AID-FOR-TRADE CASE STORIES

INFRASTRUCTURE

AID FOR TRADE: INVESTING IN INFRASTRUCTURE TO SPUR TRADE

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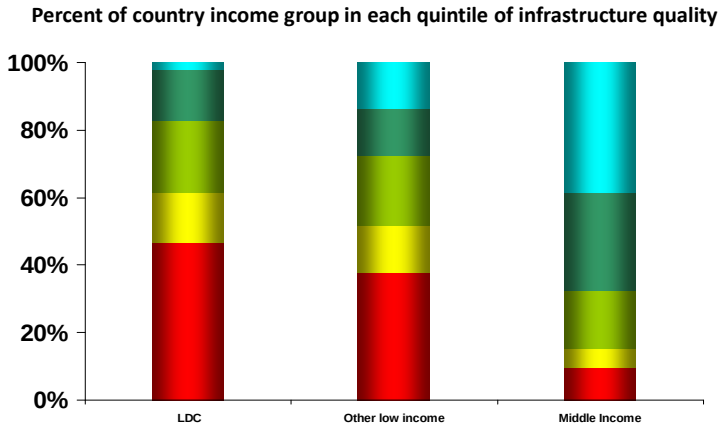
One of the most pervasive binding constraints to export growth, productivity increases, and increases in national incomes is the quality of infrastructure. In 2006, for example, telecommunications costs in Kenya were four times what they were in India. Similarly, port inefficiencies in Mozambique drove up the costs of importing a container to amounts twice those of South Africa. Electric power outages occurred far more frequently in least developed countries than in middle income countries, and hence surveyed fully one third of business managers in LDCs ranked access to reliable electricity as among their most significant obstacles to expansion. In fact, infrastructure quality, cost and reliability – whether in power, telecommunications, roads, ports or airports – is directly associated with levels of income – in general, the poorer is a country's infrastructure, the poorer are it citizens. Some 42% of LDCs ranked in the bottom quintile of countries ranked by infrastructure quality (Figure 1).

About 60% of LDCs figure in the bottom two quintiles of infrastructure rankings for all developing countries



Source: Authors calculation based on World Bank, LPI Indicators

One of the conceptual difficulties is distinguishing between investments that improve the productivity of the tradable sector from those that benefit the non-tradable sector as well. This is particularly true for investments in infrastructure. To be sure, ports and airports arguably have a direct bearing on trade capacity. However, investments in roads, telecommunications and electric power typically benefit both the tradable and non-tradable sectors. For example, in a country with an integrated grid for electric power, investment in new generating plants and transmission lines benefits the whole economy – and to the extent that it raises the productivity of the whole economy, its competitiveness improves. For these reasons the OECD/WTO defined donor financing of investments in most infrastructure to be part of "aid for trade". The definition of infrastructure aid for trade comprises donor assistance to ports, roads, airports, energy, and telecommunication [as well as water investments in irrigation] (OECD, 2006).

Measuring results: Improved infrastructure increases trade…usually

Several studies have made the link between investments in infrastructure and increasing capacity to trade.[1] For example, Limao and Venables (2001) studied the relationship between roads and telecommunications and shipping costs, and then the relations between shipping costs and trade volumes. They found that an improvement in transport and communication infrastructure from the median score on surveys to the highest 25th percentile is associated with a decrease in transport costs by 12%s - and this in turn is associated with an increase in trade volumes of 28%.[2] Moreover, they show that landlocked countries face higher transport cost since their ability to trade depends also on the infrastructure of the neighbouring transit countries. For example, in East Africa, goods bound for landlocked countries faced the time equivalent of at least three clearance processes of coastal countries. *"Poor infrastructure accounts for 40% of predicted transport costs for coastal countries and up to 60% for landlocked countries."* Furthermore, for landlocked countries, they calculated that improvements in their own infrastructure from the 25th percentile to the 75th percentile would effectively overcome more than half the disadvantage of being landlocked (Limao and Venables, 2001).

