

INFRASTRUCTURE AND POVERTY

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Summary and conclusions

i) Over the last few decades there has been a gradual broadening of the concept of poverty from the static concept of monetary income to include other dimensions of well-being such as, for example, life expectancy and literacy. It has also been proposed that the well-being of the poor be assessed in terms of their exposure to risk, their vulnerability and powerlessness. This multi-dimensionality of well-being means that the effectiveness of interventions to attack poverty have to be assessed in broader terms. This paper reviews our understanding of the link and impact of physical infrastructure on poverty. The paper first reviews the socio-economic impact of infrastructure on poverty, which is the facet that has been most emphasized in the past. It then explores the impact of infrastructure on reduction in exclusion, the link with social capital, reduction in vulnerability, and the implication for private sector provision of services.

ii) Infrastructure is a key element of poverty alleviation. It often acts as a catalyst to development and enhances the impact of interventions to improve the poor's access to other assets, e.g., human, social, financial, and natural assets. Its impact is felt both on the economic and social sectors. Without roads, the poor are not able to sell their output on the market. In India, it has been shown that roads alone account for seven percent of the growth in aggregate output of the rural areas (paragraph 2.1.2.). Without electricity, the industrialization process, which provides the poor an important source of employment is unlikely to take off. In Costa Rica, a retrospective review of the rural electrification experience through electrification cooperatives indicates that for one of these cooperatives the number of major businesses jumped from 15 to 86 after electrification (paragraph 2.1.4). Without potable water and sanitation health is at risk. The social and economic impact often go hand in hand. The retrospective evaluation of a feeder road project in Morocco shows that beyond its impact on agricultural production, it was associated with a trebling in the enrollment of girls in primary schools. And the use of health care facilities nearly doubled. (paragraph 2.2.1). In Bangladesh, electrification has been shown to have a substantial impact on the reduction in women's fertility (paragraph 2.3.1)

iii) However, the link between infrastructure and poverty is no more obvious than that between famine and crop production. As pointed out by Amartya Sen, the key is entitlement and capacity. The most devastating famines were not primarily the result of inadequate production but of inadequate entitlement to food. In infrastructure terms, entitlement translates into access. For the poor, the most dramatic impact of inadequate infrastructure may be less the result of lack of infrastructure per se but more the lack of access to that infrastructure. What good is a road if it has no transport services or the poor can only afford to walk? What good is electrification if the poor can't afford to connect? Given the inter-linkage between social and economic impact, lack of access results in overall exclusion from opportunity and development. Developing a clear picture of the mechanisms through which the poor are excluded from access to infrastructure is useful to understand better the link between poverty and infrastructure, and to develop more pro-poor infrastructure policies.

iv) Exclusion of the poor from access to infrastructure operates essentially in three ways; i) through location, ii) pricing, and iii) socio-political factors. The most trivial exclusion mechanism, and accordingly the one that gets the most attention is the sheer availability of infrastructure: without roads entire regions can be cut-off from the economic development process, poor and less poor alike. The solution to this aspect of the exclusion problem is simply the provision of more infrastructure. Notwithstanding availability, the poor's ability to access available infrastructure services is a crucial issue.

v) The second facet of the exclusion mechanism is thus the affordability of infrastructure services. Infrastructure is available but access to it is beyond the means of the poor. The solution to this aspect of the problem is often thought off in terms of subsidies. But the poorer the country or the community, the least likely it is to have the institutional capacity to administer a subsidy system efficiently and, in most cases, the cure has proven to be worse than the disease: heavily subsidized urban transport services almost automatically lead to deterioration and sometime the total collapse of urban transport companies. While in some cases subsidizing infrastructure services for the poor may be part of the solution, it can't be its primary component, assuming it should be part of the solution at all. The primary route to increasing affordability has to be through cost reduction. It can be achieved through the selection of more appropriate design standards, as reflected for example in the "condominial" sewerage system in Brazil (paragraph 7.4.2), or by finding better engineering solutions as the joint UNDP/World Bank water program did very successfully with water pumps (paragraph 3.3.5). But, as a general rule, the most effective way of reducing cost is to make sure that, where competition is possible, either for or in the supply of infrastructure services, it is fully taken advantage of and that markets are working properly (paragraph xii).

vi) Affordability, however, is not just a financial issue; for many poor it is a combination of time and money. For example, because they can't afford motorized transport they have to walk, and the time it takes them may not only add considerably to the time they spend away from home but may simply exclude them from even looking for work, often explaining why they have no choice but to live on the street close to sources of employment potential. The assumption that the value of the time of the poor is low, implicit in many decisions on infrastructure projects, is fundamentally flawed and more work is needed to better understand the value of their time.

vii) The third facet is socio-political exclusion. The poor do not have the political weight they need to insure, for example, that the water stand-post is located close to their houses, or that they get their share of irrigation water even in periods of water scarcity. In the worst cases they are completely excluded from access to infrastructure because they belong to one ethnic group or cast rather than another. Perhaps because this is the most difficult aspect of access to infrastructure services to deal with, it is seldom addressed. The only solution is through systematic inclusion of the poor, disadvantaged and minorities in the decision making process. In some Latin American countries participation has been made into law (paragraph 3.4.3) but experience shows that these laws are only efficient where local authorities are predisposed to follow participatory practices.

viii) Is there a conflict between growth oriented infrastructure policies and policies focusing on reducing exclusion? From a limited analysis of the transport sector,

using a simple traditional regional development model (the Ellett model), it would seem that this may not be the case: the best policy from a growth point of view is also the best from an exclusion reduction point of view. However, hardly any work has been done on this topic and the analysis carried out on the transport sector in the context of the preparation of this paper is far too restricted in scope and simplistic in its assumptions to support any broad conclusion on the subject other than to suggest that it is an important topic which would deserve more attention.

ix) The link between exclusion and infrastructure reflects a “static” aspect of poverty, focusing on what can be done to improve the lot of those who are already poor. There is also a “dynamic” aspect related to the prospect of becoming poor or of falling from poverty into total destitution. This aspect of poverty is encapsulated in the concept of “vulnerability”. The poor often live in the least desirable parts of towns and villages and are the first ones to be hit by natural disasters. Their farms are at the periphery of irrigated areas and are the first to be hit by drought. Their villages are isolated and access to medical support is difficult. As reported in a feedback from “The Voice of the Poor”: *Each day there is a funeral in a nearby village because of the distance to the hospital.*

x) The link between infrastructure and vulnerability centers around the mitigation of the impact of natural disasters or economic shocks. Mitigating the risk of natural disasters is not simple and the record shows that developing countries have a much harder time protecting themselves. Developing risk reduction strategies involves essentially banning building in hazardous zones and establishing design standards that can withstand the effect of natural disasters. While the high cost of some mitigation measures may be a problem for developing countries, others, such as good drainage and sound overall design, are affordable and may go a long way toward preventing more routine problems such as those caused by flooding. Regular maintenance of roads is an example of a win-win strategy, which is both economically sound and critical to food security and famine relief.

xi) The impact of economic shocks on infrastructure is often overshadowed by its social impacts. But, in the long run, it can be significant and have important poverty implications. For example, of all the resource allocation scenarios currently considered by Indonesia to make the best possible use of its road budget, in the best one 70 percent of the district roads will remain in poor or bad condition, in spite of these roads being allocated the largest share of the budget (paragraph 6.3.2). The condition of these roads can be expected to have a very negative impact on rural poverty. There is also a link through public works programs. In periods of crisis, constructing infrastructure through public workfare programs, can be an important poverty alleviation measure as well, through its employment impact. Often when employment creation is the only objective, the resulting infrastructure may neither be of high priority or high quality. But retrospective reviews of these programs have shown that this need not be the case.

xii) The private sector, which is sometime seen as part of the problem because the infrastructure services it provides are seen as more expensive than state subsidized public services, is an important part of the solution. But, for the private sector to play an effective role, markets are working properly and achieving this objective should be the main focus of the regulatory environment. Traditionally, policies have focused on regulatory measures aimed at ensuring the exclusivity of the provision of service, service

obligation, and uniform service standards and have relied on subsidies to cover the “affordability” gap of the poor. Instead, policies must focus on facilitating entry into the market, particularly for small entrepreneurs, and on the aspects of the regulatory system dealing with outputs, the coordination of standards to facilitate entry, and where applicable, the pricing and terms of bulk supply.

xiii) Among the most recently emphasized links between infrastructure and poverty is the link through social capital. This is a two-way link. The impact of infrastructure is related to the social interactions (social capital) within the group benefiting from the infrastructure. In one village electrification or road improvements may have a considerable impact, while, in another, it will have little or none. The difference in impact, all other conditions being equal, is the result of differences in attitude. Where the community is open minded, where its members have extensive exchanges with neighboring communities, where there is trust and transparency among individuals, infrastructure investments are likely to be successful and benefit the poor. Inasmuch as these factors can be captured under the heading “social capital”, where social capital is high infrastructure can be expected to have much more of an impact than when it is low. Conversely, recent research has shown that the most positive impact on social capital came from better communication and, in general, a more outward view of the world. By directly addressing communication problems, or indirectly favoring exchanges of ideas by making communities more attractive to the inflow of people and/or investments, infrastructure can therefore be expected to have an important impact on social capital build-up. Recent research has also shown that the poor could be expected to benefit the most from such an increase in social capital. A better understanding of the link between infrastructure and social capital is still needed, but it can be expected to affect poverty directly through a better investment selection process, and indirectly by contributing to an increase in social capital, which stands to benefit the poor the most.

xiv) There are other facets of the link between poverty and infrastructure which deserve further work. Among them is the way in which the impact may vary for the poor and the very poor. For the latter, falling one step lower means total destitution and, as a minimum, infrastructure policies should look at different sub-groups among the poor. For example, for the poor, pricing may be a key urban transport issue, while it will be a lot less relevant to the very poor, who may not be able to afford motorized transport, whatever the fare structure. Similarly, the impact of infrastructure on transient poverty (for those coming in and out of poverty) is likely to be different from that on permanent poverty. Finally, in view of the importance of the infrastructure/poverty nexus, it would be useful to develop poverty indicators that give more weight to the availability of infrastructure than is the case now. At present this is done largely through access to water (probably because the water sector is considered to be a social sector) and occasionally through the level of electrification. But this is only the tip of the iceberg and a more comprehensive indicator is seriously lacking.

