road freight transport costs, and facilitate regional integration.

Transport and ICT are critical for addressing greenhouse gas (GHG) emissions and moving towards more sustainable development. Transport accounts for 23 percent of GHG emissions, but its contribution to GHG emissions is expected to grow exponentially due to rapid urbanization and economic growth in developing countries.

“IE – Connect for Impact”

The World Bank's new impact evaluation program for transport and ICT will develop an analytical framework for prioritizing and filling knowledge gaps. It will build the necessary knowledge and data for transport and ICT investments in general, and for conducting IEs in particular. It will also include iterative experimentation during implementation to inform mid-course decisions, improving delivery and effectiveness. Finally, the initiative will help build capacity for evidence-based decision-making across development banks and client country institutions.

Working in partnership with all relevant stakeholders, the Bank's program will develop a sector-specific analytical framework for IE. It will pilot methodologies tailored to the sector which can become models for implementation. Most importantly, the success of this initiative is expected to drive the use of IE to design and implement better interventions that will benefit all concerned.

Gertler, Paul J.; Martinez, Sebastian; Premand, Patrick; Rawlings, Laura B.; Vermeersch, Christel M. J.. 2011. Impact Evaluation in Practice. World Bank. © World Bank. openknowledge.worldbank.org/handle/10986/2550

Arianna Legovini., Vincenzo di Maro and Caio Piza. 2015. Impact Evaluation Helps Deliver Development Projects. Policy Research. Working Paper WPS7157, World Bank, Washington, DC.

► For more information on this topic:

DIME: www.worldbank.org/dime

DIME Policy Outreach Briefs: bit.ly/1FJwxvG

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Envisioning the Transport We Need

Goals of the UN High-Level Advisory Group on Sustainable Transport

Nancy Vandycke

The world faces two urgent challenges: eradicating poverty through economic development, and tackling climate change. Sustainable transport is crucial to both. In August 2014, the UN Secretary-General established a High-Level Advisory Group on Sustainable Transport to make policy recommendations that “promote accelerated implementation of sustainable transport.”¹ The World Bank is a member of the technical working group supporting the advisory group, which sees sustainable transport as a prerequisite for all countries to attain competitiveness, inclusive and equitable growth, balanced social and spatial development, and energy and food security. And it is essential to reducing greenhouse gas emissions in support of the 2°C Scenario. Progress can be accelerated if all heed the calls for action on sustainable transport and development that exist today in a wide range of international agreements, conventions, and declarations.



The Urgency of Transformation

The more than 1 billion people who lack access to roads and transport services face a major barrier to social and economic advancement. Meanwhile, more than half of the world's population is concentrated in urban areas; the share is rising but often through widening urban sprawl, at unnecessary transport costs. By 2030, world population is expected to grow by about 1.1 billion people. And already, transport accounts for about 64% of global oil consumption, 27% of all energy use, and 23% of world CO₂ emissions.

Our collective global efforts have so far been insufficient. The business-as-usual approach of much action to date has generated huge social, environ-

mental, and economic losses—an estimated average reduction of 2% to 10% in country-level GDP associated with traffic congestion, pollution, noise, and road accidents. These losses arise largely from the costly, high-carbon transport systems based on private motor vehicles. Developing countries can choose a very different development paradigm and avoid the long-term lock-in of unsustainable systems. Attaining sustainable transport in the coming decades thus requires us to act on our vision today.

A 15-Year Vision

The development agenda for 2015–30 has advanced a large set of goals to put rural, urban, and regional transport on a sustainable path.

¹ UN Press Release, August 8, 2014, www.un.org/News/Press/docs/2014/sgal493.doc.htm.

The 15-year vision of the high-level advisory group sees people and businesses throughout the world enjoying sustainable transport—universal, efficient, safe, and environmentally friendly—connecting them to jobs, markets, and social services:

- In the cities—ample walking and cycling options as well as inclusive, safe, and resilient public transit, all resulting in efficient, low-carbon mobility, vastly reduced use of private vehicles and fossil fuels, and more balanced spatial development
- In rural areas—accessible all-weather roads and affordable transportation options that connect men and women to economic and social opportunities
- In landlocked developing countries—efficient cross-border logistics and transport systems providing swift access to neighboring and overseas markets through the most efficient modes
- And throughout the world—new routes and development corridors along with investments in infrastructure, seamless intermodality, and digital and low-carbon technologies that support greater and more sustainable regional and global trade.

To attain sustainable transport solutions, countries throughout the world must transform the way they conceive of, plan, invest in, and use transport services.

Proven Solutions Need Financing

Solutions to rapidly advance sustainable transport already exist for both advanced and developing economies. In the developing world, quick action will avoid locking-in an unsustainable development path.

The July 2015 Third International Conference on Financing for Development, held in Addis Ababa, called for bridging the investment gap for sustainable infrastructure, including transport, in developing countries.² Investments there on all transport account for less than 40% of global transport investment.

Domestic public funding must be enhanced with other sources, including the “user pays” principle, fuel taxes, innovative approaches such as land value capture, and those that reduce demand for conventional transport.

Investments improving the energy efficiency of urban transportation could ultimately lead to a savings

² The conference outcome document is at www.un.org/ga/search/view_doc.asp?symbol=A/CONF.227/L.1.

of up to \$70 trillion. The financial capacity of cities must be enhanced, with a key role for national policies to provide enabling frameworks and technical assistance for sustainable transport. Public sector action can also lead by example, creating incentives for private investment.

The high-level advisory group is encouraging new multilateral development banks (MDBs) and bilateral donors to follow the example of the eight largest MDBs, which have pledged \$175 billion over the 2012–22 period toward sustainable transport. It encourages all financiers to focus on regional efforts and public-private partnerships.

Less than 13% of all environmental funding has gone toward transport, but the Green Climate Fund has now identified low-emission transport as one of four strategic funding targets.

Initiatives everywhere, will require greater international effort on multiple fronts—international trade, technology, planning, and monitoring.

The Way Forward

International trade. Optimizing the global network for transport calls for international solutions. The needed investments in multimodal infrastructure and logistic services also require coordinated international reforms of institutional, fiscal, and regulatory arrangements.

Technological solutions. Technological innovation must be combined with the right policies and behavioral changes aimed at reducing the demand for travel.

Strong planning. Planning for sustainability must be based on evidence, strong public involvement, and a long-term view not subject to short-term politics. It will require greater funding for capacity building.

Better monitoring. Commitments in the post-2015 agenda must be subjected to rigorous global tracking, including a structured effort in data collection and analysis. Given the scale of the projects, investment in those processes will be highly cost effective.

► For more information on this topic:

<https://sustainabledevelopment.un.org/topics/sustainabletransport/highleveladvisorygroup>

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The Identity Target in the Post-2015 Development Agenda

Enabling Access to Services for All

Mariana Dahan and Alan Gelb

Robust personal identification (ID) systems are critical to the success of many development programs. Regardless of the methods used, official ID for all—together with the legal, political, and economic rights it confers—is becoming a priority for governments around the world. Legal ID is on the post-2015 Sustainable Development Goals (SDGs) agenda as SDG target 16.9, urging states to ensure that all have free or low-cost access to widely accepted, robust identity credentials. The international community should join forces to achieve this goal, as attaining it will also be a key enabler of many other SDGs.



About 2.4 billion people in the world today lack official identification (ID), including children up to the age of 14 whose birth has never been registered and many women in poor rural areas of Africa and Asia. SDG 16.9 aims to “provide legal identity to all, including birth registration, by 2030,” and represents the first time that documenting identity has been officially stated as a global goal.

Legal identity is a fundamental human right, and providing it to the disenfranchised is also instrumental in achieving many of the other SDGs.

The Identity Target and Other SDGs

Providing robust means of identification (SDG 16.9) to all who now lack legal ID will fundamentally support the achievement of at least 10 other SDGs in the following areas:

- Social protection, including for the most vulnerable (SDG 1.3)

- Assistance in dealing with shocks and disasters (SDG 1.5)
- Access of the poor to economic resources, including property and finance (SDG 1.4)
- Empowerment of women (SDG 5a and 5b)
- Ending preventable deaths of newborns (SDG 3.2)
- Improving energy efficiency and eliminating harmful energy subsidies (SDG 12c)
- Reducing remittance costs (SDG 10c)
- Reducing corruption (SDG 16.5) and fighting crime and terrorism (SDG 16a)

The range of these development goals demonstrates ID’s immense practical importance. A person lacking ID suffers legal, political, social, and economic exclusion. Traditional, typically paper-based forms of ID are difficult to extend to poor or isolated populations. But in the developing world, enormous gains can be obtained from extending services and opportunities to all in new ways, such as using digitally based mobile platforms to regis-

ter for, and access, legal ID (see *Connections* Note 13, “Digital IDs for Development”). A traditional birth certificate is a start but is often not enough for all purposes.

International Support for the Identity Target

Accomplishing the Sustainable Development Goals requires making the best use of every dollar from every source—including knowing who has received services and tracking with precision where, when, and to whom transfers and payments have been made. That cannot be done without establishing a unique identifier for each beneficiary.

World Bank Efforts

Last year, the World Bank Group launched its Identification for Development (ID4D) program to address SDG 16.9 in a more integrated and multisector way. The program aims to build new alliances and reshape existing development strategies.

The World Bank has engaged with a number of partners—including UNICEF, WHO, and the Economic and Social Commission for Asia and the Pacific—regarding the agenda for CRVS (civil registration and vital statistics). In July 2015, these discussions culminated in the official launch in Addis Ababa of the Global Financing Facility, which includes strengthening and expanding ID platforms of CRVS systems. Canada committed \$16 million toward a global Center of Excellence for CRVS, which will help countries better monitor and track their progress.

IDs Fit for Purpose

Official ID should be available throughout the life cycle of the individual, be available to both poor and rich, and be widely accepted under the regulations and economic practices of the country concerned.