Roads are obviously critical to trade. Buys, Deichmann, and Wheeler (2010), in a study for the AfDB, undertook an analysis of road networks in Africa. Estimating city-level gravity model averages of trade that could occur, given distance and incomes, and using actual cost and engineering data for road construction, they simulated the effect of creating a feasible continent network transport through up-grading. Their baseline estimates indicate that an investment of some USD 20 billion, together with USD 1 billion in annual maintenance, would generate about USD 250 billion in overland trade over 15 years. Similarly, Ben Shepherd and John Wilson (2008) used gravity model simulations for Europe and Central Asia to reach the conclusion that an "ambitious but feasible" road upgrade could increase trade by 50%.

Likewise efficient ports are essential to trade. Wilson, Mann, and Otsuki (2003) in their study of trade facilitation in APEC used a measure of port efficiency (an amalgamation of port efficiency, port facilities and air transport efficiency) in a gravity model and from those conducted some

[1] Methodological problems abound in studying this relationship: Association by itself does not demonstrate causality, and the better studies employed lagged variables and other techniques to strengthen conclusions. Much of the empirical literature on the relationship of infrastructure to trade is based on the "gravity model". These apply cross-country regression equations to bilateral trade among all trading partners, and take into account the volume of trade controlling for the size of the respective economies and the distance between them. For example, two large countries will obviously have a greater bilateral trade, all the more so if they are close to each other. The gravity model provides a way of controlling for expected trade levels and then measures the impact of other variables on trade volumes. These often constitute the basis for simulations: "if a country in a bottom percentile were to improve to a top percentile then the level of associated trade would be greater by an amount given in the gravity model."

[2] They take as an infrastructure indicator four components: the density of rail road per square km, the density of road and of paved road per square km and the number of telephone mainlines per capita. The indicator has been widely used by other researchers to proxy for the quality of infrastructure cost and thus, the cost of transport and communication See Carrère, C. (2006). "Revisiting the effects of regional trade agreements on trade flows with proper specification of the gravity model", *European Economic Review*, Vol. 50/2: 223- 247.)

simulations; they found that bringing below-average countries on the index up to the APEC average would produce USD 117 billion in additional trade within APEC (2003:16).

Finally, telecommunications have been shown to be critical – and probably of increasing importance. Examining at the impact of the internet, an early article by Freund and Weibhold (2000) looked at the role of potential commerce over the internet, again using a gravity model, and concluded that a 10% increase in the relative number of web hosts in one country would have increased trade flows by 1% in 1998-99. The explosion in connections all over the world has undoubtedly altered these estimations. Park and Koo (2005) found telecommunications infrastructure to be a significant determinant of bilateral trade levels. Wheatly and Roe (2005) looked at international trade in agricultural and horticultural commodities between the United States and its partners, and undertook some analysis that differentiated the export and import effects of internet infrastructure and cost; they concluded that telecommunication effects depend critically on the perishability of products. Today, one could guess that the great majority of searches for internationally supplied inputs and consumer goods begin with the internet – so being online to advertise, to purchase, and to search is important to international trade.

Similar conclusions are found in studies that measure the effects of multiple types of infrastructure together to examine the collective impact on trade. For example, Nordas and Piermartini (2004) look the quality of ports, the density of airports with paved runways, and the density of internet users and of mobile phone subscribers. They showed that port infrastructure matters for all sectors, while timeliness and access to telecommunication matters most in the clothing and automotive sector.