INFRASTRUCTURE AND POVERTY

1. Introduction.

1.1. The main purpose of this paper is to review the state of our understanding of the impact of physical infrastructure on poverty. It addresses the infrastructure-poverty linkage within the context of the various dimensions of poverty. Poverty is a multi-dimensional phenomenon and it is clear that there are aspects of poverty which go beyond the conventional measures of monetary income. There are dimensions of well-being such as health, life expectancy and literacy which can not be fully captured by material consumption. In addition the poor frequently mention security and the ability to influence decisions as being important to them. The lack of security and ability to influence decisions which concern them are additional dimensions of a life in dignity frequently mentioned by the poor. Thus risk and vulnerability and powerlessness and voicelessness are key dimensions of poverty as well. This paper looks at all these dimensions. It starts with the socio-economic impact of infrastructure on poverty, which is the facet that has been most emphasized in the past, and goes on to explore the impact of infrastructure on reduction in exclusion, the link with social capital, reduction in vulnerability, and the implication for the provision of private sector services. Powerlessness and voicelessness are treated in the section on exclusion.

2. Socio-economic impact.

Infrastructure services impact on growth and social development. This section examines the linkage between infrastructure and the economic and social sectors.

2.1.1. *Infrastructure and growth.* Creating or improving infrastructure has traditionally been seen as a major contributor to growth and poverty alleviation as a by-product of growth. The link between infrastructure and growth has been the object of many econometric studies. In a review of the literature on the subject, Ahmed and Donovan¹ group these studies into those that look at the impact of infrastructure at the aggregate level, at the village level, and at the farm level. At the aggregate level, as shown in Table 1, on the basis of a study of 58 countries, Binswanger² showed that roads and irrigation had an important impact on many facets of rural development. A 10 percent increase in the percentage of roads paved (used as a proxy for the quality of infrastructure) leads to a nine percent increase in aggregate output, as does a 10 percent increase in the percentage of the area under irrigation.

Table 1: Link Between Infrastructure and Agricultural Production

Variable	Aggregate Output	Crop Output	Crop Area	Crop Yield
Irrigation	0.899 (5.1)	1.347 (12.4)	0.349 (1.9)	0.759 (6.0)
Road density	0.359 (10.8)	0.265 (8.6)	0.108 (3.1)	0.172 (7.8)
Roads paved	0.9 (10.5)	0.984 (12.2)	0.573 (6.1)	0.254 (5.2)

Source: Binswanger et al 1987.

2.1.2. At the village level, Table 2 depicts a study on India³ which again shows the importance of roads as a factor in growth. Just about seven percent of the growth in aggregate output can be directly attributed to road investments, in addition to indirect contributions through the attraction of Banks to areas with improved roads. Electrification, which is linked to the growth in output through its impact on irrigation, explains two percent of the growth in aggregate output.

Table 2: Contribution of different factors to growth in aggregate output.

Village level study, India 1971-81

Independent variable	Share of growth attributable to the independent variable
Road Length (1,000 km per sq. km.)	0.067
Canal Irrigation (1,000 ha per sq. km.)	0.004*
Primary schools (village per 10 sq. kms.)	0.021
Rural Electrification (elect. Villages per 10 sq. km.)	
Actual growth	0.239

Not statistically significant at the 10 percent level

Source: Binswanger et al 1989.

2.1.3. However, while there may be a clear link between infrastructure and growth, the link with poverty is neither automatic nor necessarily direct. Creating infrastructure on the blind hope that it will automatically and directly alleviate poverty is both naïve and simplistic. Infrastructure may not have an economic impact. Equally, its impact may go well beyond simple economic considerations.

2.1.4. Rural electrification provides a good example of the absence of an automatic link, at least in the short run. In the 1960s and early 1970's, Costa Rica initiated a considerable effort to improve rural electrification which resulted in an increase in the national electrification coverage from about 42 percent in the mid -1960s to 92.7 percent at the beginning of 1995. Even though, when the program was initiated, the country was already relatively prosperous in comparison with most part of the developing world⁴, electricity did not automatically reach the farms. A large part of the program was centered on the creation of electricity distribution cooperatives and in a review of the experience with the program, Foley⁵ refers to an evaluation of three cooperatives which recorded significant impact as evidenced by the figures quoted below in Table 3 for one of them:

Table 3: Impact of rural electrification

Costa Rica

Impact of Electrification		
	Before	After
Education Institutions with Lighting	7	48
Number of Health Centers	7	23
Towns with Public Lighting	3	60
Major Business Establishments	15	86
Industrial Plants	10	15
Motels/Hotels	0	11

Source: Foley 1997.

The other two cooperatives were reported to have had similar impacts, however, at the time of the survey, the uptake by farmers was much more modest. For the second cooperative, of the 9,000 farms in the service area, only 340 had electricity and, of these, 189 had their own supply before the establishment of the cooperative. The figures were similar for the third: of the 15,180 farms in the service area, 521 had electricity, of which 354 predated the establishment of the cooperative.

2.1.5. While not automatic, the link between infrastructure and poverty reduction is not simple either. The complexity is illustrated well in an impact evaluation of a feeder road improvement project in Morocco⁶. The impact evaluation was carried out in the second half of 1995 and focused on four rural roads financed out of a World Bank highways project completed in the late 1980s. It found that the impact on agricultural production went well beyond an increase in yield on the production of existing crops (as one would expect for example from a more extensive use of fertilizer made relatively less expensive because of lower transport costs). It also led to an extension of the area under cultivation (because reduced transport cost make it worthwhile to cultivate lands that were previously “economically” too far from markets.) Instead of these simple and direct impacts which are those normally taken into consideration in traditional cost benefit evaluation of investments in feeder roads, the impact followed a more “qualitative” path, as evidenced in Box 1, which resulted in substantial changes in the agricultural “culture” in the zone of impact of the roads that had been improved.

Box 1: Roads and Agricultural Culture Change

When rural roads were improved in Morocco, the agricultural production mix was transformed as farmers shifted land from low value cereals to high value fruit orchards. These orchards yield higher profits, thanks to the reduction in the risk of the crops perishing brought about by the better quality and year-round operation of the improved roads. In two of the three study regions, land used for vegetables and fruits increased over 40 percent over the study period. Livestock production shifted towards pure breed cows, also a higher yield activity. The use of modern agricultural inputs, especially fertilizers, increased as improved transport made distribution channels better. Use of agricultural extension services by small farms increased more than fourfold over the study period. Improvements in the agricultural economy led to economic changes in workloads, employment on farms and establishment of new shops. These changes followed different patterns depending on the region. Off-farm employment grew overall by more than six times in the project zone (compared to about three times in the control zones) and happened across all three regions. The study found that agricultural practices in the control zones, which did not benefit from improved roads, remain essentially the same today as a decade ago.

Source: Levy 1996

2.2.1. Infrastructure and social development. Perhaps more importantly, the impact of the Morocco project went well beyond agricultural production. The surveys showed that while enrollment in primary education increased throughout all areas covered by the study, the gains in the areas served by the project roads, where enrollment more than doubled between 1985 and 1995, was much higher than in the control roads. In parallel, the quality of education improved, as it became possible to recruit teachers to staff the schools, and absenteeism of both teachers and students dropped. The rural population also nearly doubled its use of hospital and primary care health care facilities, and, similarly with education. The quality of health services was enhanced as the supply of medicines improved, health officials launched a campaign to staff rural health care centers with a doctor, and immunization and other health prevention programs became easier to implement. Some of the social impacts were especially marked for women. Girls' enrollment in primary education trebled over the period, expanded or new maternal and child care programs were made available and accessible, and the introduction of butane at affordable prices (thanks to the existence of paved roads) dramatically reduced women's chores of daily collection of fuel wood for cooking and heating.

2.2.2. The link between school attendance and infrastructure is often a matter of time availability. The lack of infrastructure means that the same task takes a lot more time. This is typically the case with water. Where water availability is poor it has to be fetched far away and this is typically the duty of women and young girls. The link with school attendance in Madagascar⁷ is illustrated in Table 4.

Table 4: School Participation Rates
(percent)

	Children of school-going age who			
	Do not go to school		Go to school	
	Boys	Girls	Boys	Girls
Spent time collecting water	37	83	41	58
Did not spend time collecting water	63	17	59	42
Total	100	100	100	100

Source: Bredie and Beehary 1998.

The percentage of boys spending time collecting water is similar whether they go to school or not. In contrast, girls going to school were two and a half times less likely to spend time collecting water than those who didn't. As shown in Table 5 below, this is consistent with the fact that the amount of time spent collecting waters is greater for girls than for boys, and much greater in the case of girls who do not attend school. Obviously collecting water is not the only task that is related to a lower school attendance. However the relatively large amount of time spent collecting water by girls who do not go to school (4.1 hours), in relation to the total amount of time spent on all household tasks by girls who go to school (8.8 hours) suggests that going to school is unlikely to be compatible with poor access to water.

Table 5: Average Hours Spent Collecting Water

	Children of school-going age who			
	Do not go to school		Go to school	
	Boys	Girls	Boys	Girls
Average number of hours spent collecting water per week	1.4	4.1	1.5	2.3
Average number of hours spent on all household tasks	8.9	21.1	5.6	8.8

Source: Bredie and Beehary 1998.

