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The Difficult Problem of Measuring the Village-Level Socio-Economic Benefits of Road Rehabilitation Projects in Rural Asia and Papua New Guinea

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The Difficult Problem of Measuring the Village-Level Socio-Economic Benefits of Road Rehabilitation Projects in Rural Asia and Papua New Guinea

Introduction

This discussion of issues relating to the measurement of socio-economic benefits arising from road rehabilitation projects draws on my own involvement in several such projects,[1] supplemented by my knowledge of other Asian Development Bank (ADB), World Bank and AusAID sponsored projects in Asia and PNG and discussions with colleagues.[2] Undoubtedly the same issues apply to similar projects in Africa and the Americas funded by a wide range of other donor agencies and multi-lateral banks (referred to hereafter as development agencies).

The fundamental goal of these development agencies is to provide funding to improve the standard of living of the target populations, especially the poor. AusAID, for example, states that the objective of the aid program is to advance Australia's national interest by helping developing countries reduce poverty and achieve sustainable development. The more reputable private sector companies investing in resource development projects in Asia and the Pacific similarly increasingly state that one of their objectives is to improve the socio-economic conditions of the people in and surrounding the areas where they operate as well as to maximise profits for their owners/shareholders and pay the requisite taxes to the host governments.

Understandably all of these organisations and even the private sector companies want to know the extent to which their efforts have been successful at raising living standards ('poverty reduction') or in achieving similar goals. To do this, during the feasibility or planning stages a socio-economic impact study (SEIS) is normally undertaken in which likely impacts (including benefits) are predicted. Ideally in the case of infrastructure and resource development projects, before the project is implemented the relevant existing socio-economic conditions are described and quantified (the baseline conditions study) as a basis against which changes during the subsequent construction, operation and (where relevant) post-operation phases can be measured and assessed. This process, referred to as 'project socio-economic monitoring and evaluation' allows assessment of the extent to which the predictions in the SEIS have been achieved. If the project is not achieving its poverty reduction or other aims some re-design, where this is feasible, may be required. In the case of road projects, the extent to which this assessment, monitoring and evaluation process has been implemented is highly variable, as discussed below.

It has been relatively easy to demonstrate the socio-economic impacts (positive and negative) arising from major projects such as mines, dams, new roads and large scale commercial agricultural and forestry projects. Laufa (2005), for example, has shown that the construction of the 81 km long Bereina-Malalaua Highway (completed in 2000) through the previously road-less and isolated eastern half of Gulf Province in PNG had measurable, generally positive socio-economic effects on the people living there, especially through facilitating the supply of betel nuts (a major and highly lucrative cash crop) to Port Moresby (personal communication, Mike Bourke, May 2005).

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[1] PNG Road Upgrading and Maintenance Project (ADB TA No. 3037). Environment, Poverty and Social Specialist, 1999-2000.
PNG Highlands Highway Rehabilitation Project (World Bank). Expert Reviewer, Environment, Social and Land Acquisition, 2001-2002.
Indonesia Road Rehabilitation (Sector) Project (ADB Loan No. 1798-INO). Senior Poverty/Environment Specialist, Core Team Consultants, 2003-ongoing

[2] My special thanks to Bryant Allen and Mike Bourke in Human Geography and Marjorie Sullivan in the Resource Management in Asia-Pacific Program, all in RSPAS, ANU

Road rehabilitation undoubtedly also brings socio-economic benefits to local villagers in Asia and PNG. When interviewed, villagers along existing roads (especially where they have deteriorated) almost always state that good road access to markets and services is the single most important thing they desire to maintain or improve their standard of living. I would contend however that it is much more difficult to identify, measure and attribute local impacts (including socio-economic benefits) arising from road rehabilitation than is generally appreciated by the development agencies.

Roads Projects and Poverty Reduction

The focus of this paper is road rehabilitation of major roads rather than the construction or improvement of local rural roads as the amount of recent and ongoing investment on the former is at least an order of magnitude greater than on the latter. However this section starts with a review of local rural road projects as it is on these that the greatest amount of effort has been given to the assessment of the poverty reduction benefits of such investment.

Local Rural Roads

As Gannon and Liu (1997: 13) point out, the role of a transport project in poverty reduction is more obvious if the project serves a poverty-stricken area where the majority of beneficiaries are poor. The international development agencies have a long record of investment in the rural road sector where the primary objective has been rural poverty reduction (e.g. ADB 2002, CRHRE 1997, Gannon and Liu 1997, Sakko 1999, van de Walle 1998, 2000). These projects generally involve the construction of new roads or major reconstruction/upgrading of existing roads, often using labour-intensive methods rather than road-making machinery. Where the monitoring and evaluation of benefits has been undertaken rigorously, these targeted rural road development projects have been shown to have had very positive poverty reduction benefits, especially in remote villages whose road access has been improved. Experience has shown that the best way to demonstrate village-level socio-economic benefits quantitatively is to carry out before and after road construction/rehabilitation evaluations, preferably using household travel and other kinds of socio-economic surveys (see below and for example Sakko 1999, Windle and Cramb 1997).