More to life than trade: Direct effects on income and social indicators

The aid for trade literature has focused on the effect of donor assistance on expanding trade on the quite compelling logic that expanded trade is associated with rising incomes and reductions in poverty (see Hallaert, 2010). Investments in infrastructure – the largest category of aid for trade – also have direct impacts on the productivity of countries, national incomes, and even health. Straub (2008) in a sophisticated review of the analysis of the growth consequences note that infrastructure can raise productivity most directly through complementarities. For example, by providing remote areas with access to markets roads or bridges make private investment remunerative; or by giving entrepreneurs access to cheap electricity or telecommunications these network investments enable private investment. Straub (2008) reviewed papers covering a wide variety of methodologies in 140 different specifications, and found that in 67 percent of the specifications for developing countries (n=54), infrastructure had a positive and significant link to some development outcome; only 7 percent showed a significantly negative relationship, and the remainder were non-significant. Similar results, if based on a smaller sample, are reported in Bricenio-Garmendia *et al.* (2004). For Africa, Ramirez and Esfahani, (2000) found that if Africa had enjoyed the growth rates in electric power and telecommunications comparable to those in East Asia in the 1980s and 1990s, the region's annual growth rate would have been 1.3 percentage points higher than it actually was; they conclude that the overall quantity and quality of infrastructure are critical determinants of growth in developing countries.

Moreover, infrastructure has direct consequences for other indicators of human development. Fay, Leipziger, and Yepes (2003) reviewed the numerous studies showing investment

infrastructure also induces improvements in health and education. Their findings suggest that apart from traditional variables (income, assets, education, and direct health interventions), better access to basic infrastructure services has an important role in improving child health outcomes.

Measuring results: Investment alone, however, is not enough

Institutions and policies also matter. For example, the productivity of transport rises when restrictions on trucks crossing borders are designed to ensure maximum competition – rather that forcing trucks that deliver products to ports to return home empty (see Arvis, *et al*., 2010). A Bank review of the main corridors in Africa's strict market regulation in West and Central Africa has lead to excessively high transport costs, by allowing transport providers in the region to keep large mark-ups or profit margins. The ensuing high transport costs have a pernicious impact on the poverty-reduction role of exports, as exports in agricultural goods and commodities mainly use road transport (Teravaninthorn and Raballand, 2008).

Similarly, regulations that maximize competition in telecommunications and finance tends to drive the largest gains in consumer welfare through lower prices and more rapid technological advance (see Fink *et al,.* 2002). Merely privatizing inefficient state enterprises providing electric power or telecommunications without providing a sound, and usually competition-inducing framework can be predicted to fall short of realizing full potential gains in efficiency and growth.

This comes out in the cross-country literature. For example, putting infrastructure and institutions together, Francois and Manchin (2006) studied transport and telecommunications for a large sample of countries in the period 1988-2002.[3] Additionally, they introduced institutional variables which reflect the size of government: expenditures and taxes; the legal structure and protection of property rights; the access to sound money: inflation rate, possibility to own foreign currency bank accounts; freedom to trade internationally: taxes on international trade, regulatory trade barriers, capital market controls, difference between official exchange rate and black market rate, etc.; and the regulation of credit, labour, and business. They show that both infrastructure and institutions matter for both trade volume and the probability that trade occurs.

Aid for infrastructure: How does it perform?

Most investment in infrastructure in the developing world is financed through domestic savings, mostly from public sources (capital expenditures of the public sector, retained earnings of state companies) and in some sectors, such as telecommunications, private domestic and foreign saving may play a role. In general, foreign donors finance a minority of infrastructure costs – with amounts somewhat higher in countries with lower per capita incomes.

In general, donor-financed projects in infrastructure have performed very well -- if the World Bank's projects can be taken as an adequate reflection of the universe. The Bank reviewed infrastructure project lending over the period 1960-2000, using a social rate of return – that is, the

[3] They proxy transport and communication cost with the percentage of paved roads out of total roads, on the number of fixed and mobile telephone subscribers (per 1,000 people), on the number of telephone mainlines (per 1,000 people), on telephone mainlines in largest city (per 1,000 people), telephone mainlines per employee, mobile phones (per 1,000 people), and freight of air transport.

benefits to the society attributable to the project measured as a percent of the cost of investment.[4] The social rate of return on average was remarkable high (especially in light of the fact that typically most cost benefit analyses did not use shadow prices). Transport projects had on average (unweighted by size) a social rate of return in excess of 25 percent for the developing world as whole, followed closely by telecommunications and energy-mining projects.