Such a credential need not always imply a specific format, such as a national ID card. Some countries do not supply national ID cards, and the attainment of many SDGs that hinge on universally

available ID does not require evidence of national status. The key is universal access to robust “fit for purpose” ID.

Near-Term Outlook

The final post-2015 agenda, to be adopted at the UN General Assembly in September 2015, represents the most important effort to date by the international community to address the major development challenges facing the world. The Addis Ababa meeting focused on financing, but it will take a lot more than aid from member states to deliver on the ambitious post-2015 agenda, including such key underpinnings as universal ID.

Among other things, the agenda requires political leadership, bold reforms, and a commitment to development-friendly policies. These in turn will require greater resources.

For example, donors support at least half of the ID-related programs in developing countries. Some of this assistance should be shifted away from costly one-off exercises to better support permanent, foundational registration and ID programs that will more powerfully contribute to attaining the SDGs. Such a shift could be a useful topic for consultation and discussion at the next meeting of the UN General Assembly.

► For more information on this topic:

The Role of Identification in the Post-2015 Development Agenda, World Bank and Center for Global Development, July 2015
<http://pubdocs.worldbank.org/pubdocs/publicdoc/2015/7/149911436913670164/World-Bank-Working-Paper-Center-for-Global-Development-Dahan-Gelb-July2015.pdf> [cont.]

Global Financing Facility:
<http://www.worldbank.org/en/news/press-release/2015/07/13/global-financing-facility-launched-with-billions-already-mobilized-to-end-maternal-and-child-mortality-by-2030>

The biometrics revolution:
<http://www.cgdev.org/publication/identification-development-biometrics-revolution-working-paper-315>

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The Next Step for Transport in the SDGs: Devising the Right Indicators

Shaping Transport's SDG Impact

Bernhard Ensink,* Shokraneh Minovi, Roger Gorham, and Nancy Vandycke

Transport was not part of the Millennium Development Goals (MDGs) for 2000–15, which were adopted at the United Nations in September 2000. The omission was widely viewed in the transport community as a missed opportunity to use the strong linkage between transport and economic development to advance the attainment of the MDGs. Now a new 15-year development framework, the Sustainable Development Goals (SDGs) for 2015–30, are about to be endorsed at the United Nations summit to be held September 25–27, 2015. This time, transport will be part of the framework as a key contributor to sustainable development. The SDGs comprise 17 goals and 169 targets; five of those targets directly involve transport, and attaining at least another six will critically depend on it. But efforts to influence the post-2015 development agenda will go on after the summit because the question of what indicators will be used to measure success is yet to be resolved. Attention in the transport community must now pivot toward that question to assure the selection of the most effective measures.



A Broader Vision

The MDGs mainly addressed the socioeconomic issues surrounding poverty reduction. The vision about to be endorsed in the SDGs is far more ambitious, aspiring to transform the world. It reflects sustainability challenges more clearly and recognizes that national issues are increasingly connected globally in scale and scope. Ending poverty is inconceivable without simultaneously achieving peace, dealing with natural disasters, connecting people to a market economy via better access to infrastructure, and reducing the impact of climate change.

Thus, the SDG framework covers the three dimensions of sustainable development: economic, social, and environmental. The framework will stimulate action in all countries over the next 15 years in the areas of critical importance for humanity: people, planet, prosperity, peace, and partnership.

The Opportunity

Water and energy are the only infrastructure sectors represented by distinct SDGs. However the transport sector is mainstreamed into many of the SDGs, including energy as well as food security, health, infrastructure in general, urban development, and climate change.

* Secretary General of European Cyclists' Federation (ECF, www.ecf.com) and of the World Cycling Alliance. The ECF and the World Bank are members of the Technical Working Group of the UN Secretary-General's High-Level Advisory Group on Sustainable Transport.

The mainstreaming of transport across the SDGs— in many cases explicitly through supporting targets—underscores its importance as a critical sector—an “enabler” of other sectors’ achievements. Indeed, in some cases, the largest benefits of action in transport are often visible only in other sectors. For example, the broadest gains from investing in vehicle and road safety will show up, without explicit regard to transport, in better health and economic outcomes. Thus, the broad economic and social influence of action in transport requires systemic thinking when defining and tracking “sustainable transport” in the context of the SDGs.

Five Transport Targets

Of the SDG framework’s 169 targets, five are directly related to the transport sector:

- *Target 3.6.* By 2020, halve the number of global deaths and injuries from road traffic accidents.
- *Target 7.3.* By 2030, double the global rate of improvement in energy efficiency.
- *Target 9.1.* Develop quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- *Target 11.2.* By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.
- *Target 12.c.* Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.

But transport is also a critical enabler of achievement in other sectors’ targets, such as agricultural

productivity (Target 2.1), air pollution (3.9), access to safe drinking water (6.1.), sustainable cities (11.6), reduction of food loss (12.3), and climate change adaptation and mitigation (13.1).

Indicators are Key

With goals and targets set for the next 15 years, the question of indicators to measure progress now comes into focus. Indicators will be the main tool used by all stakeholders to measure and evaluate progress toward a specific target. The transport community should now concentrate its efforts on developing and promoting the transport indicators that will be most effective in creating economic, social, and environmental benefits.

If the rural transport accessibility indicator—the share of the rural population within 2 kilometers of an all-weather road—is accepted as a tool to measure the SDG goal on food security (and the associated target on agricultural productivity), the enabling role of rural transport infrastructure and services will be fully acknowledged.

Similarly, making vehicle fuel efficiency an indicator associated with the target on energy efficiency will show that a key to energy success lies within the transport sector. The list of indicators to support the SDG framework is expected to be finalized by March 2016. This does not leave much time for the transport community to engage with the UN Statistical Commission, the Inter-Agency and Expert Group on SDG Indicators, and the relevant stakeholders to get transport front and center in the sustainable development agenda.

► For more information on this topic:

Transforming our World: The 2030 Agenda for Global Action: <https://sustainabledevelopment.un.org/post2015/transformingourworld>

Results Framework on Sustainable, Low Carbon Transport: <http://www.slocat.net/resultsframework>

For more information on the Secretary-General’s High-level Advisory Group on Sustainable Transport: <https://sustainabledevelopment.un.org/topics/sustainabletransport/highleveladvisorygroup>

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Action and Advocacy for Sustainable Transport

Recent and Ongoing World Bank Efforts

Pierre Guislain and Jose Luis Irigoyen¹

During its 2014–15 fiscal year, the World Bank's transport strategy focused on sustainability as part of a broader effort to eradicate poverty, raise shared prosperity, and tackle climate change. As articulated by the UN Secretary-General's High-Level Advisory Group on Sustainable Transport (see *Connections* Note 18), sustainability encompasses heightened access in rural and landlocked areas, low-carbon solutions in cities, and world trade and growth stimulated by investments in infrastructure, inter-modality, and digital and low-carbon technologies. The World Bank's new commitments in fiscal year 2015² reflected this convergence, and its operational focus has been backed by strong advocacy on transport issues in recent global conferences and high-level summits.



Investments in Sustainable Transport

The World Bank's operational focus was on supporting sustainable solutions—universal, efficient, safe, and environmental-friendly—to connect people and businesses to jobs, social services, and markets. In fiscal year 2015 (FY15), new lending commitments were evenly distributed across Africa (26%), South Asia (25%), Europe and Central Asia (23%), and East Asia (19%), with smaller shares going to Latin America and the Middle East and North Africa.

Some indicators of the World Bank's new investment in sustainable transport during FY15 are as follows:

- \$5.3 billion invested in 34 countries—contributing to the Rio+20 pledge of \$175 billion toward sustainable transport over 2012–22 by the eight leading multilateral development banks
- \$1.1 billion for transport mitigation, \$200 million for adaptation
- 50 loans and grants
- 58 technical assistance activities
- Financing for 4,400 kilometers of road, 900 km of railways, 15 urban transport systems, two airports, and two ports
- More than 70% of projects had a gender indicator and 100% of road projects had a road safety component

Advocacy

The World Bank has taken a lead role in elevating the profile of transport issues in both global and bilateral discussions:

¹ Senior Director and Director, respectively, of the World Bank's Transport and ICT Global Practice.

² All loans and grants with transport components that were made from July 1, 2014, to June 30, 2015, by the International Bank for Reconstruction and Development (IBRD) and by the International Development Association (IDA).

- In the UN high-level advisory group on sustainable transport and its technical working group; in supporting the Addis Ababa Conference on Financing for Development; and in the drafting of the high-level narrative on sustainable transport;
- Working on both the analytical and strategic fronts in raising the profile of transport for the November 2015 Global High-Level Conference on Road Safety and the December 2015 UN Framework Convention on Climate Change (CoP 21)

Most fundamentally, the World Bank has contributed to the development of the UN's post-2015 Sustainable Development Goals (SDGs) and is advocating the adoption of transport-related targets and indicators to track SDG progress. The work on transport-related indicators has been part of the sector's effort to provide evidence-based support of its sustainability narrative.

Indicators need data, and impact evaluation (IE) is a key tool for obtaining high-quality feedback on projects. To expand the use of IE, the World Bank launched its "IE—Connect for Impact" program to engage clients and development financiers in an evidence-based dialogue on transport and ICT (see *Connections* Note 17).

Sustainability at Work

Bank transport projects have tackled some of the more complex, integrated development challenges, including development corridors and urban mobility, by going beyond standard infrastructure financing into spatial development, policy reforms, and global public goods.