However in many if not most cases monitoring and evaluation of the benefits predicted to arise from such projects has not been carried out rigorously and as a result it has been difficult to identify benefits which might have resulted let alone quantify them. The ADB noted that although it is widely assumed that investments in rural roads reduce poverty, there is little evidence of the ways in which these impacts occur or what their determinants are (ADB 2002: ii). The ADB undertook a study to address this void. The objective of the study was to improve the design of rural road components to achieve sustainable benefits for the poor. As a first step the bank undertook a review of ADB-funded road projects. They pointed out from their review that although benefits monitoring and evaluation systems were part of the design of most such projects, they were exclusively the responsibility of the executing agency (i.e. the relevant national government department), which were often expected to meet the cost from counterpart funding. In a situation of scarce local resources, such systems were often abandoned, or allowed to lapse for so long that the information that was eventually collected was largely useless. ADB (2002: ii) argued that the importance of baseline studies and data monitoring needs to be realised by all stakeholders if rigorous impact evaluations are to be carried out in the future to further improve project design.

Given the almost complete absence of useable data, the ABD undertook its own field studies of six projects in three countries (Indonesia, the Philippines and Sri Lanka) in which it compared project sites along roads which had been improved with ADB funding with similar control sites in the same areas, but far from motorable roads (ADB 2002: 6). This 'with and without a road' type of analysis is more akin to a comparison of 'before and after new road construction' than to the rehabilitation of an existing road. The study (ADB 2002: ii) found that people living in the project sites along the roads benefited substantially from the social impacts of rural roads compared with those in the

control sites without roads.[3] This was not surprising given the strong contrast in road access between the project sites and the control sites. A summary of some of their major findings is presented in Appendix 1.

National and Provincial Roads and Highways

The level of development agency investment in most rural road sector projects of the kind discussed above is very small compared with that in the rehabilitation of main trunk roads and highways deemed to be of strategic importance at the national, provincial or regional level. The ADB and World Bank are providing hundreds of millions of dollars in loans for major road rehabilitation projects which are ongoing or in the pipeline in Asia (including Indonesia) and PNG. AusAID has provided aid funding for numerous road rehabilitation projects in PNG over the last decade, including currently for sections of the Highlands Highway.

In relatively sparsely populated Papua New Guinea and much of rural Asia main highways and roads service a diverse and widely distributed target population which includes in addition to rural villagers the residents of the major towns, a high proportion of whom are wage-earners and business people, major rural-based economic enterprises such as mining, petroleum and timber projects, large-scale commercial plantations and producers of semi-commercially grown vegetables and other agricultural produce for sale in the major provincial towns and cities and even the capital cities. In the more densely populated parts of Asia where there are large cities, in addition to these users a high proportion of the traffic consists of inter-city trucks transporting non-rural manufactured and other commercial goods or their components and of inter-city buses.

The major beneficiaries of these kinds of road rehabilitation project are the better-off, most of whom do not live along or adjacent to the road, but are business people and consumers who live in towns and cities often far from the project area, including overseas. This is more so in most parts of Asia than in PNG. Such projects are generally selected because they are deemed to be economically sustainable, i.e. they have high economic internal rates of return (EIRRs). Local villagers, including the poor, also benefit, but not to the degree that such benefits on their own could be used to justify these considerable investments in road improvement.

In this Working Paper I will concentrate on the benefits which might accrue to local villagers living along the road, and ways of measuring them, rather than benefits to the wider group of road users, to whom the section of road being rehabilitated may simply be one link (often small) in the total road network which serves them. The main benefits to local villagers from road improvement repeatedly identified in the previous studies reviewed in this paper or in which I have been involved are summarised in Box 1.

[3] This ADB (2002) report is essential reading for those with an interest in the socio-economic monitoring and evaluation of roads projects in developing countries. It can be downloaded from the ADB website (http://www.adb.org/Evaluation/reports.asp?p=poverty&s=2&subj=188)

BOX 1. The Benefits to Rural Communities from Road Rehabilitation

The major benefits reported to accrue rural populations from road upgrading and maintenance projects roads are as follows:

- A more frequent and reliable service with more comfortable and faster travel, leading to greater mobility. Operating costs for vehicles transporting both goods and people became cheaper. The extent to which these costs are passed on to the consumers vary. Even where the cost savings are not passed on as decreased fares, passengers tend to be satisfied with this because travelling became faster and more comfortable. Similarly, although rural traders may have improved access to goods from wholesalers in towns, freight charges may not be cheaper because the reductions in transport costs resulting from road improvement may not be passed on to the retailer. Motor vehicle ownership rates (private and commercial) tend to increase and this in turn enhances mobility.

  Increases in transport volume and decreases in fares generally occur most markedly where road improvement is accompanied by increased competition among transport providers.

- The improvements in transportation facilitate access by rural people to markets and suppliers in larger villages and towns. This applies to small-scale sellers of agricultural produce, commercial agricultural producers and traders (shopkeepers and service providers).

  Small-scale sellers of agricultural produce (rice, fruit and vegetables) have more ready access to markets. This is especially important for women as they are the major producers and sellers of market produce and the road is a vital part of the marketing network. Similarly, village producers engaged in the broader cash economy (coffee, commercial quantities of rice and other village plantation crops in particular) benefit because they can more readily transport their crops to the buyers in towns, or they can sell directly at the point of production to travelling buyers whose access to customers also has been improved.