Table 1. Social rates of return on World Bank Projects

Unweighted Average 1960-2000

Region	Energy/Mining	Telecoms & Information	Transport
Africa	14.1	20.6	25.5
East Asia	18.3	19.5	24.8
Eastern Europe	30.9	31.1	25.8
Latin America	12.8	16.6	22.4
Middle East	12.3	26.9	25.1
South Asia	23.2	22.0	24.1
Developing World	18.4	21.5	25.4

Source: Briceno-Garmendia, Estache, and Shafik (2004)

In summary, the larger literature based on cross-country analysis leads to some powerful conclusions: First, infrastructure matters for trade. Access to higher quality infrastructure is associated with high levels of bilateral trade in the great majority of studies, and evidence of causality – that is, where investments *result in* higher levels of trade is convincing for a significant portion of the literature. A cautionary note is important to record, however: these studies deal with averages in particular countries, and never explain all of the variance. From the vantage point of policy, it matters a great deal whether a country's investment in infrastructure is rewarded with a lot of trade (and growth) or only a little – and this depends on other policies, institutions, and country-specific circumstances. Second, transport and communications are obvious candidates to be most important determinants, especially for landlocked countries – though this may reflect the understudied relationship between investments in electric power and trade. Third, policies affecting infrastructure matter about its productivity.

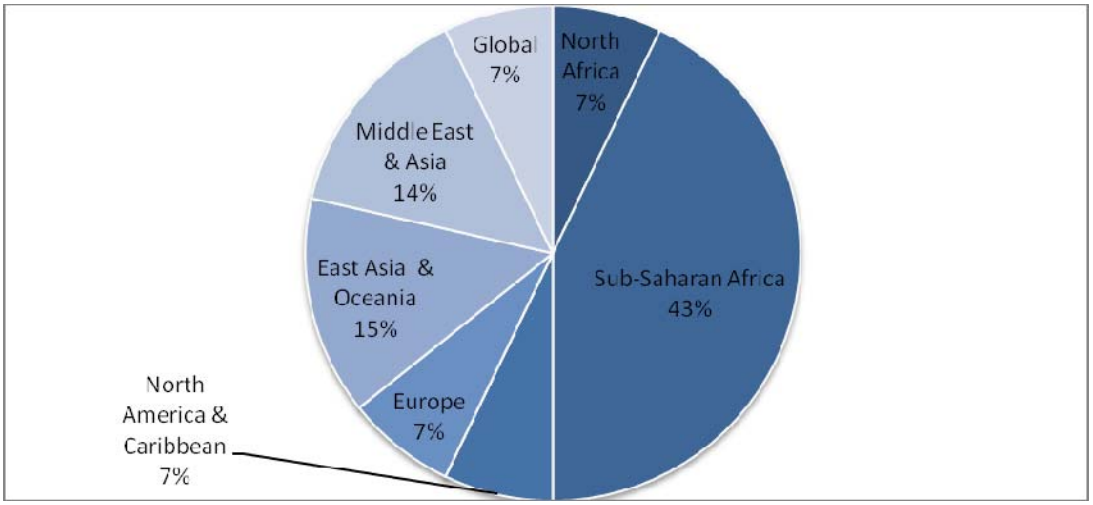
[4] The Bank has increasingly used market prices rather than shadow prices to calculate social rates of return. This is in part to eliminate subjectivity normally involved In establishing shadow prices and because in the last two decades exchanges rates have become more commonly market-determined, financial markets reflect the price of capital, and labor markets have become more integrated. In that sense, the social rates of return in this table are actually understated since they commonly do not account for secondary and tertiary benefits captured in shadow price weights to account for regional and income class gains.

What do the case stories tell us?

Of the 269 received, only 14 concerned infrastructure centrally.