- In Ethiopia, supporting development corridors by enhancing the infrastructure backbone with intelligent transport systems and a safe systems approach (\$370 million IDA credit)
- In Vietnam, taking a bus rapid transit project in Ho Chi Minh City beyond the traditional model to incorporate transit-oriented development for the surrounding area (\$124 million IDA credit)
- In Colombia, helping the government strengthen its policy framework for developing sustainable, inclusive cities and inter-urban connectivity (\$700 million IBRD credit)

- In India, helping improve the efficiency of bus service in four demonstration cities while reducing greenhouse gas emissions by a total of 230,000 tonnes through 2023 (\$9.2 million GEF grant)
- In Kazakhstan, supporting the ongoing further extension of the Western China–Western Europe Corridor

Sustainability Dimensions of Lending

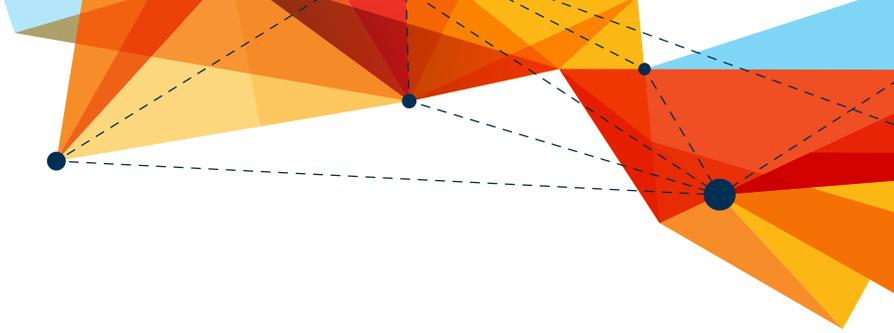
In addition to compliance with the Bank's safeguard policy, transport projects have been enhanced with certain sustainability dimensions that are backed by objective targets:

- **Climate benefits.** In FY15, 31 percent of the new commitments in transport included climate benefits equivalent to \$1.3 billion. The tracking methodology has been harmonized among other multilateral development banks (MDBs).
- **Greenhouse gas emissions.** Unique among MDBs is the World Bank's requirement that all transport projects account for greenhouse gas emissions at project appraisal. The methodology was peer-reviewed externally in June 2015 and was piloted on seven projects.
- **Road safety.** All road projects are screened for road safety during the preparation and design phase. Dedicated safety components are included when feasible, and in FY15, all World Bank road projects included such a component.
- **Gender impact.** Projects are screened to encourage provision of the following elements for gender relevance: (1) gender analysis, (2) a project component, and (3) monitoring and evaluation of gender impact. In FY15, 55% of transport projects met all three criteria, and 79% met at least one.
- **Jobs and employment impact.** In FY15, the main development objective for 10% of transport projects was job creation, and job gains were an incidental result for 53%.

► For further information on this topic:

Secretary-General's High-level Advisory Group on Sustainable Transport:
<https://sustainabledevelopment.un.org/topics/sustainabletransport/highleveladvisorygroup>

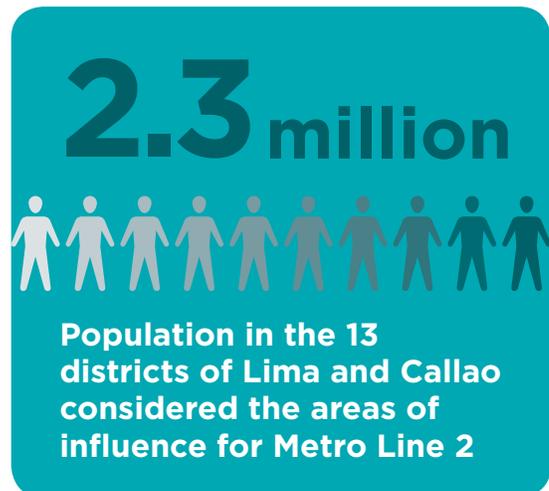
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Lima Urban Transport: On the Way to Transformation

Georges Darido, Daniel Pulido, Felipe Targa, Bernardo Alvim, and Tatiana Peralta-Quirós

The implementation of Metro Line 2, now under way, will provide a modern, 35 kilometer mass transit axis linking major population and job centers in Lima—the capital of Peru—with Callao to the west, the country’s chief seaport and international airport. Integrated with the Lima-Callao region’s existing public transport network, Line 2 will create a major corridor that will improve the accessibility of jobs, services, and markets for 2.3 million people and provide a backbone for more efficient urban development. Beyond the investment loan, this cofinanced project is an outgrowth of a long-term metropolitan transport strategy and multifaceted engagement that is aligned with the World Bank’s goals of reducing poverty and boosting shared prosperity through sustainable development. It will give a boost to the competitiveness of the entire Lima-Callao Metropolitan Region, which has a population of more than 9 million and constitutes more than one-third of the national economy.



Challenges and Progress to Date

As the urbanization of Peru continues, the country faces severe constraints in making its growth sustainable. A key problem is the past underinvestment in transport infrastructure, which limits access to jobs and services in many urban areas, especially for the poor who tend to live in peripheral areas.

The Lima-Callao Metropolitan Region (LMR) grew rapidly in the past decade and is now one of the most congested and polluted in Latin America. The launch of service on the Metropolitan bus rapid transit system in 2010 (supported by a World Bank investment loan) and on Metro Line 1 (elevated rail) in 2011 were tremendous steps forward for the LMR. The two lines together now carry about 1 million

passengers per day, but there is still much to do, as this nascent mass transit system carries less than 10% of the public transport trips in the LMR.

The vast majority of motorized trips are still made with largely unregulated, low-capacity vehicles that compete for customers on the street. Essential to realizing the economic potential of the LMR in a sustainable and inclusive way is expanding the mass transit system and strengthening transport policies with complementary investments.

The Metro Line 2 Project

Metro Line 2 is the first priority in a 168 km mass transit Master Plan for LMR approved by the

government of Peru in 2010. Once completed and integrated with the public transport network, Line 2 is expected to carry 660,000 passengers per day and influence the region's long-term development in many ways.

- Expanding the mass transit network improves opportunities for all by reducing the travel time and expense required to access jobs, markets, and services such as health and education.
- Universal design features will accommodate peoples with disabilities and other disadvantaged groups.
- Transit integration will reinforce complementary actions for a transport system that reduces accidents, air pollution, and noise.
- The integrated transit corridor constitutes the backbone of an inclusive urban development process that will promote more efficient land use and boost competitiveness.

Improving Mobility and Accessibility

About four-fifths of public transport users in the LMR are in the bottom 40% of the region's income distribution.

- On average they spend more than 20% of their income on transportation (while the overall average for the region is about 13%).
- They make 30% fewer trips overall than do the rest of the population because of long travel times or high costs.

More than 60% of the estimated ridership for Metro Line 2 will come from other modes of transportation, making modal integration a key objective. By linking Line 1 with the Metropolitano BRT and the future Line 4 and urban feeder services, the Line 2 Project could increase the number of jobs available within a 60-minute commute by as much as 25%.

Innovative Delivery Approach

The Metro Line 2 Project is pioneering on many fronts. It will be implemented in stages under a public-private partnership (PPP) arrangement that remunerates the concessionaire for milestones completed. The 35-year concession contract,

signed in April 2014, covers every phase of the project, from design through financing, construction, operation, and maintenance. Thus, it is one of the world's few "fully bundled" PPPs in the urban transport sector.

Line 2 will also include state-of-the-art construction technologies and a "driverless" automated system to operate the trains that is expected to reduce operational costs.

Investment and Engagement

At a cost of more than \$5.3 billion, with about 20% of the financing coming from the private concessionaire, Metro Line 2 is one of the largest and most ambitious investment projects in the history of the country. A \$300 million loan from the International Bank for Reconstruction and Development to the government of Peru will support the public contribution to the concession. The government has also secured financing from the Inter-American Development Bank and the Development Bank of Latin America (CAF) and may be negotiating with three other international financing institutions.

A single "megaproject" such as Line 2, however large, does not by itself guarantee the needed transformation. Also required will be integration with land development, surface transport reform policies, complementary investments, and partnerships with local governments.

The World Bank is working with governments at the national and local level and with partner financing institutions to leverage a plan for coordinated technical assistance and institutional strengthening in several key areas:

- Integrated transit fare policies that are socially progressive and financially sustainable
- Reorganization of other public transport modes to feed and complement Line 2
- Concepts for transit-oriented development
- Communications and citizen engagement strategies
- A joint and rigorous impact evaluation study

► For more information on this topic:

<http://documents.worldbank.org/curated/en/2015/09/24952460/peru-lima-metro-line-two-project>

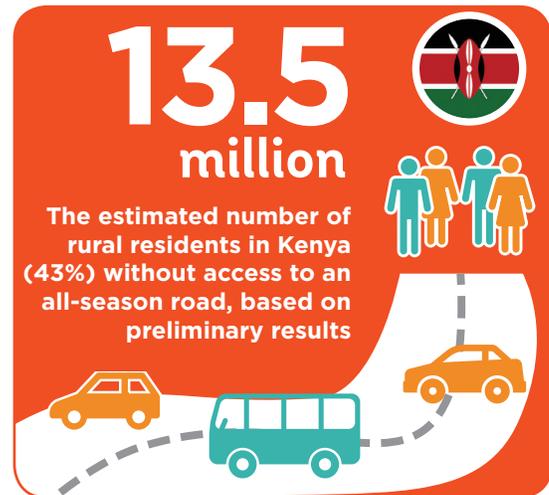
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A New Measure of Rural Access to Transport

Using GIS Data to Inform Decisions and Attainment of the SDGs

Atsushi Iimi and Adam Diehl

In rural areas of the developing world, where the majority of the poor live, good transport connectivity through road infrastructure and transport services is an essential part of the enabling environment for sustainable growth. A lack of detailed nationwide data has limited previous efforts to develop measures of access to roads in rural areas that would guide policy and investment. The World Bank, with support from DFID, has been piloting a methodology that exploits advances in digital technology to assess population distribution and infrastructure location and quality. The resulting Rural Access Index (RAI) may serve as a useful and cost effective tool for governments planning their rural transport programs and as an indicator of progress towards the achievement of several of the UN Sustainable Development Goal (SDG) targets



Rural Poverty, Road Data, and the SDGs

In the developing world, and especially in Africa, a lack of road access isolates farmers from markets, thus keeping the vast majority of agricultural production at the subsistence level. For the same reason, the strength of manufacturing and other local businesses in remote and isolated areas often lags behind that of well-connected counterparts. In the short term, enhancing rural road connectivity reduces transport costs and improves access to markets and social facilities such as schools and hospitals. In the longer term, it raises agricultural productivity, business profitability, and employment.