  In Asia producers commonly sell their produce to village middlemen, who because they benefit in similar ways should be able to pass on part of their increased profit in the form of higher prices to these producers.

  Traders have easier and generally cheaper access to wholesalers in the major towns and cities.

  If road improvement significantly increases the amount of up-road traffic passing through, and a proportion of this increased traffic stops in the village to purchase goods, this can increase economic activity.

- The delivery to rural people of health, education and agricultural extension services available in major towns can be improved in the region if the road is upgraded to a former standard. Improvements in access to health services for women and children in particular are especially important for poverty reduction. The ADB (2002) study showed that for very poor rural people, this was often the major benefit of road improvement to them.

- There is generally some long-term increase in cash incomes, mainly because of improved access to markets and suppliers. There may also be a temporary inflow of cash from employment on the road improvement project itself. Increased cash availability allows families to pay for school fees, health services and a whole range of consumer goods, both food and material items. Where these goods are purchased from village traders, this provides a boost to local small-scale business.

Benefits of the kind summarised in Box 1 accrue much more to the well-off than to the poor. In an Indonesian case study incorporating travel data for 300 households from villages along roads in 10 provinces, Hughes (in prep.) showed that the frequency of travel by these households was very strongly influenced by their standard of living, there being a more than 80-fold difference between the very poor (1 trip/household/month) and the very well-off (86 trips/household/month). These results provided strong support for Gannon and Liu's (1997: 32) observation that typically the poorest people use almost no motorised transport.

In the villages in this Indonesian case-study the amount of road travel undertaken by the poor and very poor was low to extremely low. Hughes (in prep.) suggested that although road travel and transportation should improve markedly as a result of the road rehabilitation project, all of the villages are currently served by roads which, although in poor condition, are with few exceptions passable in all but extreme weather conditions. The relatively high frequencies of travel of the well-off (30 trips/month) and very well-off households (86 trips/month) indicate that the generally poor road conditions are not in fact a severe impediment to travel. If so, the low to extremely low amounts of road travel by the poor (6 trips/month) and very poor households (1 trip/month) are not primarily a function of the poor road conditions (a conclusion supported by other aspects of the socio-economic study), but rather reflect the constrained circumstances in which these households find themselves.

Differences of this order in the frequency of travel between the poor and the well-off are likely to occur widely in rural Asia and PNG. If so, it can be expected that after roads have been rehabilitated the frequency of travel of all affected villagers will increase, but that most of this increase will be by the better-off.

What Rehabilitation Projects for Major Roads Involve and Why They Have Relatively Limited Local Socio-Economic Benefits

Selecting Roads for Rehabilitation and Improvement Options

Various methods are used to select road sections for inclusion in rehabilitation projects and the appropriate level of treatment they require. In most countries management systems are in place which can be used for all phases of the road management process, from central and regional planning, budgeting, project design, contract document preparation, and finally regular monitoring of the national and provincial networks (Paterson 1990).[4]

Usually roads are not selected unless they exceed an economic internal rate of return (EIRR) of 12-15 per cent. The higher the EIRR the more economically 'efficient' the project. Emphasising the EIRR however, often leads to the selection of projects serving better-off groups over projects which would serve poorer groups (see Gannon and Liu 1997, Sections 3 and 4 for a detailed discussion of efficiency versus equity).

In PNG Bryant Allen and his colleagues (e.g. Allen and Hughes 2003) have demonstrated that socio-economic data available at the national level can be used to rank the importance of PNG's national road within and between provinces. The objective of producing the ranking has been to ensure that when all other factors are equal (including those considered by RAMS), spending on road maintenance reflects the relative importance of particular roads. This approach can be used only in PNG because of the unique nature of the GIS databases available for that country, especially geo-referenced census data and the Mapping Agricultural Systems of PNG (MASP) database.

[4] These systems use as their basis the World Bank's Highway Design and Maintenance (HDM) model. PNG has the Road Asset Management Systems (RAMS) and Indonesia the Integrated Road Management System (IRMS). The information incorporated into these systems is often of highly variable quality (e.g. traffic counts, VOCs and data on existing road conditions). See Allen and Hughes (2003: 7-9) for a discussion of RAMS.

Once the selection is made, computer models in the management systems such as RAMS or the IRMS are used to analyse the economic viability of various improvement options for each section of road, based on the construction costs for each option, traffic counts and traffic forecasts, and vehicle operating costs (VOCs). The economic analysis then determines the optimum rehabilitation and maintenance strategy for each road section.

There are three broad levels of improvement: maintenance, rehabilitation and upgrading. The most basic treatment, *maintenance*, involves treatments such as the repair of potholes, patching of sealed pavement, re-sealing of the existing asphalt pavement, and (in PNG) re-gravelling. In Indonesian projects currently being funded by the World Bank and the ADB the equivalent level of improvement is known as *periodic maintenance*, consisting of single or double layer asphaltic concrete overlays and associated reshaping of roadway shoulders, pavement markings and minor drainage works.

