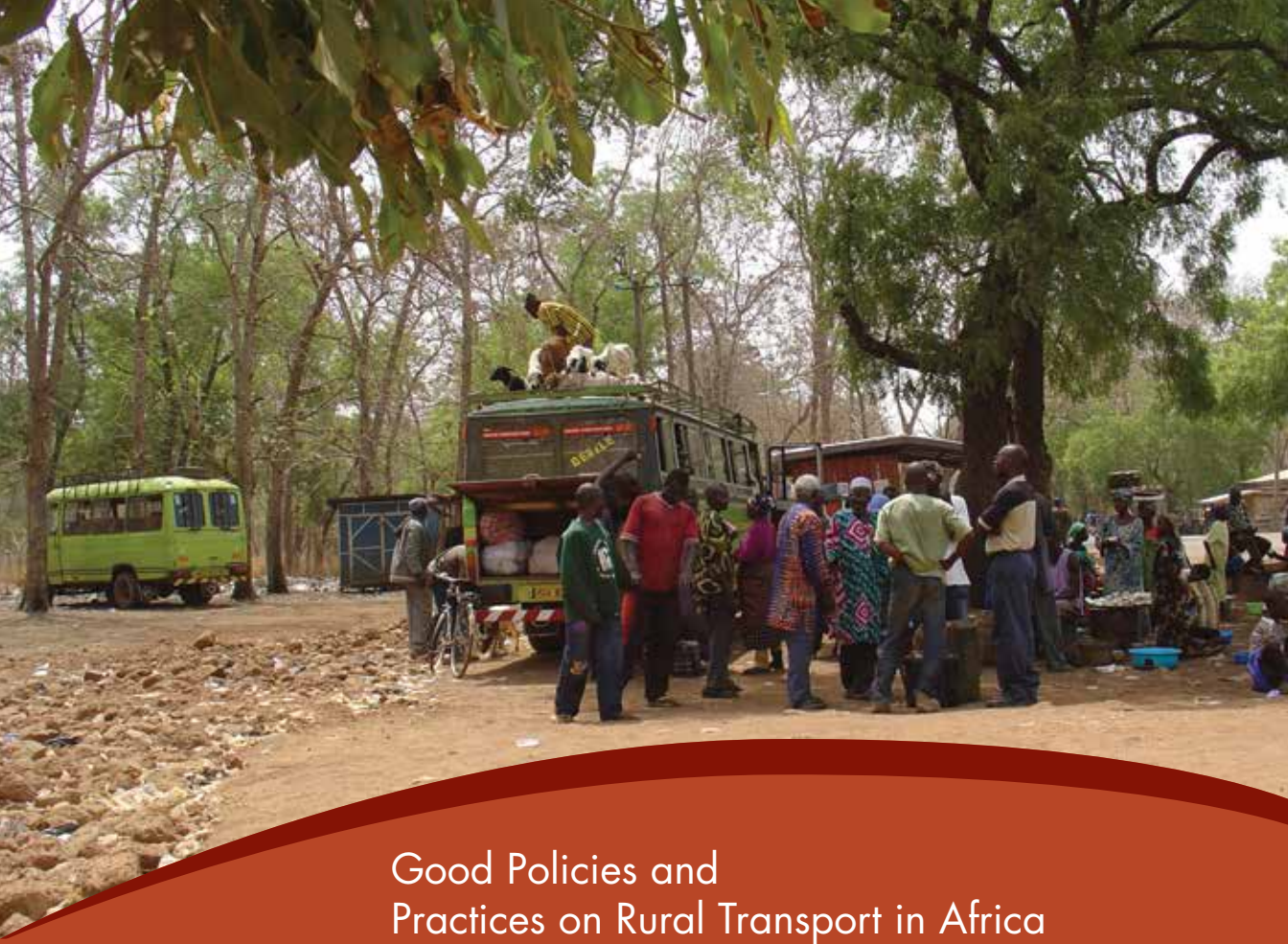

Good Policies and
Practices on Rural Transport in Africa

Monitoring & Evaluation

Anthony Airey

SSATP
Africa Transport
Policy Program

Working Paper No. 99

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May 2014

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Africa Transport
Policy Program

The SSATP is an international partnership to facilitate policy development and related capacity building in the transport sector in Africa.

Sound policies lead to safe, reliable, and cost-effective transport, freeing people to lift themselves out of poverty and helping countries to compete internationally.

* * * * * * *

The SSATP is a partnership of
40 African countries
8 Regional Economic Communities
2 African institutions: UNECA, AU/NEPAD
Financing partners for the Second Development Plan: European Commission (main donor), Austria, France, Norway, Sweden, United Kingdom, Islamic Development Bank, African Development Bank, and World Bank (host)
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The SSATP gratefully acknowledges the contributions and support of member countries and its partners.

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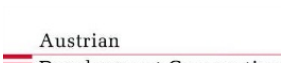

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Acknowledgements

This working paper forms part of the activities of the Africa Transport Policy Program to advocate the adoption of good policies and practices in rural transport in Africa. It is intended to fill identified knowledge gaps on rural transport monitoring and evaluation that is key for impact evaluation of rural transport's contribution to poverty reduction and growth in Africa.