Yet, a consistent and replicable method for measuring the accessibility of transport infrastructure has been lacking. The need for it will be crucial for measuring progress toward several SDG targets that rely directly or indirectly on rural accessibility to transport. For instance, SDG 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation) is directly related to rural transport access. SDG 2 aims to “end hunger, achieve food security and improved nutrition and promote sustainable agriculture.” And SDG Target 2.3 is a doubling of “the agricultural productivity and incomes of small-scale food producers ... through secure and equal access to ... productive resources and inputs,” an aim clearly reliant on improved access to rural roads (see Connections Note #20).

The Household Survey Approach

An initial Rural Access Index (RAI) introduced in 2005 primarily used household surveys to estimate road accessibility, defined population as living within 2 kilometers of an all-season road. Applied in Africa, this measure found that more than 70 percent of the continent's rural population, or about 450 million people, lacked road accessibility in rural areas.

The survey methodology was the source of several weaknesses in the RAI. Besides being difficult and costly to conduct and update, household surveys cannot provide both consistent and extensive data on road conditions. For instance, a 2010 household survey in Tanzania covered only 3,917 households in 409 villages in the country's vast land area of 950,000 km². Hence, it is easy to imagine access improvements that will never be captured by subsequent surveys.

Development of a New Methodology

The World Bank, with the support of DFID, is devising a new, GIS-based RAI that exploits advances in digital technology. The aim is to create a more accurate, operationally relevant and cost effective RAI that will also aid in monitoring improvements in accessibility. As in the original survey methodology, access to transport is defined as the share of the rural population living within 2 km of the nearest all-season road.

The GIS-based RAI is grounded on three principles:

- **Sustainability.** The new RAI relies primarily on government-owned data. Doing so fosters client countries' ownership, which in turn motivates sustainability and regular updating.
- **Consistency.** Consistency across countries is critical if the RAI is to serve as a global indicator and as a measure of achievement for of the SDGs. Ensuring consistency has entailed translating country standards into a coherent global standard and checking the robustness of the RAI against differing definitions and assumptions. While a small number of inconsistencies will be unavoidable, others will be resolved.
- **Operational relevance.** The new RAI will provide highly disaggregated information to policymakers. New geospatial technologies

are revealing the highly varied status of rural connectivity in a given country (see the 2009 World Development Report). Such a highly localized level of detail provides the factual support for government decisions on how to prioritize new construction and maintenance.

Preliminary Results

Eight countries, in Africa and South Asia, are currently testing the new RAI methodology, and preliminary estimates are available for Kenya and Mozambique.¹ In Kenya, the national RAI of 57 percent means that about 13.5 million rural residents are unconnected to an all-season road. In Mozambique, where the national RAI has been estimated at 19 percent, about 14.5 million rural residents lack access. At the subnational level, access in rural areas varies from less than 5 percent to nearly 100 percent.

Even at this preliminary stage, the richer detail in the GIS-based index on road locations and conditions is suggesting policy-relevant conclusions. For instance, Kenya could attain an RAI of nearly 100 by upgrading and maintaining its existing road network. In Mozambique, however, greater access will require extensive construction of new roads or upgrading of unclassified roads, as well as rehabilitating existing routes.

With the subnational level of the results, the strong correlation between the RAI and development has been confirmed, which makes it directly relevant to the SDGs and the poverty reduction agenda. The RAI has also proven relevant for connectivity to a variety of services and destinations. The standardized and digital nature of the new GIS-based RAI will allow for the rapid inclusion of many access targets such as schools, hospitals, markets, ports and other destinations.

¹ In addition to Kenya and Mozambique, the methodology is being tested in Bangladesh, Ethiopia, Nepal, Uganda and Zambia.

► For more information on this topic:

<https://www.gov.uk/government/organisations/department-for-international-development>

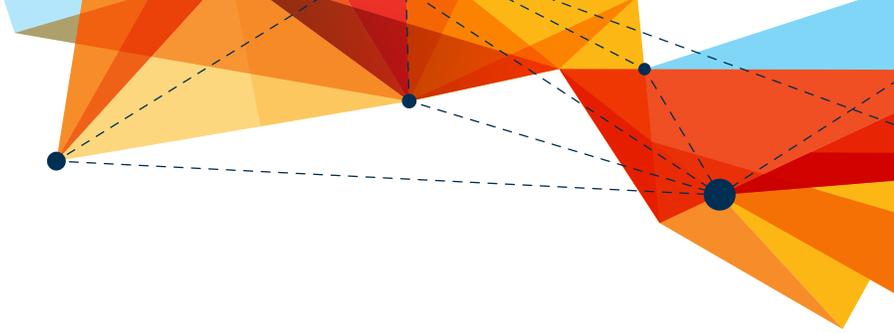
<http://afcap.org/SitePages/Home.aspx>

<https://sustainabledevelopment.un.org/topics>

<http://www.worldbank.org/transport/transportresults/headline/rural-access.html>

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Creating Pro-Poor Transport

Connecting the Dots: Transport, Growth, and Poverty Reduction

Muneeza Mehmood Alam¹

Transport plays a crucial role in connecting people to goods and services and fostering sustainable development. The literature links improved transport infrastructure to economic growth and poverty reduction through five key mechanisms (1) reducing transport and production costs, (2) creating jobs, (3) expanding productive capacity, (4) improving access to markets and basic services like health and education, and (5) reducing prices of final goods and services. These benefits depend on supportive conditions in other sectors, such as access to credit, functioning land markets, low trade barriers, and so on. Therefore, any assessment of potential gains from transport infrastructure and services should also account for the interaction with complementary markets. However, the analysis of such interactions—assessing how and when transport infrastructure can help reduce poverty and income inequality—is largely missing from the literature, leaving significant knowledge gaps across the spectrum of transportation settings. This note highlights existing findings and some limitations in the literature on three basic types of transport infrastructure: large projects such as regional or national highways and railroads; rural transport; and transport in urban areas



Regional and National Transit Corridors (Highways and Railroads)

Improving connectivity between and within countries can bridge stark differences in economic development by strengthening interregional trade. For example, five coastal countries in Africa—Angola, Kenya, Nigeria, South Africa, and Sudan—account for more than 70% of Africa’s GDP. But in sub-Saharan Africa overall, estimates suggest that tightening the connectivity between cities by upgrading the primary road network can catalyze trade worth hundreds of billions of dollars.

In Peru, intercity highway upgrades increased the

average annual rates of growth for exports (by 6%) and employment (by 5%). In China, connecting cities with railroads has moderately increased county-level GDP per capita, and in India, colonial railways boosted interregional trade and raised real income levels.

Improvements in transport infrastructure can also enhance firm efficiency and affect firm location. Upgrading highway infrastructure has allowed Indian firms to hold inventory for shorter durations, increased the survival rate of existing firms, and induced new firms to open near upgraded highways. In Indonesia, expressways have been associated with the dispersion of manufacturing activities.

¹ This note draws on the works listed under further reading. The author is grateful for helpful comments from Karla Carvajal, Carlos Castelan, Matias Dappe, Steven Farji, Somik Lall, Harris Selod, Nancy Vandyke, and Tara Vishwanath and other reviewers in the World Bank’s Development Economics Group, Poverty Global Practice, and the Transport and ICT Global Practice.

Rural Settings

Transport can play a crucial role in enhancing food security and agricultural productivity. For example, Africa could become self-sufficient in food and create a regional food market worth \$1 trillion by 2030. But farmers will need better access to roads to trade their products. Africa's current food insufficiency is not surprising given the deficiencies in its road infrastructure—the average road density in low-income countries in sub-Saharan Africa is less than one-third that in other low-income countries. Improving rural road connectivity has been shown to increase agricultural productivity by reducing the travel time to agricultural markets, inducing farmers to adopt modern farming techniques and favor cash crops, and raising market participation. Improving road quality has also been shown to induce migration and shift workers from agriculture to manufacturing.

Research shows that reducing rural isolation—by lowering transportation costs and travel times or improving road access and proximity to markets—may have multiple benefits. It is associated with a reduced likelihood of a household's facing multidimensional poverty, with increased school enrollment rates for boys and girls and disadvantaged groups, and with greater use of distant hospitals.

Urban Settings

The placement of transport infrastructure within a city can alter the production mix of the urban economy, affect employment opportunities for the poor, and alter crime rates. For example, evidence suggests that the development of city roads in Colombia has shifted economic activity toward the production of lighter tradable goods. Similarly, transport infrastructure has altered the economic landscape of Chinese cities—radial highways have decentralized the services sector, radial railroads have decentralized the industrial sector, and ring roads have decentralized both sectors.

The urban poor rely heavily on public transportation for commuting. Without fast, secure, and affordable mass transportation, the urban poor are typically forced to walk to work, which is time

consuming and limits their job search radius. Thus, the geographic dispersal of the labor market can dampen the gains from industrial agglomeration. A lack of security in the public transit system may also limit the labor market participation and job search radius of the poor, particularly for women, who are especially dependent on public transport. Even a simple intervention can make a difference: improving nighttime lighting reduced the incidence of crime around bus rapid transit stops in Colombia.