Rehabilitation involves more major treatments for roads which have deteriorated badly and which require pavement reconstruction, usually involving removing and replacement of the existing base course layers and asphaltic concrete. *Upgrading* in PNG at least usually means the sealing of gravel roads, but more generally major widening and/or straightening of sealed roads is included in this category. In many countries, especially PNG, the development agencies will not fund projects of the latter kind where land acquisition is involved (see for example Hughes 2000). In Indonesia the equivalent level improvement to rehabilitation and upgrading is referred to as *betterment*, consisting of civil works for improvements and additions to surface and subsurface drainage, strengthening and minor widening (within the existing ROW) of pavement and shoulders, resurfacing, pavement markings, and signing for safety improvements. Sealing of gravel roads is included in this category.

Typically a development agency funded project will consist of a large number of smaller sub-projects involving improvement works of the kinds described above. Roughly half of the works in terms of length of road improved falls into each of the categories of *periodic maintenance* and *betterment*. For example, the Indonesian Road Rehabilitation (Sector) Project (RRSP) I am currently involved with is doing road improvement works on about 2000 km of road, comprised of about 100 sub-projects in 17 provinces, i.e. an average length of about 20 km, with the longest being 76 km. The World Bank funded PNG Road Maintenance and Rehabilitation Project in six provinces was designed to include 28 sub-projects with an average length of 19 km and maximum of 83 km (Rivers and Duguman 2001: 18-19). The proposed World Bank sponsored PNG Highlands Highway Rehabilitation Project (SMEC 2001, Table 2.1) involved improvement works at 16 critical sections along the highway whose average length was 10 km and maximum length 55 km.

Reasons Why Projects of this Kind Have Limited Local Socio-Economic Benefits

Most projects involving rehabilitation of major roads are unlikely to produce any measurable reduction in poverty in most of the areas through which the roads pass. As explained above, this is because the individual schemes in themselves, whilst important, are in most cases relatively short sections of road within much longer road links. The funding is seldom used for the rehabilitation or construction of whole road links.

In most cases is unlikely that the proposed road improvement works which is undertaken on the individual sections of road will dramatically improve local transportation, and the benefits to individual long distance transporters of freight and passengers will be minor to insignificant. This is especially the case for *periodic maintenance*, which in most cases is being undertaken to prevent further road deterioration rather than to rehabilitate roads in poor condition. In effect, the purpose of periodic maintenance is not so much to improve road transport (and thus bring benefits to and reduce poverty amongst local villagers and others), but to prevent deterioration that might cause road transport to decline, with a decrease in the existing socio-economic benefits of the road, including those accruing to villagers.

Betterment will result in more marked improvement in road conditions, especially where the road is now in poor condition and/or there are stretches of gravel road which will be paved. However the

lengths of road to be improved are generally relatively short, typically between 10 km and 25 km. In the case of operators carrying freight and passengers over long distances such road improvement will have very minor to insignificant benefits to individual operators in terms of lowered VOCs and travel times. However on roads used heavily by long distance traffic the cumulative benefits should be considerable. These cumulative benefits are expressed in the net present value (NPV) of the sub-project, which takes into account comparison of cumulative VOCs and times savings with and without the project, as well as the road construction and subsequent maintenance costs.

In the case of local traffic on roads subjected to *betterment*, there is potential for measurable VOC and travel time savings to occur for local traffic, as well as a wide range of socio-economic benefits such as those summarised in Box 1. However, as discussed below, even in the most favourable circumstances benefits which can be directly attributed to the road rehabilitation are likely to be small and difficult to attribute with complete confidence to the road improvement works.

The Dire Effects of Allowing Roads to Deteriorate Completely

The theme of this paper is that because the socio-economic impacts of rehabilitating existing roads tend to be relatively small it is difficult to measure and attribute such impacts. Before going on to discuss ways in which these rather minor benefits can be identified and measured it is worth considering the very much larger negative impacts that will occur if rehabilitation is not undertaken. It is the experience of consultants working in this field throughout PNG that in most areas where the roads have deteriorated but are still passable, communities continue to be serviced by public transport (PMVs) and produce buyers, albeit at a very much lower level than might be the case if the roads were improved. Where the roads have deteriorated badly and the amount of traffic has declined greatly (and become very slow and expensive) some produce is still sold to passing buyers, but virtually no garden produce is taken for sale in major town markets. The main reason given for this is that the PMV services are now so poor (because of the poor road conditions) that the growers are unable to transport their produce to the town markets. The few PMVs that do service the roads will carry only people, not large quantities of goods to sell.

Many roads are now virtually impassable and in the highlands, for example, entire communities have again become largely isolated from the outside world, with drastic economic and social effects. It is arguable that villagers now in this situation who once had good road access to the outside world are less able to cope with their isolation than are remote villagers who have never had road access.

It has been suggested (personal communication, Mike Bourke, May 2005) that rather than trying to measure the benefits of maintaining good road access, a more compelling justification for road rehabilitation would be to measure instead the gross negative socio-economic impacts on rural communities that would result from allowing roads to disintegrate to the point where they become impassable. This would be relatively easy to do by selecting villages along well-maintained roads and comparing conditions with those along roads which are no longer passable. This is analogous to the 'with and-without roads' or 'before and-after new road construction' approach which have been used in the past, as reviewed above.