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Abbreviations and Acronyms

ADB	Asian Development Bank
AFCAP	Africa Community Access Project
AfDB	African Development Bank
AICD	Africa Infrastructure Country Diagnostic
BIDS	Bangladesh Institute of Development Studies
CBA	Cost-benefit analysis
CFR	Caisse pour le Financement Routier (Morocco)
CID	Conseil Ingénierie et Développement (Morocco)
CNER	Centre Nationale d'Études et de Recherches Routières
CSA	Central Statistical Agency
CSO	Country Statistical Office
CTI	Community Transport Infrastructure
DANIDA	Danish International Development Agency
DFRMST	Department of Feeder Road Management Support Team
DfID	Department for International Development (U.K.)
DGSN	Direction Generale de la Securite Nationale (Morocco)
DHS(s)	Demographic and Health Survey(s)
DOR	Department of Roads (Nepal)
DSPCT	Direction de la Stratégie, des Programmes et de la Coordination des Transports (Morocco)
EA	enumeration areas
EC	European Commission
ECAM II	Deuxième Enquête Camerounaise Auprès des Ménages
EDRI	Ethiopian Development Research Institute
EI	Employment-Intensive
EIRR	economic [internal] rate of return
EmONC	Emergency Obstetric and Neonatal Care
EMNV	Encuesta Nacional de Hogares sobre Medición de Nivel de Vida (Nicaragua)
EMP	Environmental Management Plan
ERA	Ethiopian Roads Authority

ESIA	Environmental and Social Impact Assessment
EU	European Union
FAO	Food and Agriculture Organization (United Nations)
FGD	Focus group discussions
GDPRD	Global Donor Platform for Rural Development
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GPS	Global Positioning System
GR	*Gendarmerie Royale* (Morocco)
gTKP	Global Transport Knowledge Practice
HBS	Household Budget Surveys
HCP	*Haut-Commissariat au Plan* (Morocco)
HDM III or IV	Highway Design and Maintenance [Standards Model] III or IV
HICE	Household Income, Consumption and Expenditure Surveys
HIV/AIDs	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IDP	internally displaced people
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IFRTD	International Forum for Rural Transport and Development
ILO	International Labor Organization
IMF	International Monetary Fund
IMT	Intermediate Means of Transport
INDH	National Initiative for Human Development (Morocco)
IRF	International Road Federation
IRR	Internal Rate of Return
kg	kilogram
LF(M)	Logical Framework (Matrix)
LSMS	Living Standards Measurement Surveys
MCA	Multi-Criteria Analysis
MCC	Millennium Challenge Corporation
MDG	Millennium Development Goal
METL	*Ministère de l'Équipment, du Transport et de la Logistique* (Morocco)
M&E	Monitoring and Evaluation
MIMIC	Multiple Indicator Multiple Cause
MRA	Multiple Regression Analysis

NGO	Non-governmental organization
NPV	Net Present Value
NRRAI	National Rural Road Access Indicator
OECD-DAC	Organisation for Economic Co-operation and Development–Development Assistance Committee
OVI	objectively verified indicator
PAST	Programa de Apoyo al Sector Transporte (Nicaragua)
PHS	post-harvest survey
PMMR	Performance Based Management and Maintenance of Roads
PNRR1/2	Deuxième Programme National des Routes Rurales 1 and 2
PRA	Participatory Rural Assessment
PRIA	Project Road Influence Area
PSM	propensity score matching
PSNP	Productive Safety Net Program in Ethiopia
QIECP	Quick Impact Employment Creation Project (Sierra Leone)
R&D	research and development
RAI	Rural Access Index
RAPI	rapid assessment of poverty impacts
RBM	Results-Based Management
RCT	Randomized Control Trial or Experiment
RDP	Rural Development Project
RED	Road Economic Decision model
RGPH	Recensement Général de la Population et de l'Habitat de 2004
RPM	Road Prioritization Methodology
RRA	Rapid Rural Assessments
RRMIMP II	Rural roads and markets improvement & maintenance project
RSA	Republic of South Africa
RSDP	Road Sector Development Program (Ethiopia)
RTI	Rural Transport Infrastructure
RTP I	Rural Transport Project I in Viet Nam
RTTP	Rural Travel & Transport Program (of the SSATP)
RUSS	Road User Satisfaction Surveys
SIRRV	Survey of Impacts of Rural Roads in Viet Nam
SSA	Sub Saharan Africa
SSATP	Sub-Saharan Africa Transport Policy Program
STD	Sexually Transmitted Disease
TOR	Terms of Reference
URRAP	Universal Rural Road Access Program
VLTTS	Village Level Travel and Transport Surveys

VNLSMS	Viet Nam Living Standard Measurement Survey
VOC	vehicle operation costs
WCA	World Program for the Census of Agriculture
WHO	World Health Organization
WM	Welfare Monitoring Surveys
ZORI	zones of road influence

Executive Summary

There is a lack of evidence on both the development impacts of rural transport improvements and their benefits to the poor. This knowledge gap stems from the methodological weaknesses of existing SSA impact studies and the failure to undertake robust baseline data collection before the launching of a rural transport project. This failure is compounded by poor sample design and analysis of collected data. Impact studies tend also to be traffic focused and assume that resultant transport services are affordable and appropriate to the poor.

In project terms, impact evaluations are the final stage of the M&E process, preceded by and to some extent drawing on the results monitoring of the rural transport project outcomes. Impact evaluation is therefore a post project activity used to assess whether the investment has achieved its development goal.

Most rural transport projects use quantitative techniques to assess impacts, which belong to five main types. The first two are macro and sector studies, using secondary data to test existing theories and hypotheses on the relationship between rural transport and the development process, and predict the likely poverty reducing impact of a rural transport investment policy.