Documenting the Poverty Dimension of Transport: A Long Way to Go

Documenting the link between transport interventions and the various dimensions of poverty and income inequality will require much more systematic attention from research. To date there is only limited evidence on the direct impact of transport infrastructure on poverty and income inequality. (1) For national transport infrastructure, improving interregional connectivity can enhance welfare by insuring farmers against bad weather. (2) Regarding rural settings, improvements in transport in Vietnam and Madagascar were most beneficial for the least developed and remotest areas. In contrast, in rural Nepal, easier access to roads appears to have benefited poor households but did not reduce income inequality. In rural Bangladesh, middle-income households benefited the most from investments in roads. (3) The impact of urban transport projects on the welfare of the poor is largely undocumented in the research.

► For more information on this topic:

C. Berg, U. Deichmann, Y. Liu, and H. Selod. 2015. "Transport Policies and Development." <http://documents.worldbank.org/curated/en/2015/07/24779047/transport-policies-development>.

P. Starkey and J. Hine (2014). "Poverty and Sustainable Transport: How Transport Affects Poor People, with Policy Implications For Poverty Reduction—A Literature Review." <http://www.slocat.net/docs/1561>

R. Ali, A. Barra, C. Berg, R. Damania, J. Nash, and J. Russ. 2015. Highways to Success or Byways to Waste: Estimating the Economic Benefits of Roads in Africa. <https://openknowledge.worldbank.org/handle/10986/22551>.

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Mobility for All: Getting the Right Urban Indicator

Shifting from the Proximity of Transport to the Accessibility of Opportunities

Tatiana Peralta-Quirós

Most urban transport projects have focused on improving the ability of citizens to move freely and swiftly about the city. Typically, that ability has been measured by the share of the population living within, say, 0.5 kilometer of a transit stop, or the maximum travel distance per unit of time, or the amount of transportation infrastructure in a city. Using such “proximity” measures to monitor urban mobility has led to congested highway networks and public transit systems that have failed to bring jobs and services within the practical reach of residents—especially the poor. These proximity-based measures represent indirect attempts to capture the real objective of transit systems: the accessibility of opportunities. New technologies and richer databases now make accessibility—the number of jobs, health facilities, schools, and other essential services that are available without a car in, say, 30–75 minutes—a practical criterion for judging the state of mobility and for designing ways to improve it. Using the accessibility criterion will be critical to achieving SDG 11, the United Nations’ Sustainable Development Goal to “make cities and human settlements inclusive, safe, resilient and sustainable.”

15% and 34%

The share of jobs in Cairo and Buenos Aires, respectively, accessible on average within an hour without an automobile



The ability of residents and businesses to access markets, employment opportunities, and service centers such as schools and hospitals is critical to urban economic development. Recognizing the importance of mobility, the UN has included transport in SDG 11 as Target 11.2, which reads, in part, “By 2030, provide access to ... sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations....”

Quantifying the Goal

The SDGs tackle the question of how to measure the targets by providing draft indicators. The two indicators for Target 11.2 cover cities with a population greater than 500,000: “Percentage of people living within 0.5 km of public transit” (Indicator 11.2.1) and “Km of high capacity (BRT, light rail, metro) public transport per person” (Indicator 11.2.2).

However, these indicators miss the essential goal of transport and mobility, and planners should move away from these and other proximity-based indica-

tors in assessing urban mobility, for at least three reasons:

- For households and firms, the transport system itself is not important. Rather, its key attribute is the access it provides to resources and employment opportunities.
- Defined in this way, accessibility can be a powerful design tool that allows planners to gauge the effects of changes in transport and land-use systems.
- For policymakers, citizens, and businesses, the accessibility of jobs, services, and markets offers the clearest way to discuss the state of the transport system.

A Better Measure

An “accessibility analysis”—building on the work of urban economist Alain Bertaud—calculates the number of jobs, educational centers, health centers, or other resources that are reachable within a certain travel time, either from a selected place or on average by all residents.

Accessibility analysis has not always been feasible. Today, however, with the growing availability of standardized data and better computing resources, a transport project’s benefits to the residents of, say, a low-income neighborhood can be assessed with a metric more meaningful than a projection of reduced congestion or transit ridership.

For example, road congestion may be a constraint in a dispersed urban setting with inadequate transit, walking, and cycling options. But an accessibility analysis can show that improving multimodal options may yield far greater mobility benefits than a focus on infrastructure or travel times.

From Research to Practice

The transition of the accessibility indicator from research into practice is yielding a better understanding of their value in promoting sustainable urban mobility. For instance, Bertaud has constructed a measure that defines the effective size of the labor market in a metropolitan area by calculating the share of the area’s jobs accessible within 60 minutes. Applying the measure to greater Buenos Aires indicates that, on average, a resident there can

access approximately 34 percent of the jobs in the metropolitan area in 60 minutes (recognizing that actual accessibility varies by specific location).

The accessibility type of indicator provides a clear and relevant way to compare transportation scenarios in one city or compare cities across regions. And it provides a fruitful basis on which to publicly communicate the value of different transportation interventions.

Current Applications

Indeed, the accessibility-based indicator has already been applied in numerous other cities to calculate citywide accessibility of employment opportunities, schools, hospitals, retail centers, and so on. The calculations have revealed areas that, for example, are densely populated yet have poor accessibility to one or many types of service. Similarly, the analysis can identify areas that have good accessibility but have a low population density and thus have the potential for greater development.

An open-source software platform for measuring accessibility, the Open Trip Planner Analyst (OTPA) accessibility tool, is available to government officials and all urban transport practitioners. Developed by the World Bank in conjunction with Conveyal (<http://conveyal.com>), this tool leverages the power of the OTPA engine and open standardized data to model block-level accessibility. The added value of the tool (free and user friendly) is its ability to easily calculate the accessibility of various opportunities and transportation scenarios.

Conclusion

To evaluate the true benefits of urban transport investments and policies, the SDG indicator for Target 11.2 should measure accessibility. That type of indicator offers the most comprehensive measure of transport impacts on access to employment and commercial opportunities, health, education, and other essential services of urban life.

► For more information on this topic:

<http://blogs.worldbank.org/transport/how-does-investment-help-accessibility-metropolitan-area-s-poorest-40-percent>

Alain Bertaud, *Cities as Labor Markets*, February 2014, http://marroninstitute.nyu.edu/uploads/content/Cities_as_Labor_Markets.pdf

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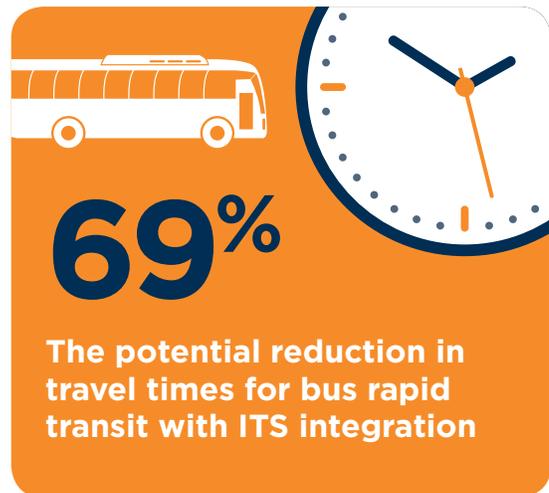
The notes are available at <http://www.worldbank.org/transport/connections>.

Advances and Challenges in “Intelligent Transportation”

The Evolution of ICT to address Transport Challenges in Developing Countries

Winnie Wang, Raman Krishnan, and Adam Diehl

Transport efficiency and safety in the advanced economies have long benefited from information and communication technology (ICT). However, these ICT applications have typically been high-cost, customized infrastructure systems. Now the era of the Internet, digital mobile communication, and “big data” analysis has created a new global potential for less costly and more powerful “intelligent transport systems” (ITS). The World Bank is supporting client transport agencies in deploying these new tools—including cloud-based services, open data standards, and smartphone applications—to more efficiently manage transportation assets and improve road safety. In the process, such projects have also demonstrated improvements in the traveler’s experience and the attractiveness of public transit. Moreover, the greater potential of the new technologies to reduce congestion and travel times means that the new era has also strengthened the potential of ITS to reduce greenhouse gas (GHG) emissions. However, realizing the potential of ITS in developing countries depends on improvements in assessment practices to find what works best and in the data capabilities of domestic institutions. Significant improvements in these areas are critical to the success of ITS.



Improving Efficiency and the Traveler’s Experience

The new generation of ICT tools are helping improve the management of national transport infrastructure. The World Bank is helping Belarus develop “weight in motion” control systems that continuously monitor axle loads, making it easier to stop overweight trucks while allowing those under the weight limit to bypass inspection. Another focus is helping clients create traffic control centers that use ICT to improve traffic management, emergency response, and the availability of information for road travelers.

The new ICT tools also show promise for improving urban systems. They include vehicle-locating systems using global positioning system (GPS) information; fare collection and revenue management; and traffic signaling; and improved information for transit travelers. The potential to replicate these technologies across the globe rests in large part on their use of the General Transit Feed Specification (GTFS) open data standard. These technologies are enabling the following urban transport applications, among others:

- E-ticketing to integrate fare systems and revenue distribution across multiple transport modes

- Area traffic control to improve vehicle flow and thus reduce air pollution and cut GHG emissions
- Dispatch and vehicle location systems to shorten transit times, including reductions of as much as 69% for bus rapid transit (BRT),¹ thus also reducing GHG emissions

New user-level ICT systems being advanced by the World Bank include a new transit information system in Brazil and a smartphone app in Belarus to report road surface problems. In Brazil, the transit agencies covering ferries, metro, trains, and inter-city buses in the state of Rio de Janeiro are working to transmit travelers' information, using GTFS, to electronic signage as well as to travelers' mobile devices. The data will also help stakeholders conduct multimodal planning.