Measuring the Socio-Economic Benefits to Local Villagers of Road Rehabilitation

The Dilemma

Paradoxically, because the local benefits from road rehabilitation are likely to be limited and difficult to attribute, the impact monitoring and evaluation methods used need to be sufficiently comprehensive to be able to (a) identify and measure a range of benefits, and (b) *prove* they have resulted from road rehabilitation. Arguably they need to be much more comprehensive than for new road projects such as, for example, the Bereina-Malalaua highway discussed briefly above and considered further here.

Before this 82 km road was built in 2000, if the inhabitants in and around Malalaua, a small sub-district centre, wished to travel to Port Moresby, the capital city and paramount market and service centre some 150 km away, they took a motorised canoe down the meandering river and along the coast to Iokea about 50 km away.[5] They then travelled by PMV along the rough coast road to Bereina some 45 km away and thence via the Hiritano Highway to Port Moresby. This was a very slow trip and it was not possible to travel and return in one day. In 1995 the one way fare was K12 per person for the canoe and K10 for the PMV (Kinhill Kramer 1995: Table 4.3), a total of K22 or A$22 at the then prevailing exchange rate. Despite the transport constraints, shortly before the road was constructed people around Malalaua had a moderately high cash income of 41-100 kina/person/per year derived mainly from the sale of betel nuts and fresh food in Port Moresby markets (Hanson et al. 2001: 41).

The new sealed road was completed in 2000 and by 2002 Laufa (2005: 82-89) reported there were many more PMV operating than previously, that it was possible to make a return trip for Malalaua to Port Moresby in a single day if necessary and the one way passenger fare was K20 or A$10 at the then prevailing exchange rate. As an indication of the level of economic activity generated by this new road, Laufa (2005: Table 5) calculated that the 2002 annual revenue (i.e. turnover) of the 27 PMVs servicing the Malalaua-Bereina highway (and thence to and from Port Moresby) for which he collected data was K4.914 million, i.e. K182 000 for each PMV, which is extremely profitable. Unfortunately we have no quantitative data on the incomes of transport operators before the road was built but the amounts of money spent on transporting people and goods to and from Port Moresby by water and road would not have been anything like as great as in 2002. Nor do we have good data on the magnitude of change in economic activity or improvement in access to services in Port Moresby. However, it is known that the consumption of betel nut has been expanding rapidly in PNG in recent years; that Port Moresby is a major destination for betel nut sellers as the population grows and is approaching 300 000; that most of the betel nut sent to the city comes from the area west of there, including the Malalaua area; and that transport by waterways was expensive and limited trade. It is highly likely that the improved transport links provided by the Bereina-Malalua road would have had a major positive impact on production, transport and sale of betel nut from this area to Port Moresby.

If a proper before and after construction socio-economic study had been undertaken I have little doubt a few relatively simple household questions such as in the following hypothetical (and simplistic) example (Table 1) would have elicited clearly real benefits and their magnitudes that accrued.

[5] Data from the 1995 environmental survey and preliminary impact statement for the proposed Bereina – Malalaua highway (Kinhill Kramer 1995), which I coordinated.

Table 1. Results of a hypothetical survey of the socio-economic impacts of building the new Bereina-Malalaua road

Question	1995 response (pre-road)	2002 response (post-road construction)	Hypothetical interpretation
How often do you travel to Port Moresby (POM)?	6 times a year	6 times a month	The construction of the road had a dramatic positive impact on the standard of living of people in and around Malalaua. Frequency of travel to POM increased 12 times and travel time and real costs were cut to less than half previously. Sales of betel nut and vegetables in POM markets increased 10 fold, but incomes increased only seven-fold because of lower unit prices in the POM markets Also because of the climatically-induced reductions in betel nut production in 2002, less was taken to market than in the first 2 years the road was in operation. In other words, when the road was first opened the benefits were even greater.
Why do you go there?	To sell betel nut and fresh vegetables and to visit relatives	To sell betel nut and fresh vegetables and to visit relatives	
How do you get there?	In a round about way by canoe then by PMV along rough roads	Directly by PMV along the new sealed road	
How long does it take?	All day (and a very tiring trip requiring trans-shipping the bags of betel nut)	4 hours (and comfortable trip)	
How much does it cost?	K22 (A$22)	K20 (A$10)	
How much cargo can you take?	1 bag of betel nut or fresh vegetables, mainly because the canoe can only carry a limited load and only a few PMVs operate out of Iokea	10 bags of produce or more, some on the PMV with me and the rest cheaply by truck, of which several travel to POM and back daily	
How did level of production and price of betel nut compare with previous years?	Excellent growing season and good price in POM	Production lower than usual because of drought and prices low because of a supply glut in the POM markets	

In 2002, when this hypothetical survey was undertaken, the road was still in new condition, but let us assume that by 2005, because of complete lack of maintenance and vehicle overloading, the road had deteriorated badly to the extent that development agency funding was required to rehabilitate it. If before and after rehabilitation impact surveys were undertaken asking the same simple questions, the finding would probably be much more equivocal, as Table 2 illustrates.