The next three are used to evaluate specific projects. They range from cross sectional studies to panel surveys with the latter emerging as the more robust and methodologically sound approach. This is particularly the case if a Randomized Control Trial (RCT) sampling of household respondents is adopted and propensity score matching is applied to identify comparable treatment and non-treatment groups as the basis for the counterfactual—what would have happened without the intervention. These have been called the "gold standard" impact methodologies but rural transport projects may not be large enough to warrant the technical and financial resources needed to collect and analyze the large quantities of impact data required by such an evaluation. This emphasis on increasingly sophisticated quantitative techniques has meant that qualitative techniques are usually used to

triangulate or crosscheck the econometric findings. Rarely are they used as a stand-alone evaluation.

All of these techniques use a range of indicators to measure direct and indirect effects and impacts. One indicator though missing from this list is the Rural Access Indicator (RAI), the defined percentage of population living within 2 kilometers (20-25 minutes' walk) of an all-weather road. This type of data is usually collected and developed at the macro level but there are notable inconsistencies in the way it is measured between different SSATP member countries. These inconsistencies need to be addressed if the RAI is to remain as a high-level access indicator capable of generalization within and between countries.

The experiences of impact studies carried out by two SSATP country members have been reviewed and this has identified a number of key principles that should be followed before a RT project commits to undertake an impact study:

1. There has to be a strong government and sector interest and commitment to undertake a robust impact evaluation. The financial and capacity needs of this commitment lie beyond the scope of most SSA countries and it is expected that development partners' support will be needed to address this shortfall.
2. Ideally, the impact study should be also aligned with government systems and be part of a capacity building exercise to carry out evaluations as part of the normal administrative, sector and governance functions that asks "what works, and for whom" This widens to impact evaluation to include country statistics offices (CSOs) and where appropriate university staff/research institutions. It should be possible to draw expertise from these organizations and put together a team of national researchers, supported by one or more international experts who have experience of conducting robust road impact evaluations outside SSA.
3. The scope of the evaluation has to be clearly defined by the client (public authorities). It should answer one or more of the following questions:
    - Is the intervention making a difference – What has happened because of the intervention?
    - What are the results on the ground – Has the project delivered its expected benefits?
    - These in turn can be addressed by a number of indicators or variables, which can be collected by both quantitative and qualitative techniques,

as a baseline before the project has initiated any works and at various stages after the works have been completed.

- The cost of impact studies reflects the scope defined by the client. At its simplest, an evaluation can undertake qualitative user-focused access surveys costing $100/200,000. At the other extreme, "gold standard" randomized control trials costs can exceed US$1 million in today's terms. The costs of the latter, and the need for international expertise, make them suitable only where there is significant government and DP commitment to the rural transport sector.

The adopted methodology for an impact evaluation is usually a compromise between the information needs of the funding agency/counterpart line ministry and the project provision for M&E. Budget constraints usually mean that project management focuses on methodologies that quantify project results or outcomes notably transport cost savings enjoyed by road users. Thus, many rural transport project logical frameworks specify traffic or access changes as objectively verified indicators with a supplementary expectation that there will be a similar reduction in transport charges. Access indicators associated with attendance and use of markets, health centers, schools, etc. might also be included as objectively verified indicators. These performance or outcome indicators are easy to collect and analyze while project management and the subsector ministry alike will readily understand the findings and justify the investment in cost benefit terms without any need to understand the long-term impact.

This approach has worked where the road network is well trafficked, which is not the case for a number of rural transport projects. In this situation, the proponents of quantitative techniques have argued that traffic-based evaluations need widening to include household and community surveys, which capture the full development impact of RT improvements.

The high cost and resource demands of this more rigorous and defensible impact study mean that it is only occasionally used, usually in situations where development partners and clients have a need for impact data to inform their policy and program commitments. Most rural transport projects usually adopt a results or performance approach to project monitoring. This type of impact evaluation is methodologically sound if it stays focused on the direct traffic and transport benefits of a project. In this way, it provides subsector feedback on the success of its planning and appraisal procedures and meets the accountability needs of financing agencies and development partners. However, it has a number of weaknesses the

most important of which is its inability to assess the distribution of benefits in poverty terms. Here it is recommended that qualitative PRA techniques in social mapping/modeling and wealth/well-being ranking are explored as a means of answering the question of who benefits from rural transport interventions.

1. Introduction

This publication is part of a series aimed at promoting good policies and practices on rural transport in Africa. A recent review of the status of Rural Transport Knowledge Products and Practice (Riverson, 2012) identified a number of knowledge gaps and recommended the production of working papers to address these. One of these gaps was the absence of robust tools, including relevant indicators and instruments, to measure the impact of rural transport projects on rural growth and poverty reduction. This paper addresses this gap.

1.1 Working definitions and terminology

The focus on impact monitoring appears relatively straightforward but in reality requires a distinction between *effects* and *impact*, terms used interchangeably in the literature. Similarly, there is a range of technical terms and definitions applied to Monitoring & Evaluation, presented in Annex 4.

A monitoring & evaluation system is an essential element of planning, design and implementation of a rural transport project[1] as it serves to assess whether it has achieved its objective and its development goal. Figure 1-1 outlines the monitoring hierarchy in Logical Framework terms, the dotted line outlining normal project responsibilities and impact monitoring identified as a post-project activity.