In Belarus, the World Bank team worked closely with the national road agency to develop a new smartphone application, RoadLab,² which allows automatic evaluation of road roughness and detection of major road bumps based on smartphone accelerometers in real time. It also allows road users to report live road safety hazards with precise GPS information. This user-based approach also promotes citizen engagement and enhances government accountability by enabling road agencies to promptly and strategically respond to collectively identified problems. Built with open protocols, the product will be easily applied globally.

The World Bank has supported other crowdsourcing transport applications to transmit opinions and complaints to road agencies and in turn permit the agencies to address them in a cost effective manner.

World Bank support has helped produce smartphone apps that employ locational data to collect user-generated origin-destination information about transit use (see Connections Note #2). It has also helped create tools for estimating travel demand patterns from the call detail records generated by mobile phones (see Connections Note #4) and, with

the GTFS standard and census data, to evaluate the accessibility of public transport systems in real time.

Road Safety

Improving road safety is a focal point of ITS work. Speed cameras and remotely controlled electronic signs to discourage road traffic violations have helped reduce the incidence of accidents. A 2007 report on studies of speed camera programs worldwide found crash reductions ranging from 9 to 41 percent.³ Road safety "hackathons" use crowdsourcing to develop safety-enhancing web-based and smartphone applications. Data management systems help authorities collect and analyze systematic information on road incidents and create responses to make roads safer (see Connections Note #12).

Challenges

The deployment of ITS in the developing world faces some significant obstacles that must be overcome if ITS is to be widely applicable in developing countries. However, the lack of adequate research on cost effectiveness is a global challenge.

Interoperability. The various client agencies in a multiagency project may not have a mandate to share data, and the data to be exchanged may not conform to standardized formats.

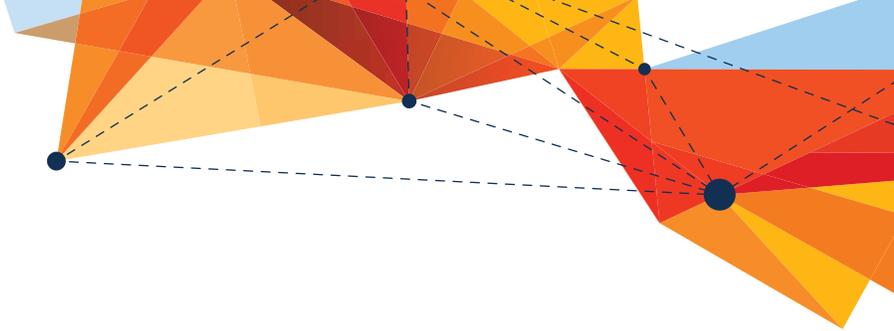
Data analysis. Even when data systems are integrated and standardized, editing the raw data so that it can yield useful results often challenges the capacity of agencies in developing countries.

Documenting effectiveness. The connection between ICT and transport benefits experienced anecdotally has not received enough systematic research (see Connections Notes #16 and #17). Also needed are case studies to highlight the technological and institutional conditions required for success.

¹ Kittelson and Associates et al., 2007, TCRP Report 118: Bus Rapid Transit Practitioner's Guide, National Academies Transportation Research Board, U.S. Federal Transit Administration, Washington, DC.

² <https://play.google.com/store/apps/details?id=com.softteco.qualityroad&hl=en>

³ Lawrence E. Decina et al., 2007, Automated Enforcement: A Compendium of Worldwide Evaluations of Results, U.S. Department of Transportation, National Highway Traffic Safety Administration, Report No. DOT HS 810 763, Washington, DC.



Real-Time Passenger Information: Getting It Right

Daniel Pulido and Diego Canales

The widening use of smartphones, high urbanization rates, and the rapid evolution of technologies are driving the expansion of real time passenger information (RTPI) systems for urban transport services. RTPI provides accurate information on actual departure and arrival times and service disruptions, enabling passengers to plan more-efficient trips. Such public information systems can also create an extra incentive for the transit agency to maintain or improve performance. The market potential for RTPI systems includes installations in existing systems as well as new infrastructure. Traditionally sold as part of a larger vehicle management system that is controlled by a chosen vendor, conventional RTPI systems are a challenging expenditure in the developing world and, given the latest technologies, the conventional systems represent an increasingly outdated model. The new technologies can allow cities to obtain more economical and more adaptable RTPI systems, and government officials should consider these new developments when designing transit projects and procurement processes.



What Is an RTPI?

Traditionally, the information sent to the public by an RTPI system has been generated by a computer-aided dispatch/automatic vehicle location (CAD/AVL) system. CAD/AVL itself is mainly intended for operators to manage vehicle trips and comes with hardware for producing vehicle location data.

In that configuration, an RTPI system makes arrival and departure predictions based on the data obtained from the CAD/AVL system. Those data include vehicle location as well as historical and schedule adherence information. The other

components of the integrated system are the interfaces that present the RTPI to the public, either directly through smartphone apps, websites, and variable messages signs; or indirectly through an API (data feed) aimed at developers, who can then develop smartphone apps at no cost to the transit agency.

In the conventional setup, transit agencies buy the RTPI system from a CAD/AVL vendor in a bundle that includes all on-board and central hardware, network, software systems, and licenses. The product typically requires some in-house agency expertise and staff positions for IT maintenance.

Impacts of RTPI on Passengers

In terms of passenger effects, preliminary survey results indicate that providing access to real-time arrival information on transport systems decreases the perceived and actual wait times for riders and improves satisfaction.

Recent research suggests that real-time transit tools might also bring in new passengers. A 2012 study of the Chicago Transit Authority bus routes on which RTPI had been added found that the average daily ridership on those routes increased by 2%. Similarly, a 2015 study for New York City's bus system also found that after three years, the increase in ridership attributable to the RTPI system totaled 2%, which translated into more than \$5 million per year in additional fare revenue.

Innovations in RTPI Systems

Innovations by developers and other technologists have been creating better and cheaper ways to produce RTPI vehicle location data by using off-the-shelf GPS hardware or smartphones and tablets.

A key development on the software side has been the open source protocol. OneBusAway, for example, is an open source product that can disseminate AVL data to users through the web, public displays, smartphone apps, SMS service, and interactive voice-response.

Other startups, including Via Analytics and Transi-Time, have created stand-alone RTPI systems. Via Analytics has a prediction module that collects GPS data from tablets and uses an “anti-bunching” algorithm that better regulates the frequency of bus service. These systems are hosted in the cloud, eliminating the need to invest in servers and dedicated staff, and sold through a software-as-a-service (SAAS) business model.

Procuring It Right

The practice of buying AVL and RTPI systems together is gradually changing as transit agencies have started to see the potential benefit of acquiring the new RTPI technologies separately. However, AVL

systems generally lack the interoperability and open protocols necessary to make separate procurement work.

This lack of interoperability and open protocols has blocked many transit agencies in the United States and Latin America from adding separately acquired RTPI software to their AVL systems. AVL hardware providers often impose proprietary constraints on the data produced by their systems. They allow access to the processed data only through the interfaces the vendor provides, thus restricting the use of others' software and constraining sharing and re-use of the data. Under those circumstances, the data owned by the transit agency eventually decreases in value.

Thus, transit agencies should open their procurement processes to allow the entrance of new participants and technologies. However, doing so may not be enough to ensure full competition across technologies, and other measures should be considered.

For example, a transit agency cannot take full advantage of the latest technology that manipulates and disseminates RTPI data unless it has complete access to the databases managing the information. That means asking the AVL vendor to provide as many open-source components as possible (such as the PostgreSQL database system) or at least requiring an open architecture (meaning that the software is independent of the hardware).

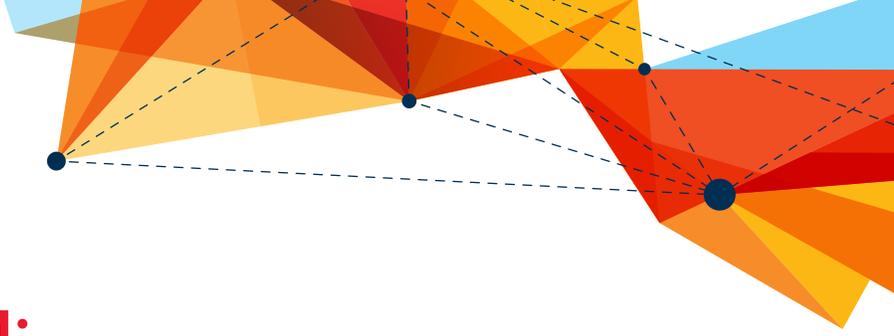
The ideal when procuring new AVL systems is to require (1) open and fully documented architecture and interfaces, thus allowing interoperability; (2) open and standard data protocols as well as standardized and documented data feeds (APIs) from which to extract data; (3) permission to query and extract data from the database; and (4) authorization to reuse that data for other products.