2.3.1. The social impacts of infrastructure are far reaching. For example, Hoque⁹, in an exhaustive analysis of the link between electrification and fertility in Bangladesh, concludes, as shown in Table 6, that there is a very strong link between fertility and fertility related issues and the level of electrification:

Table 6: Link between Electrification and Fertility in Bangladesh.

	Percent of Women Practicing Family Planning	Mean Ideal Family Size	Children Ever Born	
			Average	10-19 age group
Electrified households	46.6	2.67	5.15	.67
Non-electrified households in Electrified Villages	29.5	2.94	5.06	1.4
All Non-electrified Households	25.5	3.06	5.2	1.17
Electrified Villages	40.6	2.77	5.12	1.00
Non-electrified villages	21.2	3.2	5.35	1.00
Overall	35.8	2.88	5.17	1.00

Source: Hoque1998

While, overall, the figures on the total number of children born are similar with and without electrification, the difference for women in the 10 to 19 age group is much more significant. The figures indicate that the impact of electrification is essentially on the younger generations as older age groups straddle pre and post electrification periods and are less likely to change attitudes quickly.

3. Exclusion and Infrastructure.

3.1.1. *Entitlement and capabilities.* The socio-economic link between infrastructure and poverty discussed above concentrates on the physical availability of infrastructure. But the physical availability of infrastructure does not guarantee that the poor will benefit from it, far from it. As Amartya Sen has pointed out, poverty is essentially a matter of entitlement and capabilities:

“... the most important deficiency of traditional development economics is its concentration on national product, aggregate income and total supply of particular goods rather than on ‘entitlements’ of the people and the ‘capabilities’ these entitlements generate.”¹⁰

In the same way as the most famous famines were more a matter of food policy than of food availability, and that the income of a villager can be increased but that

“...if there are no schools in the village and no hospital nearby... this rise in income may not be able to deal adequately with his entitlement to education or medical treatment...”¹¹,

the availability of infrastructure per se may not have much of an impact on the entitlements of the poor. Translated into an infrastructure term entitlement means access. Providing infrastructure is relatively easy. It may be expensive and technologically complex in the case of large power generation plants or ambitious civil works projects, but these difficulties can be mastered. Furthermore, the type of infrastructure that the poor need the most is often simple and small scale. On the other hand, making sure that the poor have access to it is much more difficult. If the water stand-pipe is far away from their house they may prefer to use the nearby traditional well even if its water quality is poor. There may be a good urban transport system but, if they can't afford to pay the fare they will keep walking. There may be reasonable health facilities but without adequate transport access it will be of little use.

3.1.2. The converse of access is exclusion and, in the infrastructure context, exclusion manifests infrastructure manifests itself essentially in three ways:

- Exclusion through location
- Exclusion through pricing
- Exclusion through socio-political factors.

3.2.1. **Location related exclusion.** Many poor live in remote areas and inadequate or nonexistent infrastructure is a major factor inhibiting them from improving their lot.

“Each day there is a funeral in a nearby village because of the distance to the hospital”¹³.

This seemingly innocuous quote from the “Voices of the Poor” summarizes location related exclusion eloquently.

3.2.2. In the urban context, the problem ranges from transport to and from work for those who have a steady source of employment, to actually identifying a source of work, sometimes on a daily basis, for those who are dependent on casual employment. There is a dearth of data on the transport situation of the urban poor, particularly when it comes to non-motorized transport usage but, while the full dimension of the problem may not be well documented, it is clear that the problem is large. In the context of his work on Colombia, Rakesh Mohan¹⁴ reports that, as shown in Table 7, in Bogota travel time of the poor, is about 5 percent higher than for the population at large:

Table 7: Work Trip Travel Time by Income Level: Bogota and Cali, Colombia, 1978
(Minutes per trip)

Monthly household income (1972 Col\$)	Bogota	Cali
0-500	41.2	27.3
500-1,000	43.6	34.1
1,000-1,500	43.8	30.2
1,500-2,000	46.6	39.6
2,000-3,000	48.6	37.4
3,000-5,000	44.8	36.9
5,000-15,000	38.4	32.4
15,000-30,000	30.9	20.9
More than 30,000	27.6	-
Overall average	42.3	34.6

Source: Mohan 1994

3.2.3. These figures refer only to motorized transport and, as such reflect only the tip of the iceberg. The poorest of the poor often do not have access to motorized transport or can't afford it. In a review of urban development issues Johannes Linn¹⁵ reports that in the mid 1970's walking trips accounted for two-thirds of total trips in large African cities such as Kinshasa and Dar es Salaam. Walking and cycling trips accounted for 60 percent of total trips (40 percent of work-related trips) in Karachi, and in Madras a third of vehicles entering the central business district each day were cycles, as were more than 25 percent of vehicles passing a cordon some 10 miles out.

3.2.4. The importance of non-motorized transport for the poor is further evidenced in personal travel data collected as part of the 32nd round of the India National Sample Survey in 1977 and 1978. The travel questionnaire was administered to the full 32nd round sample which included nearly 100,000 rural households and to more than 58,000 urban households containing in all more than 800,000 persons. Some of the key findings of this survey are summarized in Annex 1¹⁶. More than half the total number of trips in either rural or urban areas is related to work. Combined with trips related to school attendance these trips account for about half of the total distance traveled and, in the urban areas, about half are by walking or biking. In the rural areas this percentage is much higher, 91.2 for work related trips and 84.7 percent for school related trips. This choice is motivated essentially by economic considerations. As shown in Table 8 below, the amount of money the very poor can afford to spend on transport is extremely low.

Table 8: Share of Travel in Total Household Expenditures

Weekly household expenditures (Rupees)	Expenditure level						Mean
	0-20	20-40	40-60	60-100	100-150	150+	
Share of travel in total expenditure (%)							
Rural	.5	1.2	1.3	2.4	2.1	3.4	2.6
Urban	n.a.	1.2	1.8	2.2	3.5	3.4	2.8

Source: India National Sample Survey

In the lowest household expenditures bracket, and in absolute term, the poor spend from 20 to 50 times less on transport than the average population. This rules out most forms of motorized transport and has important policy implications for the very poor. Subsidies

on public transport are likely to affect them to a much lesser extent than any policy aimed at improving non-motorized transport or acquiring bicycles. For most of them, a bicycle is the next step up in easing the transport barrier they have to face in gaining access to employment. The importance of employment related trips is further confirmed by the relatively low percentage of production related trips. Trips related to the sale of the household's own production, or the purchase of goods necessary for that production, account for only 6.4 percent of the distance traveled by urban households and 8.2 percent for their rural counterparts.

3.3.1. *Pricing related exclusion.* The household expenditures figures quoted above are a good illustration of the importance of the cost of infrastructure services to the rural poor. The service may be available but they can't afford it. The Nigeria water expenditures quoted in paragraph 7.2.1. below tell a similar story. Paying for access to infrastructure services accounts for a very important share of the household budgets of the poor.

3.3.2. The first reaction to this problem is to consider subsidized services for the poor. But, as pointed out in paragraph 7.3.3, this poses serious problems and the cure may be worse than the disease. In practice, subsidies are a crucial obstacle to the entry of the private sector into the provision of infrastructure services which, in many instances, is key to the poor getting any service at all. If subsidies are to be resorted to some key conditions have to be met:

- The source of subsidies has to be clearly identified and the implications for the provider have to be assessed realistically.
- The prospect for sustainability of the payment of the subsidy has to be realistic.
- The mechanism for the payment of subsidies has to be simple and yet minimize leakages to the non-poor.

There are countless examples of low urban transport fares leading to the collapse of urban transport companies or extremely poor quality services, of water companies which do not do justice to the needs of the rural areas in order to limit the amount of cross-subsidies from the urban formal sector and of grossly over committed local government budgets which can only make good on a fraction of their commitments. Furthermore, administering an effective subsidy system requires financial means and strong institutions, two resources which are often badly lacking in the least developed communities. The result is that a subsidy system is least likely to work effectively in the poorest countries where, a priori, it would be needed the most.

3.3.3. While subsidies can be made to work if they are well managed and kept within realistic boundaries commensurate with the financial resources of the provider, they should not be envisaged as the primary source of defense against the financial exclusion problem. They can only help "at the margin". The primary line of attack against the high cost has to be more basic and address the root cause of the problem, namely the high cost itself. In countless instances, the poor are paying far more than they need to, even without any subsidies whatsoever. There are many reasons for that but the most typical ones are:

- Lack of competition in the provision of the service.
- Inappropriate design standards.
- High construction costs.

3.3.4. Of these three factors the dominating one is almost always the first, and the area in which the most significant savings can be achieved. Contrary to often widely held views, the private provision of infrastructure services, far from being the cause of the financial exclusion of the poor, is a key element of the solution to the problem. If and where it appears to be a problem, it is almost always because the market does not work properly. Hence “making markets work” is key to reducing exclusion due to pricing. This is discussed in more detail in section 7 below on the role of the private sector.

3.3.5. While reducing costs through “engineering” solutions (using appropriate design standards or reducing construction costs) may afford less promising results than improving the functioning of markets, particularly in instances in which there is a dynamic private sector in the first instance, it can nevertheless have a non-negligible impact. For example, the introduction of efficient and robust water hand pumps has been shown to reduce the cost of rural water provision by a factor of three to four in Africa and one to two in Asia . But, here again, the purely engineering facet of the achievement can be less crucial than its institutional dimension. The poor are used to building with very limited resources. For example, in the Sahel, the classrooms they build seldom cost more than about a tenth of those provided by the Government¹⁷. The extreme constraint on resources also means that these classrooms are built to extremely low standards and often not worth the effort that went into them. But the large gap between the cost of what local communities, left to their own devices, can do, and the cost of “top down” government interventions, suggests that the biggest scope in reducing costs through “engineering” solutions is not necessarily through better engineering but through higher community participation in the design and construction process. Local communities know best what level of service they need in relation to what they can afford, and they have extensive experience with low cost construction methods. Blending this source of experience with the knowledge of what has been done elsewhere and a minimum increment in the financial resources required to build to the desired standards is the surest route to cost reduction.