Table 2. Results of a hypothetical survey of the socio-economic impacts of rehabilitating the existing Bereina-Malalaua road

Question	2005 response (pre-rehabilitation)	2007 response (post rehabilitation)	Hypothetical interpretation
How often do you travel to Port Moresby (POM)?	6 times a month	5 times a month	There has been no measurable improvement in the standard of living of people in and around Malalaua since the road was improved. Sales of betel nut and vegetables in POM markets per trip remained the same but incomes decreased considerably because of (a) lower unit prices in the POM markets, and (b) climatically-induced reductions in betel nut production in 2007. Because of these two
Why do you go there?	To sell betel nut and fresh vegetables and to visit relatives	To sell betel nut and fresh vegetables and to visit relatives	
How do you get there?	By PMV	By PMV	

How long does it take?	4.5 hours (a bit bumpy)	4 hours (a comfortable trip)	factors, fewer trips were made to POM markets than when the pre-rehabilitation survey was undertaken. Frequency of travel to POM decreased 17 per cent, although travel time decreased by 11 per cent because of improved road conditions. The cost of the fare in kina did not change, but the real cost increased because of currency revaluations and inflation. In other words, the level of economic activity was higher before the road was improved. It can be argued, but not proved, that if the road had not been improved probably the only difference would have been that trips to POM would have taken longer and been even more expensive, thus reducing net incomes even more than has occurred between 2005 and 2007.
How much does it cost?	K20 (A$9)	K20 (A$15)	
How much cargo can you take?	10 bags of produce or more, some on the PMV with me and the rest by truck, of which several travel to POM and back daily	10 bags of produce or more, some on the PMV with me and the rest by truck, of which several travel to POM and back daily	
How did level of production and price of betel nut compare with previous years?	Excellent growing season and good price in POM	Production lower than usual and prices low because of a glut in the POM markets	

A much more detailed information collecting and analysis exercise would be needed to tease out the full range factors affecting road use and those benefits which could be attributed to road improvement.

Setting up the Socio-Economic Monitoring and Evaluation (M&E) Process

If demonstrating that benefits have accrued to local people as a result of road rehabilitation is made a requirement of project development agency funding, then methods capable of identifying, measuring and attributing these benefits have to be put in place and socio-economic surveys undertaken *before* construction works commence, to be repeated *after* they have been completed (ideally 6 months to a year after, to allow people to adapt and respond to the improved road conditions). There may also be a requirement for monitoring of benefits in the course of construction works.

There is no single 'correct' socio-economic monitoring approach. The approach selected will be influenced by a wide range of factors including:

- the scope of the road rehabilitation project (the number of sub-projects, their length, proposed treatment and project timing),
- the development agency's and host government's requirements for the study, and
- the financial and personnel resources made available for the study (including the skills and experience of the study team).

Commonly a high level of expatriate specialist input and funding is provided for the 'before' survey, but as the 'after' survey more often than not takes place after the development agency-funded component of the project has been completed, it is left to the local counterpart government agency to implement the 'after' survey, with their limited expertise (despite the best efforts at counterpart training) and even more limited resources. The outcome usually is, as pointed out by ADB (2002), the follow up 'after' surveys and associated analyses of data and reporting are seldom if ever undertaken.

Selecting Road Sections and Target Populations to be Surveyed

A first step is to select sub-projects to be included in the M&E program. For large projects with several sub-projects it is neither necessary nor practicable to include them all, unless endless time and resources are available. In general road sections which are as long as possible (more than

20 km) and in very poor condition, requiring major rehabilitation works (i.e. *betterment*) are more likely to produce measurable benefits than short sections requiring only *periodic maintenance.*

To the extent practicable, the target villages and households should come from the end of the section being improved which is furthest away from the main destination of the village road users. These villages would be expected to benefit most from the road improvement works. It will be easier to identify and measure road improvement-induced benefits in, for example, a village at the far end of a 20 km road section being rehabilitated and 40 km from their main market and service centre than in a village 5 km along the same section and 25 km from the same market/service centre. The former village will benefit from the full 20 km of road improvement and the latter from only 5 km. Ideally of course the socio-economic surveys should be undertaken in both villages (or all villages along that section), which would provide an excellent compare and contrast situation, but at twice (or more) the effort.

In most rural areas crop harvests and hence cash income flows are seasonally influenced (especially where there are pronounced wet and dry seasons) so it is important to schedule the before and after road rehabilitation socio-economic surveys at the same time of the year (i.e. in the same season). Otherwise it could be difficult in, for example, coffee growing areas to prove that the road raised living standards if the before improvement survey was undertaken at the height of the coffee harvesting season, when people were flush with cash and could travel frequently to buy and sell goods and access services, whereas the post construction survey was undertaken shortly before the coffee season when village cash reserves were at their lowest.

What Data Can or Should be Collected and How?

There is a plethora of relevant data collection techniques/sources including the use of official data from government sources, key informant interviews, participatory rural/poverty assessments, household surveys, transport operator surveys, shop/market surveys and feedback workshops. Collectively these can provide information about a range of indicators which, if measured before and after road rehabilitation, can be used to demonstrate the kinds and magnitudes of both benefits and, if properly designed, any negative effects.

Indicators which are commonly used are:

- Village and household income and expenditure, and more general indicators of standard of living including professional, employment or business status, housing standard, access to electricity and water, vehicle ownership, and education opportunities afforded to children.