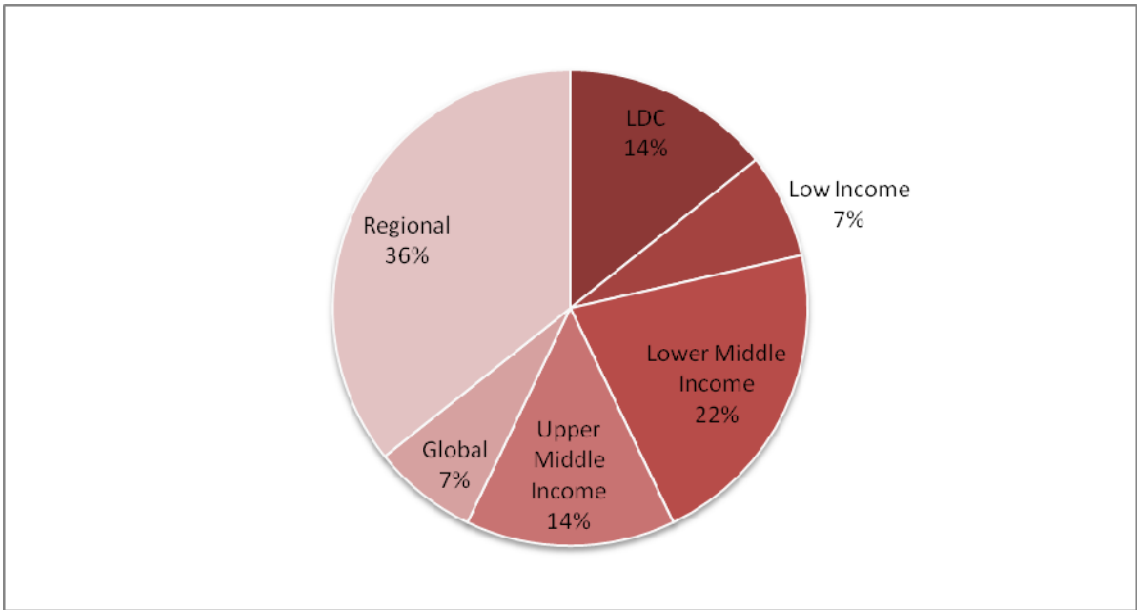
Most were from sub-Saharan Africa (Figure 1)

Figure 1 Infrastructure by Region



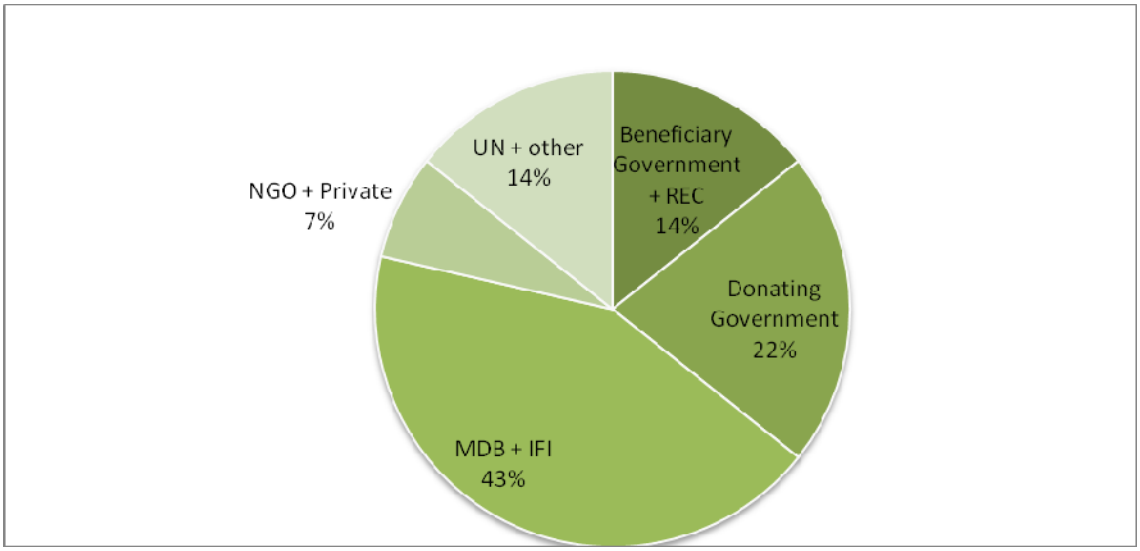
and were fairly well distributed across income groups (Figure 2):

Figure 2 Infrastructure by Income Group



Most case stories were written by Multilateral Development Banks (MDBs) (Figure 3).