3.4.1. ***Socio-political exclusion.*** Economic exclusion is but one facet of the exclusion picture. Socio-political status can have an important impact on access to infrastructure services and the least wealthy can easily end up having to do more work and reap less benefit. This is vividly illustrated in Box 2 on water user associations in Pakistan¹⁸. This example highlights the fact that traditional committees and member-based associations may be exclusive or inclusive depending on the rules that govern them.

Box 2: Exclusive and Inclusive Associations

In the Parnawan community in the Punjab, the farmers traditionally relied on a committee of farmers to organize cleaning and maintenance of the 'khal' (communal section of the irrigation system, not maintained by the provincial government). This committee was comprised of three to four elite members of the village, including the village headman serving as the committee chairman. Committee members had large parcels of land. While they were respected by the farmers they used their power to set the rules governing the irrigation system so that it benefitted the upstream, often richer farmers. The customary procedure for organizing farmers to work on kahl cleaning was for the committee or its representative to divide the khal into sections from the intake to first turnout and from there to the second turnout, etc. Within each section, farmers were assigned a distance to be cleaned proportional to the acres of land they owned. All the farmers participated in cleaning the first section. Once this section was cleaned, the farmers who received all their water from the first turnout had fulfilled their cleaning obligation and were free to go. Farmers at the tail end of the system, who are often poorer, were required to clean each section of the khal from the intake to the last turnout. While they do more work, farmers at the tail end of the system do not necessarily get the benefit of it:

"... Muhammad Nazir, a farmer owning 155 ac in the middle to tail reaches of this W/C (Water course), would very much like to see W/C improvements... Generally, most farmers own 20-30 acres. Nazir sees one obstacle to W/C improvement, namely, an absentee landlord, a big land owner who has 600 ac at the head of this W/C. 'If the big landlord were located at the tail', Nazir explains, 'he would surely use his power and influence to ensure that more water reached the tail, and all farmers from the head to the tail would thereby benefit'.

However, where the lands of a big and powerful landlord are allocated at the head of the W/C, he can easily draw all the water he needs, with tail enders accordingly receiving much less. Nazir reports that many tail enders are taking land out of production for lack of water or even leaving their farms to search for work in the cities. The small farmer who is tail ender is particularly at risk if the big landlord takes so much water that the tail ender's crop suffer severe water stress.

The head ender in this case, the big landlord, is not satisfied to draw water only during his warabandi (water allocation system) turn. He has arranged for a constant stream of water to run to a small garden. Further he is growing some 200 trees on the right of way along the 'sarkari khal' [communal portion of the irrigation system] thereby drawing additional amounts of unsanctioned water, and selling the wood when the trees mature. Small farmers have requested him to remove the trees but he ignores them. Individual farmers, lacking a [DEMOCRATIC?] Water User Association or government support and backing of the authority of such association, have no power or authority to sanction the big landlord's infractions." (p.21)

Source: Byrnes, 1992

3.4.2. Socio-political exclusion is pervasive and, in its worst manifestations related to ethnic or cast considerations as illustrated in Box 3 ¹⁹. Members of certain casts or ethnic groups are often charged higher rates than others or denied service and can, for example, be prevented from accessing existing infrastructure such as a water supply system. It is therefore essential not to take for granted that infrastructure intended for the poor will actually reach the least privileged groups. At the design stage detailed knowledge of social traditions and the way they affect the poor is essential. At the implementation stage it is equally essential that the poor be given voice in the decision making process.

Box 3. Cast Base Exclusion In India

Caste is a category of exclusion vital in the Indian context among the Hindus, that is fixed at birth. This category is typically studied by sociologists and ignored by economists, but its importance can hardly be overemphasized. There are several aspects of exclusion that cannot be characterized by a person when he is described as being simply poor or unemployed. For example untouchables in many parts of India are prevented entry into certain temples; there are certain villages where members of the Scheduled Caste (SC) are forbidden use of certain village wells that are the exclusive preserve of the upper caste members. This is because to be in contact with a schedule caste person is to be polluted.

Bhimrao Ambedkar, an important Indian leader and freedom fighter, was born a Mahar, an untouchable community in Maharashtra. His father Ramji Ambedkar was a retired military man and had 14 children. Bhimrao, the last child, was born at Mhow in Central India on 14 April 1891. During his schooldays Bhimrao realized what the stigma of untouchability meant. Once a cartman refused to associate with him and his brother in a bullock cart. Bhimrao and his brother were going to Goregaon from Masur railway station. They secured a bullock cart. Hardly had the cart gone a few yards when the cartman knew that the boys in the cart were untouchables. The boys paid the cartman double the fare. Bhim's elder brother drove the cart and the cartman followed the cart on foot for fear of pollution (see Kuber, 1978). Another bitter and humiliating experience for Bhimrao in his childhood was that no barber would cut his hair because of pollution, and Bhimn's sisters used to cur their brother's hair.

Source: Pulin Nayak, 1994.

3.4.3. Awareness of the importance of empowerment in the decision making process is increasing among policy makers and donor agencies, as is awareness that legislative reforms can promote constructive interaction, for example by obliging local governments to consult with organizations of civil society on the use of public resources and the implementation of public policies. The 1994 Law of Popular Participation in Bolivia is an example of such a law. It's implementation shows that it is an important adjunct to decentralization in stimulating partnerships. The Local Planning Law (Law 152/94) in Colombia serves a similar purpose. However these laws can't be a substitute for the will to involve the poor in the decision making process. They are only effective where local authorities are predisposed to follow participatory practices²⁰. There is a similar law in Vietnam requiring local governments to consult with their constituents.

4. Exclusion versus growth in the transport sector.

4.1.1. The Ellet model. An important issue from an infrastructure perspective is whether policies aimed at reducing exclusion are different from those aimed at maximizing production. Although there is little if any work done on the subject, there are indications that these two objectives may not be in conflict. This section briefly reviews this issue in the case of the transport sector.

4.1.2. Annex 2 builds on a regional development model that goes back many years²¹ and was last developed by Alan Walters in a study of road user charges²². The Ellet model, as Alan Walters refer to it, considers a region in which land is homogeneous and can be expected to have the same agricultural potential throughout. A port P provides access to a hinterland through a road that runs East West, perpendicular to the coast line. The area is assumed to produce a single crop K that is sold at a fixed price of \$k per ton at P (net of the production cost on the farm). To get to the port the crop is first carried to

the road in a North/South or South/North direction at a cost of \$b per ton-km and then on the road at a cost of \$a per ton-km. It can then easily be shown that the maximum area that can possibly be cultivated is the inside of the triangle ABC (fig. 1), in which:

$$PA = k/b, \text{ and}$$

$$PC = k/a$$

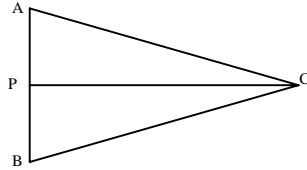


Figure 1

Any farmer outside the triangle ABC is excluded from the regional economy and can only be expected to live a subsistence economy on his farm. If the road does not go all the way to C but stops at E (fig. 2), the exclusion area boundary is ABHFG where:

$$EF = EG$$

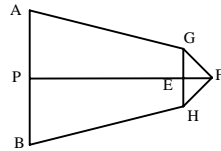


Figure 2

4.2.1. **Exclusion versus growth.** The issue addressed in annex 2 is how the impact of an investment in an extension of the road beyond E would compare with the impact of the same investment in an improvement of the existing road AE whether one looks at it from an exclusion angle or from a growth angle. Looking at it from an exclusion angle implies being concerned by the surface of the area ABHFG, while looking at it from a growth angle implies being concerned by the volume of the rent pyramid²³ (Figure 3).

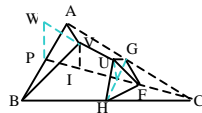


Figure 3

4.3.1. **Results.** As can be expected, the choice between expanding the road or improving it varies. But the variation is only a function of the transport cost off the road (i.e. “b”). If b is high (making the area ABHFG rather elongated) the preferred policy consists in extending the road. On the other hand, if b is low (making the area ABHFG rather “fat”) the preferred policy is to improve the road. The choice is independent of the initial length of the road or of the value of the crop (k). More importantly, it is the same whether one looks at it from an exclusion or a growth perspective: the best choice from a growth perspective is also the best choice from an exclusion perspective. The two other findings of significance are:

a) The impact of either improving the road or lengthening it goes down very quickly as the transport cost off-road increases. For example, for a 20km road, and under the other assumptions for which the analysis was carried out, the first year cost benefit ratio of an improvement project drops by a ratio of more than 100 times when the transport cost off-road increases by a ratio of 4. For the same variation in off-road transport cost, the exclusion impact also varies dramatically by a ratio of over 10. This finding suggests that the best way to help the poor may be much more by reducing off-road transport cost than by improving or extending existing networks. This can be done by introducing new or less expensive means of non motorized transport (NMT).

b) Neither the economic or the exclusion impact vary a great deal with the length of the road. This suggests that, everything being equal, large projects will have as much impact on reducing exclusion as small one. Small is not automatically beautiful.

4.3.2. In view of the extent of the simplifying assumptions made in the underlying model, these findings are tentative. But the conclusion that minimizing exclusion is in no way contradictory with maximizing growth is potentially important and would deserve a more in depth analysis.