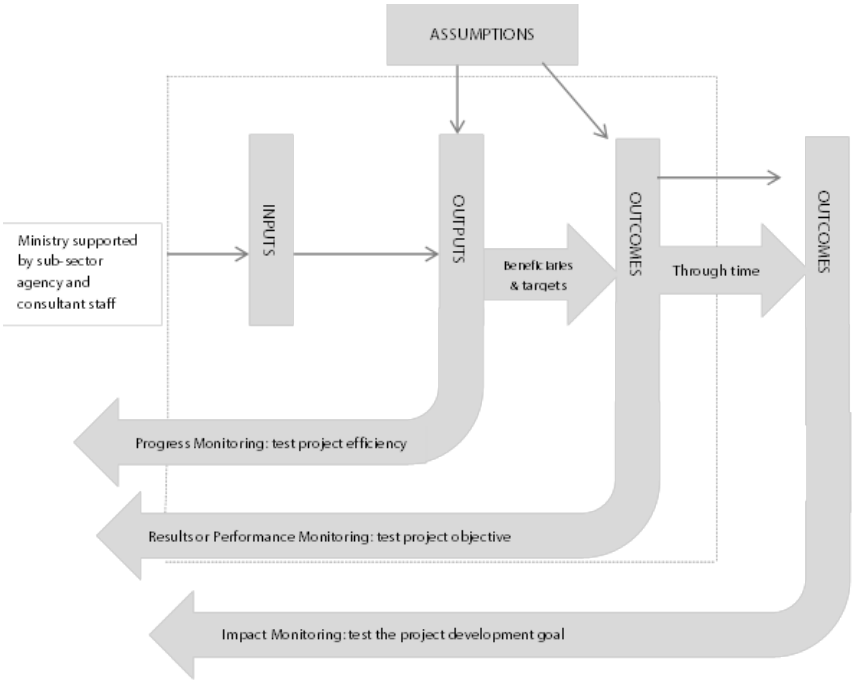
In this model, *performance or results monitoring*[2] identifies the immediate or short-term direct and indirect effects or outcomes brought about by a rural transport intervention. In contrast, impacts are the longer-term changes in social and economic well-

[1] The term is used in its broadest sense of being a collaborative undertaking, involving research or design carefully planned to achieve a particular aim or purpose (Wikipedia).

[2] Figure 1.1 equates Performance Monitoring with Results Monitoring to describe each type of monitoring (World Bank, GDPRP, FAO, 2012). The figure takes a narrower definition of Progress Monitoring as the assessment of implementation efficiency, i.e. comparing actual against expected financial and physical progress.

being arising as beneficiaries adjust their travel and transport behavior in response to the new opportunities brought about by the intervention. As a rule, effects are associated with traffic and transport, whereas impacts arise when these effects are sustained over time through maintenance. Ideally, an Impact Evaluation establishes the net effects and impact of an RT intervention on specific "treatment" units i.e. households, enterprises or locations such as roads and/or communities that have benefitted from a project. The evaluation compares these findings with those collected from similar units that have not benefitted from the project. These are "controls" or "non-treatment" units, which represent the counterfactual i.e. what would have happened if the intervention had not occurred (Van De Walle , 2009).

Figure 1-1 Monitoring and Evaluation of Rural Transport Projects



Impact monitoring tests the project's development goal, which is of interest to government, transport policy makers and financiers since it confirms or affirms their policy goals/investment focus on RT as a stimulus to development, economic growth, poverty alleviation etc. Impacts are also important to the wider public and civil society, which needs to assure that RT improvements are as inclusive as possible and their benefits are not confined to special interest groups and elites.

This literature review suggests that this distinction is not widely recognized, particularly in the unpublished grey literature. Thus, it appears that many development partners' evaluations focus on results by assessing project relevance, efficiency, effectiveness, impact and sustainability but as such are largely following a performance monitoring agenda and project timeline and focus on effects or outcomes, not on impacts.

In contrast, the published literature tends to recognize this distinction. Thus, the Millennium Challenge Corporation (MCC) sees independent evaluations as *the most rigorous means of measuring [program] impact and [is] at the heart of MCC's commitment to accountability, learning, transparency, and evidence-based decision-making* (p. 1, MCC, 2012). Yet, there are few completed independent evaluations on the MCC website and the majority of their evaluation effort seems focused on performance monitoring. Similarly, the Indian Government's Results-Based Management of its large agricultural support program separates *outcomes* from *impact* and stresses the importance of the former as a means of assessing the performance of government departments such as Public Works and Transport in supporting the government's ambitious agricultural development program (Government of Kerala Memo, 2013).

2. Monitoring & Evaluating Rural Transport Improvements

2.1 Existing knowledge

Monitoring and Evaluation (M&E) has been an important feature of rural transport projects over the last decades but was concerned with progress and performance monitoring as a means of reporting to sector ministries, government and development partners. Impact assessments, where they have been part of this reporting effort, have tended to be of low priority in the management push to mobilize and implement physical works. This has affected the resultant validity and reliability of impact assessment. Generally speaking, project management finds it easier to organize and support baseline studies than fund and support follow up surveys. This weakness was recognized as early as 1984, when Howe noted in his review of road impact literature that *not one completed study has been based on the long term monitoring of [project-induced] change* (p. 80, Howe, 1984).