- Travel patterns and transportation. How often people travel, where to, why, by what means, how long does it take and what does it cost. As Gannon and Liu (1997: 32) noted, specific data on the transport behaviour of the poor are very limited because of a lack of detailed household travel surveys of this kind.

- Transport businesses (passengers and goods). Vehicle operating costs, travel times to various destinations, frequency of operations, fares and freight charges.

- Shop/markets surveys. The number of entrepreneurs, goods and services sold, prices, value of turnover, profit levels.

- Increased use of services such as health facilities and schools

The survey team must firstly analyse what is appropriate in the particular situation, then select from this smorgasbord of indicators, devise questionnaires and other means to collect the selected classes of data, go out and collect the data in the field, enter it into a suitable database, analyse it and report on it.

Time and Resources Needed to Conduct the M&E Program

From start to finish the task of monitoring and evaluating the benefits arising from the rehabilitation of any given section of road will take a minimum of 2.5 years involving at least the following steps:

- Design of the program and assembling the study team.
- The baseline (pre-construction) survey phase.
- A construction period of 6-12 months, during which M&E of impacts (including benefits) may be conducted.
- The post-construction survey phase, to be undertaken at least 6 months and preferably 12 months after construction has finished, allowing the target population to respond to the opportunities offered by the improved road. Ideally this survey should be undertaken at the same time of the year as the baseline survey, which in practical terms means 2 years later.
- Analysis and reporting.

The program will usually include several sub-projects representing the range of provinces/geographic contexts covered by the project. The construction periods for each of the selected road sections are likely to be staged such that the M&E program will need to continue for 3 or 4 years rather than the minimum of 2.5 years as would be the case for a single road section.

The team assembled to carry out the program will have to be suitably skilled and experienced and very well resourced. If it is implemented primarily as a consultancy, the costs are likely to be in the hundreds of thousands of dollars. Ideally the key team members should be available for the duration of the program, which is likely to be ongoing (not necessarily full-time) for 3-4 years.

M&E programs of the kind envisaged above will normally be undertaken, at least in their early stages, by socio-economic consultants (led by expatriates) working with the project managing contractor or supervising consultant (again usually led by expatriates) and government counterparts. The resources needed to carry out these kinds of M&E programs usually can be provided for the duration of the construction phase of the project. However once the project is finished and the project implementation team's role comes to an end, unless provision has been made for the socio-economic benefits M&E component to be continued, responsibility to complete the M&E program will devolve to the government counterparts. Even in the best of circumstances, it is very unlikely the counterparts will have the necessary skills and experience, let alone the sizeable financial resources, to complete the program. As a consequence there is a very high probability the program will fail in delivering its evaluation outcomes.

In the Indonesian Road Rehabilitation (Sector) Program I am currently involved in, for example, planning for the socio-economic monitoring and evaluation program required to comply with the ADB loan conditions began in mid 2003, and the pre-construction surveys of the 10 selected sub-projects were undertaken between May 2004 and January 2005. Because of its large size and delays in its implementation, the project has been extended to December 2006, meaning that if all goes well the Core Team Consultants team will be able to complete post-construction surveys of the first six of these 10 sub-projects, starting in May 2006. However so far there is no certainty that the necessary personnel and financial resources will be made available to our counterparts in the Ministry of Public Works who would have to complete the remaining four post-construction surveys in early 2007. The loan agreement specifies that benefits M&E should be undertaken again 4 years after road rehabilitation but unless external support is forthcoming there is virtually no chance this will happen.

Is it Worth the Effort?

In the first half of this paper I have argued that the benefits to local villagers (including the poor) arising from development agency-funded national and provincial road rehabilitation projects are likely to be relatively small and therefore difficult to measure quantitatively and to attribute confidently to the road improvement works. In the second half I have argued that, paradoxically, because of this the impact M&E methods used need to be sufficiently comprehensive to be able to (a) identify and measure a range of benefits, and (b) *prove* they have resulted from road rehabilitation.

I have described from my experience the kind of benefits M&E program that needs to be undertaken if benefits are to be identified, measured and attributed successfully. Such programs need to be of long duration (3-4 years), they require sustained input from skilled and experienced personnel and they are likely to be relatively expensive. Furthermore, unless adequate provision is made for their continuation and completion beyond the life of the rehabilitation project they are virtually doomed to failure.

I am not aware of any previous successfully completed M&E case studies for development agency funded road rehabilitation projects which are directly comparable to the circumstances discussed in this paper. Rather than the development agencies commissioning such M&E studies on a consultancy basis, it would be more cost-effective if they commissioned Universities (especially local Universities) to undertake them. As well as being cheaper, University research groups would also be better placed to make the long term commitment of personnel required to work with host country counterparts and thus the probability of the M&E studies being followed through to a successful conclusion would be higher.

If such studies demonstrated that as predicted modest positive socio-economic benefits flowed to local people from national and provincial road rehabilitation projects, the development agencies could relax their M&E requirements for future such projects, thus freeing up more funds (in some cases hundreds of thousands of dollars) for other purposes, including road construction works or local poverty-reduction programs.