5. Social Capital and Infrastructure

5.1.1. The link between infrastructure and poverty probably goes far deeper than the growth and social sectors impact discussed above. Infrastructure plays a major role in creating a link between isolated communities and the rest of the world. The link can be direct or indirect. Until recently, direct effects through improvement in communications meant essentially improvement in the transport system. At this point improvements in telecommunication and internet connections may play an even greater role. It is not uncommon in remote villages of Africa or Bangladesh to see adults speaking to far away relations on a cellular phone, or children accessing the internet. As far as the indirect effects are concerned, good infrastructure is likely to attract better teachers, better agriculture extension agents, and open the door to industrial or agro-industrial development. These influxes are like many windows opening up again on the outside world. They bring with them outside influences and stimuli and result in profound changes in mentalities and attitudes.

5.1.2. *Social capital and poverty.* These changes in mentality and attitude are an important part of the concept of social capital. There are many definitions of social capital and, according to some, its tendency to be “everything to everybody” is the main reason explaining the success of the concept. But all these definitions go back to what would commonly be called “social interaction”. As Michael Woolcock and Deepa Narayan²⁴ put it in a draft article submitted for publication in The World Bank Research Observer:

“It’s not what you know, it’s who you know”. This common aphorism sums up much of the conventional wisdom regarding social capital.

This broad notion of social capital as an indicator of the level of social interaction of a community is the one that will be referred to in the rest of this section.

5.1.3. The link between social capital and poverty has only been investigated in the recent past but seems conclusive. The findings indicate that not only is a higher level of social capital associated with a higher level of household welfare but that the poor benefit even more than the less poor (see Box 4). Social capital can thus be expected to contribute to poverty reduction.

Box 4. Social Capital Impact

Three recent Bank studies in Indonesia²⁷, Bolivia²⁸, and Burkina Faso indicate that social capital has an impact on household welfare about equivalent to that of human capital.

In the Indonesia case, Grootaert concludes:

*“The magnitude of the social capital effect was found to be similar to that of human capital. Increasing the average endowment of education for each adult in the household by one year (which is about a 20% increase) would increase household expenditure per capita by 3.4 %. A similar increase in social capital endowment would increase household expenditure per capita by 2.3%.”*²⁹

In the same study he also concludes that:

*“The results indicate that social capital can significantly reduce the probability to be poor (table 7). The average household with 5.5 memberships has a 7.26 percentage points lower probability to be poor than a household with no memberships. Active participation and memberships in heterogeneous organizations further reduce the likelihood to be poor.”*³⁰

5.2.1. **“Good” and “bad” social capital.** However, not all facets of social capital have the same impact. Recent studies, and the three mentioned above among others, point to the fact that not all facets of social capital contribute to poverty reduction. The social norms and behaviors associated with the concept of social capital can have a negative impact just as easily as they can have a positive impact. As a general rule, inward looking social behaviors, which operate exclusively within the group, will have no impact, or possibly a negative impact, on welfare. Conversely, outward looking behaviors, particularly those aiming at introducing diversity of contacts, do impact welfare. In a recent paper³², Deepa Narayan refers to the work of Mauricio Rubio on Colombia, and writes that it shows how:

*“ ... high levels of social capital within ‘criminal’ organizations are directed to extra-legal activities, rent seeking and high returns only to those involved in such activities.”*³³

In the same paper she puts heavy emphasis on the importance of cross-cutting ties. For example:

*“Thus societies can be rich in social capital within social groups, and yet experience debilitating poverty, corruption and conflict. To understand why, it is necessary to examine three other phenomena: first, the “connectedness” or cross-cutting ties between groups; second the nature of the state; and third, how it interacts with the distribution of social capital.”*³⁴

5.2.2.A similar connection between cross-cutting ties and “growth” comes out of the work done on the link between social capital and the firm. In a study on Ghana³⁵ innovative networks (which can be considered as “outward looking”) are shown to have a significant impact on productivity, while solidarity networks (typically “inward looking”) don’t. The findings are summarized in the table 9 in which the “ private effect” refers to the impact on the productivity of the firm.

Table 9. The private and spillover effects of networking in different types of network

	Innovative-type network	Solidarity-type network
Private effect	0.3466***	0.3015**
Spillover effects	0.1448	0.4021***
Overall effect	0.2018**	0.1006

** Significant at 5% level

***Significant at 1% level

5.3.1. **“Good” social capital and infrastructure.** The link between “good” social capital and economic development probably centers around the complementarities between well functioning markets and social capital. As pointed out by Partha Dasgupta:

“...to the extent social capital is exclusive, it inhibits the flow of resources, in this case a movement of physical capital from one place to the other. ... Social networks within each community block the growth of markets, so their presence inhibits economic development.”³⁷

Where “good” social capital is high the market can be expected to work well and investments in infrastructure will have a major impact. Where it is low, and markets are not functioning well, communities are inward looking and infrastructure investments can be expected to have a much lesser impact. This link probably goes a long way towards explaining the less tangible dimensions of infrastructure investments whereby a road or a rural electrification scheme may have a major impact on one village while, everything else being equal, the same investment will have very little impact on another. Empowering communities to make decision on infrastructure project is a good way to distinguish between those that are likely to make good use of the investment and those which are not. Communities with a high social capital are likely to be more pro-active in availing themselves of infrastructure investment possibilities, while the less well off will pass the opportunity. The link between the demand responsiveness of projects, social capital, and how effective they turn out to be is beginning to be looked into more systematically, as was done for example in the case of the Java rural water project³⁸.

5.3.2. But the link between social capital and infrastructure is a two-way link. While the level of social capital in a community is likely to impact the outcome of an investment in infrastructure, an investment in infrastructure is also likely to increase the level of social capital. Because of the link between social capital and poverty, this reverse effect has a secondary impact on poverty beyond that resulting from the direct economic impact of the investment. This reverse linkage is related to the crucial importance of

“communication” in social capital. Among the various studies supporting this view, and on the basis of a review of the performance of 74 countries, Temple and Johnson⁴¹ conclude:

“This variable, COMMS [indicator of communications], is highly correlated with SOCDEV [indicator of social economic performance] ($r = 0.88$), but its direct effect is more robust. It is significant even when controlling for investment, human capital accumulation, population growth, and four regional dummies. This indicates that there is an effect of social arrangements on TFP [total factor productivity] growth as well as that on factor accumulation. Over 25 years the measured impact of changes in communications is substantial. A one standard-deviation change in COMMS is found to raise the TFP growth rate by one percentage point. (As a useful example, consider Korea and the Philippines, two countries sometimes regarded as having similar initial conditions. In the early 1960s the communications index was one and a half standard deviation higher in South Korea.)”

5.3.3. This two way link between infrastructure and social capital has received relatively little attention so far but is probably very important. In one direction it may shed some light on some of the more intangible factors which explain why some investments are successful while, everything else being equal, others are not. In the other direction it may constitute an important entry in building up social capital through improvement in communications. Most infrastructure investments have an impact on communications. It is the primary objective of telecommunication projects and a built in feature of transportation projects. Electrification is equally important by broadening the access to electronic communication. In addition, communities with good infrastructure are likely to be the preferred locations for industrial or agro-industrial development which can not but bring them new ideas and a more outward looking view of the world. This suggests that the nexus poverty/social capital/inter-community communication/infrastructure may deserve more attention than it has received so far.

6. Vulnerability and Infrastructure.

6.1.1. The work on poverty increasingly draws a distinction between poverty, a static concept measuring people’s condition in relation to a threshold, and vulnerability, a dynamic concept measuring insecurity. Vulnerability is a particularly serious concern for the poor as it can push them into total destitution. Inadequate infrastructure increases the vulnerability of the poor. They often live in the least desirable parts of towns and villages and are the first ones to be hit by natural disasters. Their farms are at the periphery of irrigated areas and are the first to be hit by draught. Their villages are isolated and access to medical support is difficult.

6.1.2. The link between vulnerability and infrastructure manifests itself essentially in three areas: coping with natural disasters, coping with economic shocks and inequality of access to infrastructure. The next paragraphs review each of these links in turn and concludes with one of the positive impacts infrastructure can have on crisis alleviation through public works type programs.

6.2.1. *Natural disasters.* Natural disasters often have a major impact on infrastructure and the first element of disaster relief is usually to rebuild essential

infrastructure. The poor are usually hardest hit by natural disasters because they settle, often illegally, in areas that are particularly vulnerable. As pointed out by Hardoy and Satterthwaite⁴³:

“... large clusters of illegal housing often develop on steep hillsides, floodplains or desert land. Or they develop on the most unhealthy or polluted land sites – for instance around solid-waste dumps, besides open drains and sewers or in and around industrial areas with high levels of air pollution. ... Poor groups do not live here in ignorance of the dangers; they choose such sites because they meet more immediate and pressing needs. Such sites are often the only places where they can build their own houses or rent accommodation. The sites are cheap because they are dangerous. Polluted sites next to industries are close to jobs. Finally, if they occupy such land illegally, they are less likely to be evicted because the land is unsuitable for commercial development. ... In Mexico City, approximately 1.5 million people live on the drained lake-bed of Texococo. This area is the “most unhospitable part of the valley of Mexico, plagued by constant flooding, dust storms in the dry season and almost complete lack of urban services.” ... The hundreds of people killed or seriously injured and the thousands made homeless by mudslides in Rio de Janeiro in 1988, in Medellin in Colombia in 1987 or Caracas in 1989 are illustrations of a much larger and more widespread problem.”

6.2.2. Mitigating the risk of natural disasters is not simple and the record shows that developing countries have a much harder time protecting themselves. People in low-income countries are four times more at risk of dying in a disaster than those in high-income countries, according to the International Federation of Red Cross and Red Crescent Societies. As far as infrastructure is concerned, developing risk reduction strategies involves essentially banning building in hazard zones and establishing design standards that can withstand the effect of natural disasters⁴⁵. While the high cost of some mitigation measures may be a problem for developing countries, others, such as good drainage and sound overall design, are affordable and may go a long way toward preventing more routine problems such as those caused by flooding.