Figure 3 Infrastructure by Author



The case stories add colour into the antiseptic black and white pictures of the econometric studies. For example, one case story looked in depth at the interaction of trade facilitation and transport infrastructure. It concluded that road infrastructure in East Africa was in *"surprisingly"* good condition or in the case of ports improving condition; but rail and internal water shipping were severely deficient. The authors argue for more regional projects on the grounds that purely national projects, while easier to implement, do not remedy coordination failures at the regional level [Africa, 229].

Some sub-regions are beginning to witness joint activities to improve trade-related infrastructure. In Mozambique, the government invested in energy with the technical assistance of the Norway and the World Bank. As a result, investments from SASOL, the Pande-field, after a long and turbulent history, finally came on stream in 2004, as did the Temane field in 2010. The governments of South Africa and Mozambique availed themselves of technical assistance from Norway to draft a treaty that eventually made the project economically viable by creating the legal framework to build a pipeline from the fields into South Africa and to Maputo. The total investment has been USD 191 million and will permit extractable gas equivalent to 440 million barrels of oil [Mozambique, 59].

Another example is electric power. Hallaert *et al.* (2011) showed that electricity access appears to be a main constraint to trade expansion, particularly the lack of reliability. Improving the reliability of electricity by 10% increased trade openness by almost 2% on average. The impact was larger on exports (2.4%) than on imports (1.7%). Zanzibar, together with the Union Government and Norway, provided NOK 400 million financed the installation of submarine cables connecting the electricity grid on the island Pemba to Tanzania. The 78 kilometre cable will replace 3 diesel generators, and increase electricity reliability, thus providing more efficient electricity to inhabitants for the next 20-25 years. This has had downstream effects: the availability of electricity made it feasible for the private sector to invest in a new hotel, with concomitant benefits for tourist export earnings [Tanzania, 135]. Similarly, Chinese technical assistance to Laos led to the creation of an Overall Plan for Comprehensive Development of the Northern Area. This provided a blueprint for

investments in, among other things, infrastructure; and subsequent investments prompted the expansion of new trade links with China [Lao, 155].

One example of how improving port services are essential to trade is in Fiji. The government, with support from the ADB, invested in the ports of Suva and Lautoka on the island of Viti Levu. Originally built in 1963, the port facilities were run down by the time the project commenced - failing to meet modern standards and with insufficient space for container cargo. The project figured prominently in both the government's Strategic Development Plan 2003-2005 and the subsequent ADB's program. As a result, investments lead to an increase in turnaround times, and productivity improved from 5.2 to 8 containers per vessel-hour. Moves per hour of cranes nearly doubled from 11 to 20 [Fiji, 29].

Improving roads is a common theme in the case stories. The Kyrgyz Republic and Kazakhstan collaborated to rehabilitate 226 kilometres of road between their respective capitals, Bishkek and Almaty. The project was coupled with technical assistance to improve customs facilities, including new equipment and training for customs officials. The ADB and the European Development Bank teamed up to finance the road work, implemented by the ministries of transport and communication in the two countries, and the EU's Transport Corridor Europe Caucasus-Asia Program provided a parallel grant for customs reform. The program had numerous benefits: best-practice were introduced into road planning and construction; and new livelihoods were opened up along the corridor, such as retail shops, taxis, car washing, roadside cafes, and hair salons. Border-crossings increased by 38% annually between 2000 and 2007, traffic volumes rose 25% (relative to 1998), and the Kyrgyz Republic's exports have risen 160% [Kyrgyz Republic and Kazakhstan, 10]. A similar story is told (without the quantitative detail) for the Rijeka-Zagreb motorway, a critical link between the Croatian capital and its primary port [Croatia, 228].