In recent years poverty reduction has been given by the development agencies as the primary justification for funding national and provincial road rehabilitation projects, and this has driven the requirement for monitoring strategies and evaluation studies focused on demonstrating there has been poverty reduction, especially in local communities. In reality the major justification for such road rehabilitation projects should be (as it was in the past) to stimulate national and provincial economic growth and to facilitate communications, interactions between regions and consequent strengthening of national unity. All of these beneficial outcomes will also address poverty through increasing opportunities for the most disadvantaged and improving livelihoods.

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Appendix 1

A Summary of the Major Findings of the ADB (2002) Impact of Rural Roads on Poverty Reduction Study

ADB (2002) undertook a case study-based analysis of the impact of rural roads on poverty reduction, using two roads in each of three Asian countries: Indonesia, the Philippines and Sri Lanka. Although it is widely assumed that investments in rural roads reduce poverty, at the time their study was undertaken there was little evidence of the ways in which these impacts occur or what the determinants are.

The findings from their study were similar in all three countries, indicating that the impacts of rural road improvement on rural communities were similar despite socio-cultural-political-economic differences within and between the three countries.

All of the roads they studied were rural roads, and most would be classified as local roads rather than provincial or national roads/highways.

Socio-economic impacts on the poor and very poor

The results showed that in all case study projects the poor and very poor benefited substantially from social impacts of rural roads through access to state services in areas such as health, education, rural extension and provision of information. Such improvements reduce the perception of isolation and remoteness among the poor and very poor. These social impacts could not be quantified rigorously due to the lack of baseline socio-economic data and periodic monitoring.

Although economic benefits did flow to the poor and very poor, they did not do so to anywhere near to the extent they did to the better-off. The poor and very poor have little financial and social capital to invest in economic opportunities arising from road improvement. They are more risk-averse than the better off and are often locked into relationships of debt with rural landlords and traders. Contrary to common belief, increased mobility benefits the better-off rather than the poor in seeking employment outside the community. Better-off households are more likely to have access to information on well-paid, or stable, outside employment, while the poor and very poor lack education and support networks in more urban areas and can access only temporary, seasonal and unskilled work opportunities, which are usually poorly paid.

The study also showed that the context within which economic impacts take place was often determined by conditions which could not be affected by the road, or only incidentally. These include climatic variability (especially droughts and floods), agricultural potential, spatial position and proximity to networks (the disadvantages of remoteness cannot be overcome simply by improving roads) and world market prices, as well as social structure and concentration of assets. Structural poverty problems such as lack of access to land and indebtedness to landlords and traders, for example, are unlikely to change immediately if at all as a result of rural road investments.

Changes in transport services

In all case studies there was an increase in the number of vehicles using the road and availability of transport services, and a significant reduction in travelling times and the VOCs of existing transport providers.

Whether these benefits were passed on to service users depended heavily on the level of competition that developed. For competition to emerge certain preconditions must be present, including demand, distance to markets, road maintenance and regulatory barriers. **Demand** is closely linked to population density and agricultural potential of the area. The higher the population density and the greater the agricultural potential, the greater the demand is likely to be. The longer the **distance to markets** the weaker competition between transport operators is likely to be. Where **road maintenance** is neglected, transport operators tend to gravitate towards other areas with better roads and the level of competition falls. **Regulatory barriers** included provision

of government-subsidised bus services, fare subsidies/tax concessions to private operators and restrictions on the numbers of vehicles allowed to operate in a given area.

Competition, and thus the benefits for consumers (poor and non-poor), appears to occur only once a threshold has been reached. There must be sufficiently high population densities and levels of economic activity (especially good agricultural potential). There must also be a commercial centre of sufficient size within easy reach of the rural area, and there must be a commitment to regular road maintenance. Without maintenance, roads will quickly revert to their previous condition and transport entrepreneurs will have no incentive to provide services.

Transport providers and traders/intermediaries using their own vehicles to conduct their business are often the winners with both good and bad rural roads. On good roads they benefit from lower VOCs and time saved, even where there is competition. On bad roads they can monopolise transport routes and/or the purchase of primary products or sale of goods, as often they are the only transport operator or buyer/seller along the road. Except for village-based operators of small motorised vehicles, transport providers and traders/intermediaries are generally based in larger towns at either end of the road. In almost all of the case study areas these town-based operators were the primary beneficiaries from road improvements.

Recommendations for strengthening poverty reduction impacts

Experience from the case studies showed that rural roads alone were not enough to tackle poverty, and that this could best be done through **integrated projects** where the road was one part of a larger program of support, rather than a sector road investment.

It has been widely demonstrated that direct benefits to the poor can come through their direct employment in **labour-based road construction and maintenance**. Given a sufficiently long period of employment on the road, the poor can accumulate capital to invest in alternative livelihood opportunities and thus move away from poverty.

ADB (2002) stresses that long-term social and economic benefits from roads are often threatened by a neglect of **road maintenance.** Devolving responsibility for rural road maintenance to local communities is a means of ensuring simultaneously that the poor can receive benefits through direct employment and that local communities are stakeholders in the road servicing their communities. The income generated from employment on road maintenance can provide start up capital for the poor to make use of the road in some future enterprise or endeavour.