Since then there has been considerable changes in the level of funding and techniques used to evaluate interventions, but *there is [still] surprisingly little hard evidence on the size and nature of rural road improvement benefits, or their distributional impacts* (p. 1, Van De Walle , 2008). Van De Walle goes on to say, *there has been relatively few rigorous and credible IEs of rural roads* (ibid). This continuing knowledge gap seems to stem not from a lack of impact studies but from methodological failings in assessing the counterfactual usually over a short and project-dependent timeline when impacts need a longer period of time to emerge. Yet as Kingombe indicates, the stimulus of rural road investment on cotton production took some seven years to emerge in eastern Zambia (2012). Similarly, Mu and Van De Walle found that the range and availability of goods, services, markets and off-farm employment and changes in primary school completion rates took some six years to become statistically significant changes in Vietnam (2007).

Given these concerns, it is nevertheless possible to identify the likely results chain brought about by interventions (Table 2-1). The table highlights the positive[3] relationships expected from an evaluation; it should be noted that the strength and direction

[3] Potential negative effects are considered in Section *Possible negative effects and impacts.*

of the relationships is dependent on the national and regional context as well as the dynamics of the local economy. This theory-based approach is ideal for a project-based impact evaluation as it uses existing logical frameworks to map out the causal chain from inputs to outcomes and impact, and tests the underlying assumptions and development expectations behind the project design. It therefore sheds light not only on what works but also why it works (White, 2009) and can be broadened to include access impacts on social capital and networks (Davis, 2003).

Table 2-1 Likely Effects and Impacts of RT Improvements

Activity area	*Effects*		*Impacts*
	----------Increasing Time---------->		
	Direct road surface dependent changes		
Traffic and transport	Lower vehicle operating costs and hence transportation charges, fares and tariffs (+++) Faster, more reliable and safer travel (+++)	Improved access to cheaper/better goods and services (+++)	Traffic growth and more efficient transport services (modal composition) (+++)
	Indirect traffic and transport dependent changes		
Rural Economy	Lower transportation charges, fares and tariffs (+++) Increased access to extension, inputs and markets (+++)		Increased productivity of businesses (+++) Increased productivity of agriculture (+++) Increased income and consumption
Education	Saved time and effort, hence increased energy and time to channel into education and easier access to schools (++)		Improved delivery of education (+)
Health	Increased access to health care (++) Increased access for public health extension workers/outreach programs		Improved delivery of health care (+) Improved Water, Sanitation and Hygiene (WASH) potable water (+)
Individual well-being	Saved time & effort (++)		Greater empowerment for women (+)
Social capital and networks	Changes in mobility (+)		Maintenance of social networks (+)
Governance	Greater access/interaction with government agencies (+)		More effective lobbying for other development interventions (+)

N.B. The number of '+' reflects the strength of impact.

Source: Adapted from Tables in Brenneman, A. and Kerf, M.; 2002

Traffic and transport

Traffic and transport studies have been the most consistent and widely applied focus for impact studies yet in reality, they should be considered to be one of the immediate effects or outcomes and as discussed later are at the core of performance monitoring.

Traffic. Traffic analysis examines the levels and mix of all traffic to ascertain if post improvement traffic flows are cheaper, faster and safer which is often associated from a modal shift from less efficient to more efficient transport vehicles. The first two benefits assess cost and savings and are often the basis for economic analysis to confirm if the project was a sound investment in Net Present Value (NPV) of Economic Internal Rate of Return (EIRR) terms and form part of a more comprehensive cost benefit analysis[4]. These conventional economic models are developed at the appraisal stage and are revisited as part of the project results monitoring. Importantly, if the economic benefits fail to achieve an acceptable economic rate of return then the improvement has been over designed, which equate to a waste of resources or a planning weakness—a cause for concern for project management and client alike since it may represent a planning and design weakness.

Most rural transport projects involve improving roads and tracks, which carry very low volumes of traffic. In Zambia, the baseline study for Community Transport Infrastructure improvements in five districts reported that an average of 253 pedestrians, 110 intermediate means of transport (IMT) and 10 motorized vehicles were using the proposed community roads on a daily basis (I.T. Transport, 2009). Similarly, the traffic levels were so low in Ghana that in spite of demonstrable transport cost reductions, standard economic analysis suggested that the investments were uneconomic. Thus, baseline studies showed that rural roads in the project areas were carrying an average of ten motorized vehicles per day, eight of which were motorcycles. This number increased to twenty-seven motorized vehicles along the project road of which twenty-three were motorcycles. This steep increase in motorcycles was mirrored along the control roads and reflected the falling costs of purchasing a motorcycle and their greater flexibility in traversing unimproved roads.

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[4] ORN 22: A guide for pro-poor transport appraisal identifies these in terms of 1) the initial costs of the investment; 2) the direct savings in the costs of operating vehicles 3) economies from reduced road maintenance; 4) time savings incurred by travellers and freight; 5) resource savings generated from reductions in road accidents and 6) the wider effects on the economic development of a region from changes in transport conditions. UK Department for International Development (DFID), 2004.

Transport. While transport is directly affected by savings in vehicle operating costs owing to reductions in the roughness brought about by road improvements, the critical question in terms of assessing impact is whether these savings are passed on to travelers and producers paying for transport services. All too often transport operators plying low volume roads face little competition and fail to pass on any post improvement vehicle cost savings they enjoy. An examination of this tendency in Malawi indicated that "*transport costs on poor feeder roads are disproportionately high as operators contend with the low volume of goods carried over short distances to local market centers and the possibility of empty backhauls*" (p. 2, Lall et al., 2009). A more recent study in Ethiopia confirms this relationship. It found that distance from markets was correlated with increased transport costs and c concomitant drop in demand for freight of more than 1,100 kg per household in accessing communities to just over 500 kg in the more remote areas (Stifel et al., 2012).