6.3.1. **Economic shocks.** During periods of major economic shocks, budget cuts are often targeted at infrastructure without a full appreciation of what the long-term effects on the poor may be. While cutting down on new investments may be easy to justify, not preserving existing ones may turn a transient effect into a permanent problem. Secondary and tertiary infrastructure serving poor rural areas is particularly vulnerable because of the limited “voice” of the people served by this type of infrastructure.

6.3.2. But, even where budget cuts are made in a rational way, the poor may end up being particularly affected, as evidenced by the case of Indonesia. In recent years Indonesia has gone through difficult economic times and the highways authority has been asked to further cut its budget by half. The highway authority has an up to date record of road conditions and sophisticated planning tools which enables it to optimize the use of whatever budget it is given. It can thus decide where to use its resources and what to use them on in a rigorous manner. Various scenarios are being examined⁴⁶ and the following two graphs show the impact of the strategy that is being considered on national roads and local roads (Kabupaten) respectively:

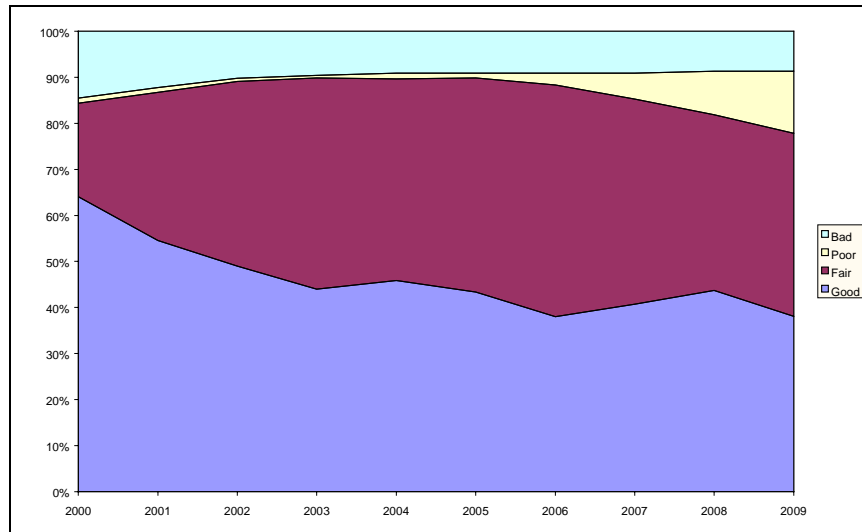


Figure -1: Condition Distribution, National Roads – Scenario S-4.9

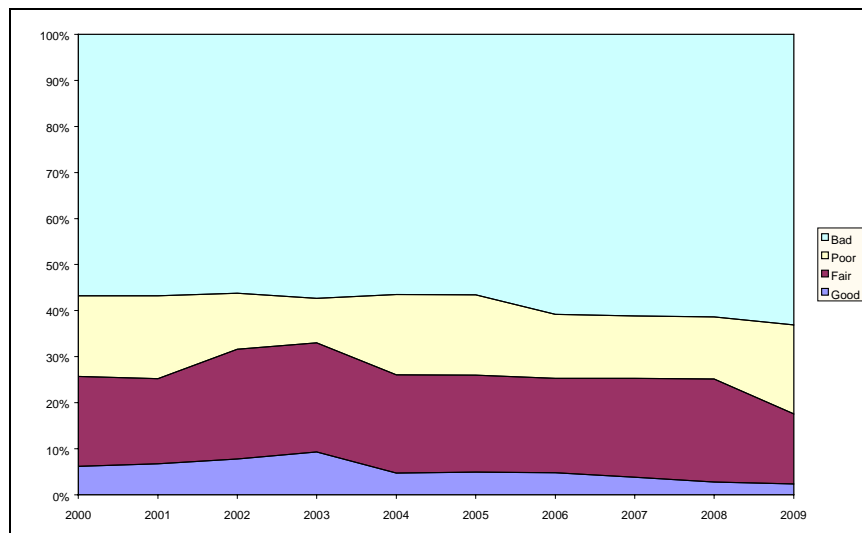


Figure -2: Condition Distribution, Kabupaten Roads – Scenario S-4.9

The roads are classified in four groups (good, fair, poor and bad). Figure 1 shows that, under current budget constraints, the percentage of roads in good condition on the national network will decline. It also shows that that there is no hope of any improvement to the local road network, 70 percent of which will remain in the poor to bad condition it has currently reached. Yet, as shown in the next figures, these local roads will be assigned the largest share of the budget.

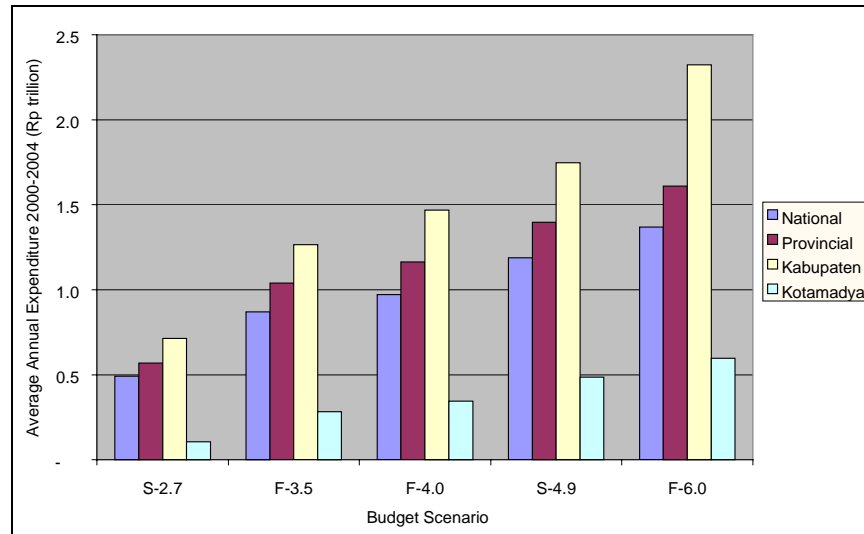


Figure -3: Budget Distribution by Road Status

The logic of this situation is quite simple. In a situation of extreme budget scarcity, budget allocations exclude all new construction and, being concentrated on maintenance, follow traffic levels: the regional road serving a group of villages has higher priority than the spurs linking it to each village. When the resource constraints are extremely tight, there is just not enough money to reach individual villages.

6.3.3. The rural poor are thus going to bear the brunt of the budget constraint, even in a scenario in which resources would be allocated in the most effective way. And, in practice, their lot is likely to be even worse because they are unlikely to have the political clout that will enable them to establish their claim. Looking into the impact of economic shocks should therefore not be limited to tracing the direct consequences of budgetary constraints on the social sector, but should also take into consideration the indirect impact on poverty through the deterioration of infrastructure. While this impact manifests itself with a time delay it does so with a vengeance. The cost of correcting the progressive deterioration of a road network, like that of Indonesia, will be a multiple of what it would cost to preventing this deterioration.

6.4.1. ***Inequality in access to infrastructure.*** Since the poor operate at very low to nonexistent safety margins, economic shocks do not need to be of significant levels to affect them. Minor and local variations in market prices or factor costs are enough to push them over the poverty line or worse drag them from poverty into destitution. As convincingly pointed out by Caroline Moser⁴⁷, there is a strong link between assets, and among them access to infrastructure and vulnerability. The fact that access to infrastructure is uneven, however, is often masked behind high averages. This is frequently the case in urban areas where access to infrastructure varies greatly with the neighborhood.

6.4.2 The impact of infrastructure is dramatically different depending on how far away someone is from the "average." Yet, the economic justification of infrastructure investments is almost always based on "average" benefits which hide potentially large differences in impact. Building a new well may result in a two hour time saving for one family and half an hour for another hence, on average, the well will

be assumed to result in a one and a quarter hour time saving per family. This “averaging out” ignores the fact that the value of the two hour time saving may be proportionally far greater than that of the half hour. The latter may only take time away from leisure while the former may have far reaching secondary effects on the education or nutrition of children. Similarly, the increased travel time of the poor mentioned in paragraph 3.2.2 above picks up only the tip of the iceberg of the problem they are confronting. Typically, the time the poor spend on travel is not only larger than that spent by the better off, but the variations from one household or individual to the other are much larger. For the poor, averages are made up of a group that hardly spends time on travel because they have given up any hope of getting work, and a group that spends far more time on travel than their better-off counterparts. Taking into account the vulnerability dimension of infrastructure investments would mean looking not only at their “average” impact but at their impact on poor separately and most likely at their impact on different poverty categories.

6.5.1. Public Workfare Programs. Inadequate access to infrastructure is part of the problem in a period of economic crisis. But infrastructure can also be part of the solution through its employment creation potential. Workfare programs are often included in crisis mitigation packages. Their primary aim is employment creation and, unfortunately, this objective sometimes overshadows all others and leads to infrastructure being built for the sole purpose of creating employment. As a result it may be built where it is not necessarily needed, or at least is not of the highest priority. This often goes together with a lack of “ownership” by the beneficiaries or the institutions which should normally assume responsibility for it and translates into poor operation and maintenance. To avoid these potential shortcomings and to make sure that, in addition to creating employment, the infrastructure built under workfare programs is sustainable and fully meets the need of the poor for which it is usually intended, projects built under these programs must be subjected to the same selection, design standards, and institutional sustainability criteria as any other infrastructure projects.