► For more information on this topic:

OneBusAway, rider perceptions, and ridership:
http://thub.uconn.edu/wpcontent/uploads/sites/766/2014/10/The-effect-of-information-technology-on-transit-user-perception_Kari-Watkins.pdf

The impact of real-time information on bus ridership in New York City:
<http://www.sciencedirect.com/science/article/pii/S0968090X15000297>

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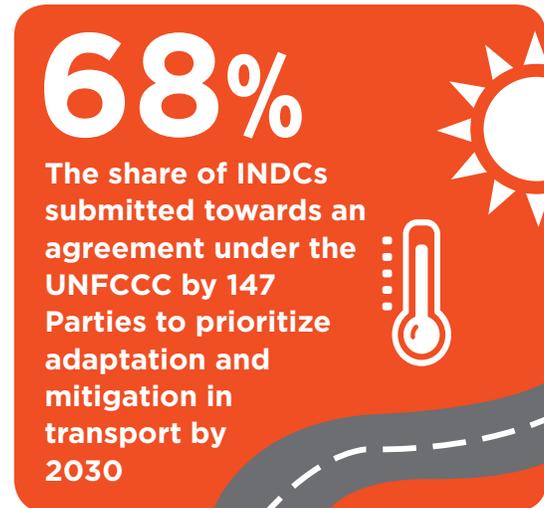
Transport at COP21: Part of the Climate Change Solution

Joining forces to ramp up mitigation and adaptation

Jane Ebinger, Nicolas Peltier, Habiba Gitay, Carolina Monsalve, Andrew Losos, John Allen Rogers, and Nancy Vandycke

The case for climate action has never been stronger. Around the world, climate change is putting at risk the lives of millions of people as well as threatening many coastal cities and endangering trillion of dollars of investments in transport infrastructure and services. The Twenty-First Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) will bring heads of state and ministers to Paris at the end of November to reach a global climate agreement with far-reaching implications for low-carbon and climate-resilient growth. Transport is playing a greater role in COP21 than in past UNFCCC conferences as a critical part of the solution: a sector that can contribute to both reducing greenhouse gas (GHG) emissions and building economy wide resilience

to the impacts of climate change. In view of the sector's potential, the heavily debated transport question is how to sustainably meet the rising global demand for greater interconnectedness and mobility. The World Bank and the seven other leading multilateral development banks have joined forces with the Paris Process for Mobility and Climate (PPMC) and the rest of the transport community to call for more action on transport and climate change.



An Opportunity for Transport

Actions to reduce GHG emissions and stabilize warming at 2 degree Celsius, as agreed internationally in 2009, will fall short if they do not include the transport sector. Discussions have largely focused on the reduction of emissions and mitigating the effects of climate change, but transport resilience is critical to the quick recovery of other sectors after natural disasters and climate-related events. Hence, social and economic resiliency depends on adapting transport systems to better withstand climate impacts.

A vulnerable transport sector will face high costs for maintenance and repair; reduce community

access to jobs, schools, and hospitals; and potentially lead to heavy economic losses.

In the face of these challenges, client countries are demanding more climate action. The 147 Parties to the UNFCCC have submitted Intended Nationally-Determined Contributions (INDCs)¹ ahead of COP21; of those, more than 100 prioritized transport sector for mitigation, and fewer for adaptation.²

¹ INDCs introduce a bottom-up process to define country-level mitigation and adaptation efforts that are guided by national development priorities, equity, and common responsibility.

² As of November 5, 2015.

Climate Finance target

Multilateral development banks (MDBs) have been delivering finance for climate action. From 2011 to 2014, they committed more than \$100 billion to climate mitigation and adaptation, including about \$20 billion in the transport sector.

The MDBs took a concerted move for transport at the 2012 UN Conference on Sustainable Development (Rio+20), where they pledged \$175 billion in loans and grants for more sustainable transport over the 2012–22 decade (see Connections Note 18). The resulting increase in MDB support for sustainable transport since then—they are currently lending an average of \$25 billion per year—is putting them on track to meet their Rio+20 commitment.

In October 2015, the MDBs agreed to significantly ramp up overall climate finance by 2020, and transport is expected to play a key role. The World Bank Group pledged to increase its climate finance by one-third, to 28 percent of its annual commitments, by 2020. Currently, transport is second only to the energy sector in its contributions to mitigation and adaptation co-benefits in World Bank projects.

Low-Carbon Transport Solutions

With transport contributing to 23 percent of global CO₂ emissions, the sector holds the key to reducing the emissions trajectory. Investments in low-carbon solutions are urgently needed to increase the sustainability of existing and new transport systems. The most significant opportunities to shift policies and investments are in the design of public transport systems, vehicle efficiency, demand management, regional development, and land use.

At COP21, the MDBs and other international financial institutions will announce “common principles” to ensure transparency and credible, robust reporting of GHG emissions in transport projects.

Call for More Action on Adaptation

Developing countries are investing massively in transport infrastructure, and spending is likely to rise even further to meet aspirations for greater mobility and connectivity. But worsening climate impacts have the potential to affect the entire transport value chain, from its location, design, and construction standards to the services it provides. Hence, new and existing transport systems urgently need greater investment in resilience.

And the demand for climate action is there—from the 100 Parties to the UNFCCC that have adaptation among their priorities, to the 20 most vulnerable countries that have come together to implement greater climate resilience.

Tellingly, however, very few of the plans submitted to COP21 include transport-specific adaptation measures. Thus, enormous effort is still required to build the climate resilience of transport in client countries and hence build the climate resilience of the countries themselves. Doing so depends in part on developing the right approaches, including upstream sectoral and spatial planning and post disaster risk and recovery support. The effort must also strengthen and refine the enabling environment, which includes awareness, the capacity to address climate impacts, and the tools and methodologies to integrate these concerns in decision making. The World Bank is ready to play its part in all these ways.

► For further information on this topic:

Moving Toward Climate-Resilient Transport: The World Bank's Experience from Building Adaptation into Programs:
www.worldbank.org/transport/resilience

Climate-focused Vulnerable Twenty Group of Ministers of Finance:

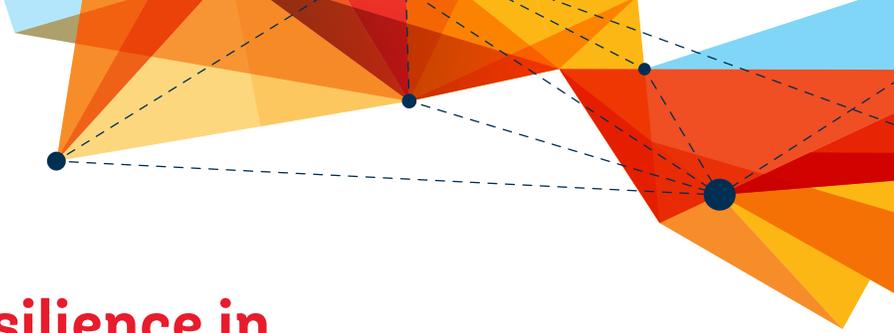
<http://www.thevcvf.org/launch-of-the-v20/>

Paris Process on Mobility and Climate (PPMC):

<http://www.slocat.net/ppmc>

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Enhancing Road Resilience in Pacific Island Countries

World Bank Assisting Adaptation to Climate Change

Sean David Michaels¹

Pacific island countries are experiencing higher temperatures, rising sea levels, and extreme weather that is increasingly frequent and intense.² The resulting damage has likewise been extreme. Between 2012 and 2015, for example, losses from three cyclones ranged from 11% to 64% of GDP in Samoa, Tonga, and Vanuatu.³ In many of these countries, primary roads and critical infrastructure are adjacent to the coast, and the majority of the population lives within 1 kilometer of the sea. Expected climate change effects will place coastal assets and communities at a higher level of risk. Governments are well aware of these challenges. Today, more than one-fourth of the World Bank's transport commitments support mitigation and adaptation to climate change (a share that is growing), and its work with Pacific island countries is one of the ways it is responding to the rising demand for climate action. The demand from Pacific island countries in recent years has focused on road resilience, and early lessons will provide a strong basis for further progress.



The World Bank's support for enhancing the resilience of vulnerable road networks and neighboring communities in Pacific island countries encompasses four pillars:

1. Sectoral and strategic spatial planning that is informed by risk-based assessments of vulnerability and hazards
2. Resilient infrastructure solutions that are fit-for-purpose, such as raising road elevations, installing drainage, relatively new technologies such as geocells for low-volume roads, and strengthening coastal infrastructure
3. Enabling environment: institutional and capacity support, awareness raising, and finance

to enhance the capabilities of the relevant stakeholders at the policy and regulatory level

4. Post disaster risk and recovery support to ensure that risk and resilience regarding short- and long-term climate change is integrated into rebuilding efforts

Spatial, Risk-Based Planning

Risk-informed planning is fundamental to mitigating the impact of climate change and extreme weather events, and it is feasible for all governments given the advent of new tools that work

¹ The author is grateful for helpful comments from Christopher Bennett and Michel Kerf.

² See The Pacific Climate Change Science Program, *Climate Change in the Pacific: Scientific Assessment and New Research—Volume 2: Country Reports*, 2011, www.pacificclimatechangescience.org/publications/reports.

³ The World Bank has active engagements in 10 Pacific island countries: Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

well even in low-capacity environments. Samoa and Tonga are already using Light Detection and Ranging (LiDAR) technology, which provides high-resolution aerial photographs to generate elevation data that will strengthen spatial hazard mapping analysis.

Samoa will use the data to update plans developed through Coastal Infrastructure Management (CIM)—a tool focused on citizen engagement that assesses the resilience of coastal infrastructure, identifies solutions, and assigns responsibilities for implementation.

Fit-for-Purpose Infrastructure

Complex design solutions are often not fit-for-purpose in Pacific island countries, given their limited resources. Near- to medium-term design efforts center on installing drainage and raising low-lying coastal roads. A key paving innovation to reduce maintenance needs for low-volume roads are geocells, a labor-based approach to constructing durable pavement at low cost that is already in use in Kiribati. Finally, coastal infrastructure is also being improved to help protect adjacent roads. Green options to replace or complement basic hard infrastructure such as seawalls and breakwaters include living shorelines and recovery of coastal habitats for mangrove replanting. These basic hard and soft options are suitable for low-capacity environments and generally less expensive than solutions used in wealthier countries.

Stronger Enabling Environment

Project management support, a core component of all resilience projects, includes resilience-related training for ministry staff members and civil society organizations. New and amended legal frameworks will enable governments to mobilize funding and create programs. On the regulatory side, reform includes incentives to support resilience-focused maintenance and stakeholder engagement in the design of regulations.