Alternatively, households on poor roads with few transport services may pay high transport costs indirectly by accepting lower prices for their farm produce i.e., by selling at the farm gate. (Jacoby and Minton, 2007). This poor access is to some extent being overcome by the widespread use of mobile phones. In the Zambian CTI survey, mobile phones are used to check market prices and organize the bulk movement of produce to markets offering the best prices (I.T. Transport, 2009).

In all of the above cases, the authors highlight the transport cost reductions arising from feeder road improvements as a means of increasing agricultural production and in the case of Ethiopia as a cost-effective way of reducing poverty (Stifel et al. 2012). In contrast, recent research in Malawi suggests that *reduced VOCs do not translate to reduced transport prices (especially where [traffic] volumes are low) and reduced transport prices do not translate to poverty reduction if the poor cannot afford to use transport services or need other factors to increase production* (p.18, Raballand, et al. 2011). These contrasting cases illustrate the lack of consistent impact evaluation findings, which in turn highlight the importance of the research setting.

Rural economy

Subsistence and cash crop agriculture is the primary basis of rural economy in Africa. The interaction between road infrastructure and this economy is indirect where access improvement facilitates the access to agricultural extension services, and the movement of inputs, marketed surpluses and cash crops. This facilitation role depends on the existence of a right of way along which motorized and non-motorized vehicles and transport services can operate. Ideally, the right of way should be engineered to provide all-weather access although seasonal access before and after the main rains may

be sufficient for moving bulky inputs and the harvesting and marketing of most crops. In either case, the road must be capable of attracting affordable transport services for farming households. It must also be maintained so that access benefits are sustained in support of agricultural investments like irrigation. Given this relationship, it is reasonable to expect that improved access would stimulate agriculture in one or more of the following ways.

- Extension or intensification of the cultivated area
- Increased number and range of crops being grown
- Greater use of agricultural inputs and credit
- Increased productivity and marketed surpluses
- Greater use of external markets with a commensurate increase in prices and returns. (Cranfield University and I.T. Transport, 2012)

This positive perspective is supported by the AICD (Africa Infrastructure Country Diagnostic) study on crop production and road connectivity in SSA which found that agricultural production and proximity (as measured by travel time) to urban markets are highly correlated, even after taking agro-ecology into account. Likewise, the adoption of high productive or high-input technology is negatively correlated with travel time to urban centers (Dorosh et al., 2009). However, research in Uganda cautions that it is not always the case that improving rural transport will generate a positive chain of events; it depends upon the "*assumptions, prices and market conditions*" encountered by the project (p. 4, Raballand et al., 2011). This finding is supported in by Gachassin et al. (2010) whose research in Cameroon concluded that better access to roads still left agricultural households "*trapped in poverty*" (p. 28, Gachassin et al., 2010) as they did not have the necessary endowments (land, skills, labor) to increase production and surplus.

One mechanism, which may explain this "poverty trap", is the reduction in price of local crops after a road improvement in Sierra Leone. Competition amongst producers and reduction in transport costs on the improved roads had the effect of lowering market prices of local food crops i.e. supply side effects were more important than demand side effects, which would have increased prices. This trend strengthened in remoter markets and in less productive areas but weakened where there was good mobile phone coverage (Casaburi et al., 2013). The latter has become an important marketing tool for farmers producing a surplus in Sub-Saharan Africa.

In contrast, it is found in Kenya that lowering high transport costs through improvements in rural infrastructure, especially roads, was not only important for improving access to input and output markets, but also indirectly enhance the productivity of non-traded crops, which significantly reduce rural poverty and encourage growth (p. 34, Thurlow et al., 2007).

Finally, there is some evidence that road access can stimulate the diversification of the rural economy, which can help rural livelihoods in periods of low cash crop prices or crop failure. This tends to be most common where there is a nearby demand for non-agricultural services e.g. in the peri-urban areas of Tanzania (Lanjouw, Quizon and Sparrow, 2001). Similarly, Smith, Gordon, Meadows and Zwick (2001) suggest that road rehabilitation in Uganda stimulated the development of transport related enterprises and extended job opportunities in the service sector. In both cases, access was associated with paved roads and as Kim states, given the poor condition of access on the unpaved roads in rural Uganda, one can infer that the poor have very restricted access to markets and thus diversification opportunities (Kim, 2011).

Education

It can be assumed that the majority of children in most rural areas walk to primary school; the Zambian baseline study indicated that schoolchildren made up to half of the pedestrian stream along the community roads (I.T. Transport, 2009). This assumption is validated by Porter [*the vast majority of children in our study … in all three countries (Ghana, Malawi and the Republic of South Africa), walk 5 kilometers or more to school*] (p. 67, 2011).

The impact of rural transport improvements will therefore be indirect—through increased provision of primary schools, teachers and educational oversight. Yet many studies show this indirect effect is largely reflected by school attendance data and less commonly by completion or attainment rates. Thus, a survey of 12,558 children in Zambia indicated that access to a passable road increased the probability of school attendance by 8.83% and 6.53% for eight year olds and thirteen year olds respectively (Nielsen, 1998). Similarly, multiple regression analysis of student data from the Ghanaian Living Standards Measurement Survey, showed that the access to a road in a village increases the probability of a child from that village of going to a primary school by 4.3% for children aged 5-12 and 8.8% for children aged 9-12. (Lavy, 1996, quoted in Brenneman and Kerf, 2002). Recent research shows that this effect is often stronger for girls than boys since they seem to be more constrained by poor access.