6.5.2. Besides being designed in a way that will ensure that they will bring maximum benefits to the poor, workfare programs must also be organized in a way that will ensure that they will create employment for the poorest and not divert employment away from already existing jobs. To a large extent this is largely a matter of setting the wages at the right level. Set too low, wages will not have the intended revenue generation impact. Set too high they will result in jobs being diverted away from the poor for whom they are intended.

7. Private sector provision of Infrastructure.

7.1.1 Private sector provision of infrastructure has great potential to improve infrastructure access for the poor. As such it deserves careful attention. In the past, as pointed out by Penelope Brook Cowen⁴⁸, it was implicitly assumed that infrastructure services were to be provided by large public or private companies. Common features of private-public partnership arrangements included:

- exclusivity provisions
- (universal) service obligations
- uniform service standards

- reliance on subsidies to cover “affordability” gaps, in particular, “life-line” or social tariffs.

However, the services provided by large companies seldom reached the poor and even less the very poor. In addition it has become increasingly evident that, across the board, small suppliers could in fact play a much more significant role than had been assumed heretofore. As a result, ongoing work is going beyond issues of monopoly regulations into the kind of conditions that must be met to create a true market environment. This section gives first an account of the important role of the private sector in delivery of infrastructure services. It then focuses on two key aspects of improved service delivery: i) the structure of the market and how to facilitate entry, and ii) what increased competition implies for the regulatory and transaction processes.

7.2.1. Importance of the private sector. A very large portion of the population of developing countries purchases infrastructure services from the private sector. For the less poor the choice is related to the quality or reliability of service. Public provision of infrastructure services is often poor and those who can afford it secure their own supply: they drill a private well rather than rely on the local water supply system, they buy a generator to back up the national power supply, or they get a cellular telephone rather than depend on the state telephone company. At the other end of the spectrum the poor, and the very poor in particular, are equally reliant on the private sector, not by choice but by necessity because there is simply no public infrastructure. In some cases, as for electricity, they do without the service but in other cases doing without is not an option: they have to travel to get to work, seek work, or sell their produce in the market. If they do not have access to water they have no choice but to buy it from a street vendor. For those who have no choice but to buy these services from the private sector the costs can represent a very substantial percentage of their budget. This is not only because their budget is small and, percentage wise the share is larger, but because of the high cost of retailing these services in the absence of a minimum amount of infrastructure. These facts have been documented in many studies, of which the supply of water in Onitsha in Nigeria is a good example⁴⁹. In addition to illustrating the high share of income spent on water, the following table is yet another example of the vulnerability of the poor who have to spend an inordinate amount of their income just on water during the dry season.

Expenditure on Water as percent of income		
Income level (Naira per month)	Dry season	Rainy season
Up to 499	18	8
500 to 799	4	2
800 to 1,999	5	2
2,000 and over	3	.5

These high figures are the direct consequence of the high distribution cost of water when sold in small quantities of the type the poor buy. Water which would be sold at N 0.01 per gallon to individuals at the borehole is worth N 0.04 by gallon when purchased by drum and N.12 per gallon when distributed by a vendor in small quantities commensurate

with daily needs. Private sector provision of infrastructure services is therefore not just big business, but it can also be expensive. Facilitating market entry and competition through appropriate regulation holds great potential for improving service delivery across the board, and particularly for the poor.

7.3.1 *Facilitating entry.* The key factors in facilitating entry dwell around issues of market structure, exclusivity arrangements, pricing structure, interconnection or bulk supply arrangements, input and output standards, and partnerships. These various issues are relevant to the supply of infrastructure services to the poor as much as to the non poor. But exclusivity, pricing structures, and output standards are particularly relevant to the poor and areas in which good intentions can work at cross-purposes with the long term interest of the poor and developing partnerships often hold the key to success.

7.3.2. It is very tempting to accede to the request of a supplier who, on the ground that development costs are high, will guarantee universal access only if he is granted exclusive access to the market. But, as pointed out earlier, there are endless cases of the poor not getting service from infrastructure monopolies, and the thought of creating additional ones should be considered with suspicion. The first step is to check that the services to be provided would indeed benefit from exclusivity of provision. New technologies (e.g. telecommunications) or new ways of organizing the provision of a service (e.g. looking at the generation, transmission and distribution of electricity as distinct activities) have considerably reduced the instances in which the provision of infrastructure automatically leads to a monopoly situation. The case for exclusivity is therefore often made on false pretenses and, even if exclusivity might theoretically result in some scale economies, reality can easily wipe out these benefits with a vengeance. The burden of the proof should therefore be on those who want to argue the exclusivity case. In practice, if the supply of an infrastructure service is in the nature of a natural monopoly, no entry protection is needed and, if it is not, the long-term costs of encouraging the creation of one is likely to far outweigh the benefit.

7.3.3. The same “practical” considerations apply to pricing structure and output standards. The idea of “social” or “lifeline” tariffs at subsidized rates for the poor are very appealing in theory. But, in practice they lead to a disincentive to the supplier to add connections and are not consistent with encouraging entry into the market. In the worse scenarios, where the subsidies they require are not forthcoming, they may put the overall financial stability of the supplier in jeopardy and affect negatively affect all the services. Finally, many studies have shown that there are large “leakages” in who actually benefit from subsidized services, with the poor getting only a fraction of what was intended exclusively for them. Similarly well intentioned, output standards can also lead to a practical negative impact that may easily outweigh the theoretical benefit that they were intended to achieve. They may lead to entry barriers by putting constraints on the level of service pitched above what beneficiaries actually need or can afford.

7.3.4. In most instances, the problems stem from the difficulties in reconciling the operating constraints of a large service provision organization and the reality of what works at the community level. Promoting partnerships between traditional large scale suppliers of infrastructure services and local groups (e.g. local NGOs) with expertise in dealing with non-traditional customers is the most promising way of overcoming this

problem and, most likely, the way ahead. A large part of the success of these partnerships is related to the regulatory and transaction mechanisms.

7.4.1. **Regulatory and transaction processes.** The regulatory process has to focus on outputs and, if it is to encourage entry into the market, on the coordination of standards to facilitate interconnection, on the pricing and terms of interconnections, and the pricing and terms of bulk supply. These issues are equally relevant to the poor and the less poor and well addressed in the general regulatory literature. However, the design of the regulatory process in a way that will accurately reflect the interest of the poor is less well developed. If they are to be heard there is a need to develop the use of local advisory groups, complaint mechanisms, and local hearings. Furthermore local communities, and the poor in particular, have to be encouraged to actively participate in these forums.

7.4.2. As far as designing the transaction process is concerned, protecting the poor is again a matter of making sure that their specific needs are well understood. This implies paying more attention to the market structure and recognizing the niches that are important to them. For example, inter-modal connections are a key issue in urban transport. However it typically addresses exchanges between the typical modes of transport such as bus and rail and ignores the fact that non-motorized transport is a crucial issue for the poor. The provision of adequate bicycle parking at bus terminal may be far more important to them than the price of a transfer ticket from a bus to the subway. Similarly, it implies opening the door to agents operating at the local level and with technologies that are not standard in traditional systems. An illustration of this would be the low cost “condominial” sanitation system in Brazil, in which groups of users pool their sanitation pipes and connect to the main sewer system as a group, rather than each one individually⁵¹.

8. Other Dimensions of Poverty.

8.1. 1. The approach followed in this paper consisted in tracking the link between different facets of poverty and infrastructure. The list of topics one can look at is not exhaustive. However, as one increases the number of topics, the argument becomes repetitive hence the reason for limiting the discussion to the topics reviewed up to this point. There are however a number of alternative cuts that could have been taken instead, or in addition, to those reviewed above. Four additional ones readily come to mind and are discussed very briefly below.

8.2.1. **Types of poverty.** One of the traditional distinctions between types of poverty is between relative and absolute poverty. Current poverty reviews often distinguish between poverty (which allows for a minimum asset build-up in the household consumption basket) and ultra poverty (which allows none). The section on vulnerability often draws a distinction between these different degrees of poverty. When a problem occurs the poor become poorer and this is bad enough. But the very poor have nowhere to go and become completely destitute. But the distinction between the impact of infrastructure on the poor and the ultra-poor is not limited to the link between infrastructure and vulnerability. The economic impact of investments probably affects them differently, the private sector may be more relevant to some of their needs than others, certain types of infrastructure may be more important to the ultra poor than to the

poor. These and a number of other questions would be worth looking into beyond the extent to which it has been done in this paper.

8.2.2. Along a similar vein, the current literature on poverty, particularly within the context of poverty in industrialized countries, draws a distinction between permanent and transient poverty. Some of the poor never get out of poverty while for others it is a temporary episode in their lives. Does infrastructure affect these two groups in the same way? Prima facie, it may be more important to the permanent poor than to the transient poor since, before they fell into poverty, the transient poor could manage with whatever infrastructure they had. However, the inadequacy of that infrastructure may be one of the factors that push them temporarily into poverty. These are at this point largely unanswered questions.

8.3.1. **Poverty traps.** Closely related to the concept of permanent versus transient poverty is the concept of poverty trap, the simplest form of which is geographical location. Isolated communities which have to bear very large transportation costs to access markets, may be locked into poverty for ever. To some extent this point is covered in the section on exclusion but may affect other facets of poverty as well. Its link with infrastructure may go beyond the issue of exclusion and would deserve investigation.

8.4.1. **Inequality.** Infrastructure may be available to all, but the better off may have far easier access to it than the poor. As shown in the Nigeria water supply example mentioned in paragraph 7.2.1 above, water costs the poor 12 times as much as it does the better off whose large consumption justifies the drilling of a deep water well. This is a general rule, across the board, for all types of infrastructure. Because they consume small quantities of infrastructure services, the ratio of fixed to variable costs makes provision of infrastructure more expensive to the poor than to the rest of the population. This basic problem is often combined with the fact that small quantities are often associated with poorly functioning markets, thus compounding the problem. There is thus a strong link between infrastructure and inequality, which, again, would constitute a topic for investigation in its own right.