Supporting Postdisaster Recovery

Practical measures are critical to recovery, including the rapid assessment of road network damage to identify key areas needing attention. Rapid clearing of drains and culverts and repairs to

protective infrastructure (e.g., seawalls) are necessary given the threat of concurrent severe weather events. More broadly, advance government procurement and retroactive financing are imperative for effective emergency operations. Tonga is considering framework agreements to speed the mobilization of contractors for cleanup and recovery. Wherever feasible, relocation of affected roads, communities, and infrastructure further from the coast should be a priority in recovery operations.

Initial Lessons Learned

Experience gained from projects in Kiribati, Samoa, and Tonga are helping make ongoing interventions there and in other Pacific island countries more effective and would be relevant for consideration among nations in the V-20.⁴

Anticipatory action is vital to protect roads, which provide connectivity essential to growth. Identifying the type and locale of road damage can focus planning and improvements to infrastructure, reduce damage, and limit the need for recovery efforts.

Financial sustainability requires long-term donor engagement. Domestic resources have been insufficient for the long-term needs of fiscally constrained Pacific island countries.

Road authorities often prioritize quick repairs over resiliency measures. In response, task teams have helped persuade agencies that ancillary infrastructure, such as drainage, and risk-based planning tools ensure the long-term sustainability of their road networks.

Project design and implementation must be simple and engage local communities from start to finish. Samoa's Second Infrastructure Asset Management Project made effective use of multilevel stakeholder planning through its best-practice CIM plans.

⁴ The Vulnerable Twenty Group of Ministers of Finance (www.v-20.com).

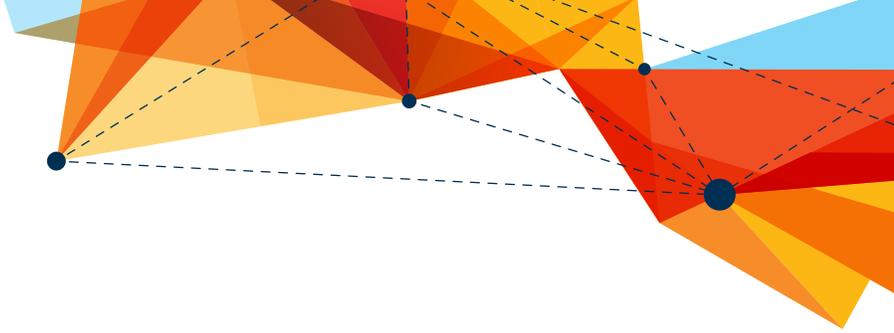
► For more information on this topic:

World Bank projects: [Kiribati](#); [Samoa\(A\)](#); [Samoa\(B\)](#); [Tonga\(A\)](#); [Tonga\(B\)](#)

Moving Toward Climate-Resilient Transport: The World Bank's Experience from Building Adaptation into Programs: www.worldbank.org/transport/resilience

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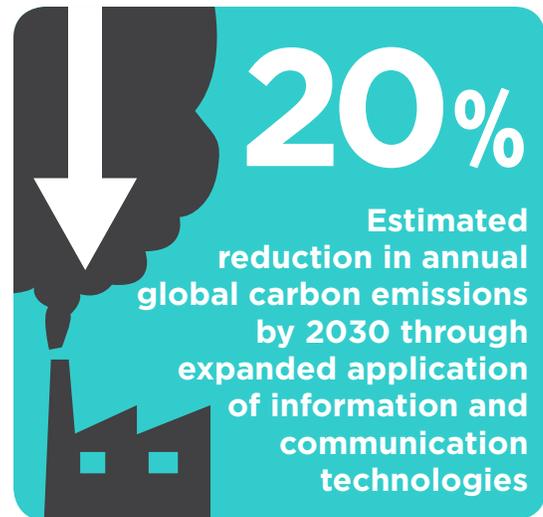
The notes are available at <http://www.worldbank.org/transport/connections>.



ICT at COP21: Enormous Potential to Mitigate Emissions

Doyle Gallegos and Junko Narimatsu

The transformational potential of new information and communication technologies (ICTs) was on display in Paris at the Twenty-First Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change. ICTs—including the Internet, mobile phones, geographic information systems (GIS), satellite imaging, remote sensing, and data analytics—could reduce yearly global emissions of carbon dioxide (CO₂) 20% by 2030, thus holding them at their 2015 level.¹ Moreover, ICT emissions are expected to decrease to 1.97% of the global total by 2030, from 2.3% in 2020, while emission reductions attributable to ICT will be nearly 10 times greater than those of the ICT sector. ICTs are also critical for climate change adaptation, providing vital tools for all phases of the disaster risk management cycle. Although the opportunities for ICTs to support the climate change agenda are enormous, much work remains in order to realize them. Governments of developing countries must be further encouraged to include ICTs in their national climate change policies. And the international development community will have to make significant efforts, particularly in low-income countries, to develop ICT infrastructure as well as the institutional capacities and skills to implement and sustain these solutions.



By 2030, ICTs could eliminate the equivalent of 12.1 billion tons of CO₂ per year in five sectors—transport (30% of the total reduction), manufacturing (22%), agriculture and food (17%), buildings (16%), and energy (15%).² Here are some of the ways:

Transport (mobility and logistics): Electric vehicles, traffic control, real-time route optimization, smart

logistics, car sharing (e.g., Uber), and other ICT-enabled solutions can save travel time and reduce fuel consumption. The Lagos Bus Rapid Transit (BRT), supported by the World Bank, is a good example of a system embodying several of these strategies.³ “Disruptive” ICTs in transportation (such as driverless vehicles) are expected to mature over the next decade.

¹ *Smarter 2030*, June 2015 (http://smarter2030.gesi.org/downloads/Full_report.pdf), a report by GeSI (Global e-Sustainability Initiative, an industry group) presented at COP21. Those possibilities were explored at a number of ICT-centric COP21 sessions, including those hosted by the UN Global Pulse initiative (which in April 2015 had launched Data for Climate Action), the French Development Agency, the U.K.’s Department for International Development, and the Data-Pop Alliance, which was created by the Harvard Humanitarian Initiative, the MIT Media Lab, and the Overseas Development Institute to promote the use of Big Data through collaborative research, capacity building, and community engagement.

² The total exceeds the combined carbon footprint of the European Union and the United States (www.ericsson.com/res/docs/2015/mobility-report/ericsson-mobility-report-nov-2015.pdf).

³ <http://blogs.worldbank.org/transport/lagos-bus-rapid-transit-system-decongesting-and-depolluting-mega-cities-0>.

Manufacturing: Examples include virtual manufacturing, 3D printing (allowing customer-centric production at a faster and more efficient pace), circular supply chains, and smart services.

Agriculture and food: ICTs can help raise productivity and reduce food waste and are estimated to also reduce water needs, potentially by 250 trillion liters per year by 2030. For example, farms in developing countries can monitor soil conditions by using intelligent sensors and send the data to irrigation systems, leading to efficient allocation of scarce water resources.

Buildings: Sensing devices linked to controls and applied to building energy management could reduce energy costs by \$0.4 trillion per year by 2030.

Energy: Smart grids driven by web-enabled sensor networks in combination with big data and analytics can predict electricity usage patterns with increased accuracy and modify output in response to immediate data rather than historic patterns.⁴

The use of ICTs in climate adaptation measures is becoming more routine. In Egypt, alerts for flash floods are issued on the basis of rainfall forecasts, and Chile became the first developing country to have a fully operational tsunami early-warning system that uses a satellite-based positioning system. After the April 2015 Nepal earthquake, the efficiency of rescue efforts was boosted by tech volunteers in the OpenStreetMap community, who located more than 13,000 miles of roads and 110,000 buildings within 48 hours.⁵

Projects supported by the World Bank are employing some of these technologies:

- In Samoa, GIS mapping is used to help identify important sections of the road network vulnerable to climate and weather impacts (a strategy also under way in a Belarus project).
- In Tonga, a drone for postdisaster and geospatial mapping is helping assess storm damage and plan recovery efforts.

Critical ICT infrastructure and services are still lacking, especially in low-income countries. Today,

two-thirds of the population residing in developing countries remains offline, and less than 10% of the 940 million people living in the least-developed countries use the Internet.⁶

The UN's Sustainable Development Goal (SDG) 9.c is to "significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020." Globally, the arrival of 5G Internet speeds in the near future as well as the accelerating development of next-generation access (NGA) networks are expected to enable productivity gains on a massive scale. These will significantly advance the potential to attain SDG 9.c, benefiting climate change mitigation and adaptation as well as health, education, agriculture, and gender equality.

Greening the ICT sector itself will also be critical as data traffic continues to explode. In 2014, the International Telecommunications Union established the new Connect 2020 agenda, which includes two ambitious targets directed at reducing the environmental footprint of the ICT sector by 2020: reducing the volume of e-waste 50% and reducing greenhouse gas emissions generated by the sector by 30% per device.⁷ The consolidation of data centers, the expansion of cloud-based services, and innovative solutions such as liquid cooling will become increasingly important to reduce energy required for ICT power.

The opportunities for ICT to support the overall climate change agenda are enormous, and the development community must continue to aggressively explore ways to raise awareness for using ICT solutions to facilitate the greater provisioning of this global public good.

⁴ The total energy footprint has started to decrease in OECD countries with high ICT use (www.ericsson.com/res/docs/2015/mobility-report/ericsson-mobility-report-nov-2015.pdf).

⁵ <http://www.wired.com/2015/05/the-open-source-maps-that-made-rescues-in-nepal-possible>.

⁶ <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFacts-Figures2015.pdf>

⁷ http://www.itu.int/en/ITU-T/climatechange/Documents/Publications/Resilient_Pathways-E.PDF


\$70 trillion 

The potential global savings from energy efficiency investments in urban transportation

13.5 million

The estimated number of rural residents in Kenya (43%) without access to an all-season road, based on preliminary results

**2.4 billion**

The estimated worldwide number of people lacking official identification

**\$5.3 billion**

The World Bank's investment in sustainable transport projects in 2014-15

0.4 %

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