The impact of increased attendance on school completion or attainment is less documented in SSA impact evaluation, but Van De Walle and Mu's road impact study in Vietnam found a statistically significant, sustained and robust improvement in primary school completion rates, up by 15% to 25%. Unfortunately, this data was not disaggregated into boys and girls.

It has been argued that better qualified teachers are willing to work in areas served by roads. The evaluation of Kilombero and Ulanga Road Rehabilitation Program (KURRP) in Tanzania, suggested that motivation for teachers assigned to rural school increased after road rehabilitation as did pupil attendance levels (Kapsel, 2004).

Improved health

Rural transport improvements affect both the provision and utilization of health care facilities so much so that "*access to medical facilities frequently emerges as the major perceived benefit of new roads*" (p.72, Howe and Richards, 1984,). The importance of roads to health access is still evident as social appraisals of rural roads in Uganda demonstrate (Odoki, et al., 2006). Similarly, a study of the barriers to the care of HIV-infected children in rural Zambia, found that most participants (73%) reported difficulties accessing the HIV clinic, including insufficient money (60%), lack of transportation (54%) and roads in poor condition (32%) (van Dijk et al., 2009).

In impact terms, analysis of clinic records in Ghana indicated that more women used the clinics after a road improvement mainly for prenatal and neo natal services. In addition, health workers were more inclined to visit communities to train village health workers with the improvement of the village access roads (I.T. Transport, 2005). This finding is echoed in The Gambia where transportation problems contributed to peri-natal mortalities (Cham et al, 2005).

However, improving rural transport will not necessarily increase access for the poor, for whom health service fees, perceived quality of government health services and transport and opportunity costs may still be a barrier to health care (Dowling and Sethi, 2001). A study from Kenya (Airey, 1991) showed that, after building a new regional road, the "better off" increased their use of a district hospital whereas user fees and transport costs continued to be constraints for the poor.

A gender perspective on access to health was also explored in Ethiopia, Lesotho and Ghana using Demographic and Health Surveys (DHS) that are routinely carried out in many SSA countries. Analysis of the questions exploring women's barriers to access suggested that the lack of money for treatment was the most important constraint

affecting 73%, 40% and 57% of women in each country. Distance to the health center involved walking and was identified as the second most important barrier to access for 63%, 29% and 37% of DHS respondents respectively (Walker, 2009).

Individual well-being

Constrained mobility is often one of the significant challenges women face in accessing markets, schools and health facilities creating a spatial poverty trap for women and girls (Porter, 2007). Gender breakdown of the CTI users in Zambia showed a strong and statistically significant difference in the use of the different transport modes. Men travel almost twice as much as women and use IMTs and vehicles to accomplish half of these journeys. In contract, women travel less and most of their journeys are on foot (I.T. Transport, ibid). This pattern was also found in Ghana, where six out of ten road users were men, who disproportionately dominated the IMT and vehicle modes, while women comprised 72% of the pedestrian stream (I.T. Transport, ibid).

This reflects the fact that in most SSA rural communities, transport modes are generally controlled by men, limiting the independent mobility of women (Fernando and Porter, 2002). Moreover, women often bear a disproportionate transport-related burden by head loading the fuel, water and food needs of the household (Dawson and Barwell, 1993). These time and energy demands put them at a further disadvantage when seeking the opportunity to access schools, health services and markets.

Given this context, it is argued that while improved access to transport does not guarantee increased gender equality, it provides transport services that allow women to be more mobile and reduce their transport burden. This can empower women by allowing them to develop other income generating activities and participate more in community affairs. Recent research suggests that while women generally appreciate the widespread availability of motorcycle taxis, they found it difficult to meet their high travel costs and prefer to use conventional transport services (Starkey et al., 2013).

More effective governance

The transport network is a physical manifestation of the national governments' ability to exercise political power, deliver services and collect taxes and revenue. In spite of recent reforms, most SSA governments are involved in the decision making and planning behind the construction and maintenance of roads. This is the case in Ghana, where there is some evidence that voters recognize that the ruling parties influence the allocation of road sector resources. Thus, during the 2012 national and presidential elections, people living along poorly maintained roads displayed slogans like "No

Road No Vote". Regression analysis of Ghanaian electoral behavior confirms that voting is indeed influenced by the condition of local roads i.e. within one kilometer of the electoral area and this can be critical in marginal constituencies (Harding, 2013).

In contrast, governments tend to leave the operation of RT services to the private sector and try to manage these by varying degrees of regulation, legal enforcement, incentives and technical support. Thus, road improvements in Morocco have failed to stimulate formal transport services along some 60% of its improved roads and unregulated transport operators have filled the gap. Starkey and Njenga argue that in this situation local authorities and transporters should work together to reduce tariffs, improve vehicle quality and service frequency as well as enhance passenger safety. This benefits all users, particularly women who may be constrained by poor condition of most rural transport (2010).

Possible negative effects and impacts

Traffic accidents. In spite of the low speeds associated with most pedestrians and cyclists, there is a significant safety risk in rural transport. The increased number of motorized vehicles that follow road improvement makes the right of way more dangerous for those who walk, cycle and use motorcycles (WHO, 2013). Thus, Obeng reports that pedestrian accidents account for over forty percent (40%) of all road traffic accidents in Ghana (2013). Worryingly, SSA is reported to have the highest road traffic fatality rates in the world, averaging some 28 deaths per 100,000 people (gTKP, 2013).