8.4.1. **Measurement.** While measuring poverty is a difficult and often controversial issue, all concrete poverty alleviation initiatives rely on some explicit or implicit measure of poverty. Besides income considerations, these poverty indicators almost always include some indicators of the performance of the health and education sectors. Inasmuch as the water sector is often considered as part of the “social sectors”, they may also include some indicators of water availability. But, typically, they only include access to other types of infrastructure on an exceptional basis. It would be worth considering whether there should be a more systematic and broader inclusion of infrastructure in the compilation of poverty indicators, how it should be done and whether we have any examples of instances in which it has been done successfully.

Annex 1

Characteristics of Rural and Urban Transport in India.

	Rural	Urban
Household characteristics		
Size	5.2	4.9
Average weekly household expenditures (1978 Rupees)	15.5	20
Travelers per household		
Regular trips	.4	.6
Irregular	.4	.3
Total	.8	.9
Number of journeys per traveler		
Regular	9.4	10.6
Irregular	2.1	2.1
Total	5.6	7.8
Distribution of trips per purpose (percent)		
Employment	56.9	68.4
Educational	11.5	13.8
Household purchase	10.4	2.4
Others	21.2	15.4
Distance per trip (km)		
Employment	6.4	9.6
Educational	7.1	6.7
Household purchase	7.9	6.3
Average	9.3	11.3
Distribution of total kilometers traveled (percent)		
Employment	39.1	47.1
Social visit	10.8	7.8
Educational	8.8	10.5
Household purchase	8.9	2.0
Sale of own produce	4.5	3.3
Purchase for Production	3.7	3.1
Doctor, health center	4.2	2.3
Others	20.0	23.9
Distribution of single mode trips by mode (percent)		
Walk	72.3	34.8
Bike	10.8	19.0
Bus	11.2	26.3
Train	1.1	8.4
Others	4.6	11.5
Average distance per single mode trip (km)		
Walk	4.6	3.7
Bike	10.3	7.2
Bus	23.9	14.9
Train	39.3	26.7
Percentage of trips made by walking or biking		
Work	91.2	57.4
School	84.7	48.2

The Ellet Model

The Model.

1. The Ellet model considers a region in which land is homogeneous and can be expected to have the same agricultural potential throughout. A port P provides access to an hinterland through a road that runs East West, perpendicular to the coast line. Unit transport costs on the road is \$a per ton-km. The area is assumed to produce a single crop K that is sold at a fixed price per ton at P. To get to the port the crop is first carried to the road in a North/South or South/North direction at a cost of \$b per ton-km.

2. If the road is of infinite length, and if k is the difference between the price and the production cost of crop K, it is easy to show that the maximum area that can possibly be cultivated is the inside of the triangle ABC (fig. 1), in which:

$$PA = k/b, \text{ and}$$

$$PC = k/a$$

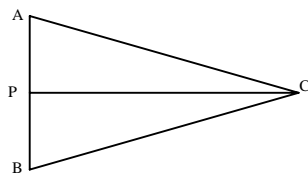


Figure 1

Anybody outside the area ABC is “excluded” from producing crop K and as one moves away from P towards A, B, or C the profit on the sale of the crop goes down and progressively reaches zero on the AC and BC boundaries. Poverty thus increases as one moves towards the boundary of the triangle ABC and those living beyond this boundary are excluded from access to the market where they can sell crop K. The area of cultivation is :

$$S_0 = \frac{k^2}{ab}$$

3. If the road ends at E at a distance of d km from P (fig. 2), the exclusion area boundary is ABHFG where:

$$EF = EG$$

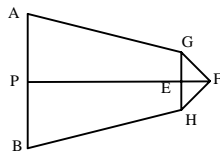


Figure2

The area of cultivation can be shown to be:

$$S_t = \left(\frac{2k}{b} - \frac{ad}{b} \right) \times d + \left(\frac{k}{b} - \frac{ad}{b} \right)^2$$

4. Lengthening the road results in adding the area $GG'F'H'HF$ to the area under cultivation, as shown in figure 3 below.

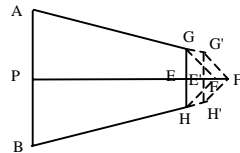


Figure 3

On the other hand, improving the road results in a widening of the cultivation area as shown in figure 4.

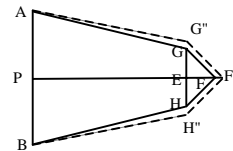


Figure 4

5. The rent per ton of the infinite road is measured by the volume of the rent pyramid $ABCW$ (fig. 5) where:

$$PW = k$$

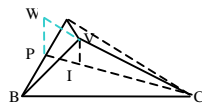


Figure 5

This volume is equal to:

$$V = k^3/3ab$$

6. For the truncated road the rent per ton is measured by the volume ABHFGUW (fig. 6).

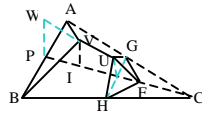


Figure 6

$$V_t = V - \underbrace{\text{Volume}(GHCU)}_{V3} + \underbrace{\text{Volume}(GHFU)}_{V4}$$

$$\text{Where } V3 = 2 \int_d^{k/a} \int_0^{\frac{ax+k}{b}} (k - ax - by) dx dy = \frac{(k - ad)^3}{3ab}$$

$$\text{And } V4 = \frac{1}{3}(k - ad) \times \left(\frac{(k - ad)^2}{b} \right) = \frac{(k - ad)^3}{3b^2}$$

Thus

$$V_t = 1/3b \times [(k^3 - (k-ad)^3)/a + (k-ad)^3/b]$$

7. The value added resulting from the cultivation of the area is equal to the rent per ton times the number of tons produced. In turn, the number of tons produced is equal to the area S_t times the yield (y) times the percentage (r) of the area that is under cultivation. The value added is thus:

$$\text{Value added} = y \cdot r \cdot V_t \cdot S_t$$

The benefit resulting from a road improvement or a road lengthening is equal to the increase in value added resulting from the increase in the area under cultivation as shown in figures 3 and 4 above.

Analysis.

8. For the purpose of the analysis it is assumed that the initial road is a gravel road in poor condition and that goods are transported in medium size pick-up trucks. Transport to the road is assumed to be a combination of non-motorized transport and all-terrain vehicle. The investment strategies tested consist in either improving the road to a high standard gravel road or spending an equivalent amount of money extending it. The assumptions made in the base scenario are spelled out in table 1. To simplify the computations, the economic return of the investment is equated with the first year benefit cost ratio. The exclusion impact is measured by the incremental number of hectares brought under cultivation by thousand \$ of investment.

Results.

9. The results of the analysis are displayed in table 2. The exclusion impact, measured in hectares per thousand \$ of investment, and the first year benefit cost ratio of the investment are shown for various values of:

- The cost of improving the road (C_i)
- The value of crop K at the port P (k')
- The length of the road (d)
- The transport cost off the road (b)

10. The conclusions which emerge from the analysis are:

c) The best strategy from an economic point of view is also the best strategy from an exclusion point of view. For the value of the parameters tested, there are no instances in which road improvement would be best from an exclusion point of view while lengthening would be best from economic point of view, and vice versa.

d) The best strategy shifts from improving the road, when the off-road transport cost are low, to lengthening it when they are higher. The switching value is somewhere between off-road transport costs per ton km of \$.83 and \$1. This is because, with high off-road transport costs, it is only worth cultivating a narrow band of land on either side of the road, and improving the road has very little impact on the width of that narrow band.

e) The impact of either improving the road or lengthening it goes down very quickly as the transport cost off-road increases. For example, for a 20km road, the first year cost benefit ratio of an improvement project drops by a ratio of more than 100 times from 922% to 8% when the transport cost off-road increases by a ratio of 4 from \$ 0.50 to \$ 2.00. For the same variation in off-road transport cost, the exclusion impact also varies dramatically by a ratio of over 10 times, from 234 ha. to 18 ha. per thousand \$ invested. This finding suggests that the best way to help the poor may be much more by reducing off-road transport cost than by improving or extending existing networks. This can be done by introducing new or less expensive means of non motorized transport (NMT).

f) Neither the economic or the exclusion impact vary a great deal with the length of the road. This suggests that, everything being equal, large projects will have as much impact on reducing exclusion as small one. Small is not automatically beautiful.

Table 1

ASSUMPTIONS

Cost of extending existing road (C):	\$100.000/km
Cost of improving existing road (Ci):	\$ 60.000/km
Vehicle operating cost on existing road (2-ton pick-up):	\$ 0.63 /ton/km
Vehicle operating cost on improved road (2-ton pick-up):	\$ 0.25 /ton/km
Effective load :	1.5 ton
Transport cost on existing road (calculated value):	\$ 0.42 /ton/km
Transport cost on improved road (calculated value):	\$ 0.17 /ton/km
Value of export at point P (k'):	\$ 100 /ton
Yield (y):	1.54 ton/ha.
Production cost (r):	30 % of k'
Area cultivated with crop K:	25% of total farm area

Table 2

RESULTS

Ci \$.000	k \$/ton	d km.	b \$/t/km	Scenario			
				Improve		Lengthen	
				ha./000 \$	B/C (%)	ha./000\$	B/C (%)
60	100	10	0.5	235	887	41	149
		20	0.5	234	922	38	140
		40	0.5	231	995	31	119
		10	0.67	134	298	72	154
		20	0.67	135	324	66	152
		40	0.67	136	378	53	138
		10	0.83	87	130	77	112
		20	0.83	88	147	70	114
		40	0.83	91	183	57	110
		10	1	61	66	75	80
		20	1	63	78	69	84
		40	1	66	103	56	84
		10	2	16	6	51	18
		20	2	18	8	47	21
		40	2	21	13	38	25

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