In the Mekong delta region, the governments of Vietnam, Lao PDR, and Thailand launched an effort in 1998 to connect their respective road networks in order to expand trade. With the support of the ADB, the project identified critical road links necessary to expand regional trade among the three countries. To support transport and facilitate trade, the authorities reached a Cross-Border Transport Agreement (CBTA) that covered nearly all aspects of goods and services flows – including customs inspections, transit traffic, and road and bridge design. As a consequence, average trade value rose by more than 50% -- to USD 142 million in 2006-07 from 93.5 million in 1999-2000. Average travel times were cut by as half along the corridor. Time spent crossing selected borders also fell by 30-50%, and the average number of vehicle crossings per day increased. Finally, in June 2009, a CBTA agreement allowed issuance of licenses for some 500 trucks to operate along the corridor without transhipment fees [Asia and Pacific, 9].

Some projects embedded improvements in road transport and other infrastructure with efforts to strengthen human technical capacities and productive capacities. One example is El Salvador's FOMILENIO project, an integrated rural development project that focuses on human development (through education and training), productive development (through technical assistance in entrepreneurial development and through investment in and loans to in six productive chains), connectivity (through the construction of the Northern Longitudinal Highway (*Carretera Longitudinal de Norte*) and investments in rural electricity. Financed by the US Millennium Challenge

Corporation, the project has raised incomes, generated employment, and improved the rate of technological adoption [El Salvador, 233].

The stories also contain cautionary tales. For example, efforts to privatise railways in Southern Africa between 1990 and 2005 through long-term concessions, often with donor support, have largely failed, mainly because of process and design flaws. The process took much too long, funding provisions were inadequate, the agreements were generally weak and the choice of concessionaires was often poor, in that there was a lack of serious bidders with appropriate skills and resources [Africa, 144].

Adequately functioning railways are fundamental to participating effectively in regional and global trade. Governments are just beginning to look for new ways to revitalise this infrastructure, often through public and private partnerships. Establishing well-functioning arrangements, however, is not easy and results are not automatic.[5] The success of any revitalisation effort hinges on getting designs right for anticipated volumes and speeds, getting operating regulations right to encourage full utilisation based upon adequate maintenance, and getting incentives right through correct pricing, investment provisions, and clearly stated obligations [Africa, 144].

Cautionary tales also extend to the social dimensions of infrastructure projects. One story noted that improved road infrastructure in the Central American – Mexico corridor *could* lead to the increased spread of disease, most worrisomely HIV/AIDs, if appropriate policies are not adopted [Central America, 3]. In Africa, it has been shown that transport schemes which incorporate health measures at the program level can slow the spread of disease significantly. Only recently have similar programs been incorporated in Central American road projects and these are too new to be evaluated. Another case story underscored the importance of linking infrastructure investments to design safety in highway construction and driver and pedestrian education. The UN noted that *"road crashes claim the lives of more than 1.3 million people and at least 50 million people are injured on the roads every year"* [Global, 236]. Similar issues were raised by the Economic and Social Council for Western Asia [Asia, 238]. Pedestrian deaths are particularly tragic because they are easily avoidable. Another case story from Africa, which has particularly high road-casualty rates, argued for setting up more adequate information systems, a clear locus of government accountability, regional targets for reducing casualties, public education, and improved road design.[6]

[5] See Ronald Fischer (2011) "Public- Private Partnerships in Rwanda: Lessons from Chile" International Growth Centre, February (*http://www.theigc.org/sites/default/files/presentation_slides/fischer_ppps.pdf*)

[6] The World Health Organization and the World Bank, working with other agencies, have mounted a major initiative on road safety. See *WHO and World Bank (2004) "World report on road traffic injury prevention"*

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