This SSA average probably understates the real picture particularly for rural roads where only a small proportion of accidents are reported. In Uganda, Kwamusi suggests that only 7% of all road accidents on rural roads are reported to the police and only 20% of accident victims seek medical assistance (2002). This under reporting is exacerbated by the informal and unregulated nature of much rural travel—use of accident prone bicycle (*boda-boda*) and motorcycle taxi services (*okada*). In national terms, it is estimated that the direct costs of road accidents exceeds the annual aid budget for many SSA countries. In household terms, such fatalities are a severe "shock" to family budgets since the majority of casualties, 75% in the case of Kenya, are economically productive young adults (gTKP, 2013). Thus, road accidents appear to be a "*trigger for poverty*" in Bangladesh and Bangalore where funeral costs and the loss of income from the accident victim plunged the household into poverty (p.25, Aeron-Thomas et. al. 2004).

Environmental concerns. Rural transport interventions have both direct and indirect environmental impacts. These begin with the acquisition of productive agricultural land and housing for both the right of way as well as borrow pits/quarries for road

building material. Road construction practices also expose the workforce and people living alongside the right of way to a range of hazards ranging from "imported diseases" to noise and dust. Finally, the resultant traffic effects may impact on social and environmental well-being.

Table 2-2 Typical Environmental Concerns for a Feeder Road Project

		Equipment-Based Contracts			*Labor-Based Contracts*		
		B3 Road Rehabilitation	B2 County level Spot Improvement	B1 County level Routine Maintenance	B3 Road Rehabilitation	B2 County level Spot Improvement	B1 County level Routine Maintenance
Physical	Soils & Geology	XXX	XX	X	XXX	XX	X
	Hydrology	XXX	XX	X	XXX	XX	X
	Air Quality	XXX	XX	-	XX	X	-
Biological	Flora	XXX	XX	-	XXX	XX	-
	Fauna						
	Protected Areas						
Socio-environmental	Economic Characteristics	√√√	√√√	√√√	√√√	√√√	√√√
	Social Issues	XXX	XX	-	√√√	√√√	√√√
	Land use	-	-	-	-	-	-
	Resettlement, Compensation	X	-	-	X	-	-
	Ethnic Minority Considerations	-	-	-	-	-	-
	Infrastructure	-	-	-	-	-	-
	Cultural resources	-	-	-	-	-	-
	Public Health & Safety	XXX	XX	X	XXX	XX	X
	Waste Disposal	XXX	XX	X	XXX	XX	X
	Noise	XXX	X	-	XX	X	-

XXX Negative impact √√√ Positive impact

Source I.T. Transport 2010 Identification of a Periodic Maintenance Project for the European Commission.

Development partners and countries have developed a range of policies, guidelines and practices, which are designed to identify and mitigate any of these identified concerns. Thus, the African Development Bank (AfDB) has put in place a number of environmental policies, procedures, and guidelines targeted policies and projects (Puetz, 2013). Other development partners have a similar suite of policy and implementation instruments. Table 2- outlines the typical environmental concerns designed to address for a feeder road project in Liberia.

Such a framework will be used to develop an Environmental and Social Impact Assessment (ESIA), which will in turn be addressed by an Environmental Management Plan (EMP) to monitor and mitigate the ESIA concerns. In this case, the identification team stressed the social advantages of using labor-based methods and steps needed to minimize dust from vehicles, erosion of surfaces, and ensure the adequacy of drainage structures and outlets.

An evaluation of this development partner-driven ESIA process for AfDB identified a number of findings that are relevant to impact evaluations:

- Short-term environmental outcomes of AfDB supported roads were by and large satisfactory
- The quality of long-term environmental road management and maintenance is often deficient, in contrast to short-term effects
- Induced secondary environmental damages from road construction—such as deforestation, unplanned land settlements and loss of bio-diversity—are rarely mitigated through project and sector interventions.

Climate shocks likely to affect SSA are associated with the frequency and intensification of weather events and over time a shift in key climatic and environmental boundaries e.g. the intensity and length of the rainy season. It is argued that improved access to markets linked to an adaptive agricultural policy and more resilient engineering of rural infrastructure can help rural households adapt to these shocks (Baez et al. 2013).

Migration. Roads play an ambivalent role in the migration process. There is a long established belief that roads stimulate rural-urban migration by a two way process of increasing the flow of urban information and values while reducing the cost of travel for a would-be migrant (Connell, 1976). In contrast, where rural transport interventions are opening up previously inaccessible areas, land hungry farmers and investors may move in order to exploit the underutilized land (Jacoby and Minten, 2008).

2.2 Impact evaluation methodologies

Impact evaluation methodologies in the transport sector have been largely driven by an economic agenda, which has favored quantitative techniques. Five types of quantitative methodologies (Table 2-) have been applied to the evaluation of rural transport projects or programs and policy interventions. The first two, macro and sector studies are more commonly used to assess national and international road investment poli-

cies, while the last three, cross-sectional, longitudinal and panel studies, are likely to be applied to project and program M&E. These quantitative techniques are discussed first, before qualitative techniques are introduced as an overlapping and supporting methodology to what might seem to be an over reliance on quantitative approaches by the transport sector.

Table 2-3 Methodologies commonly used in RT Impact Studies (after Chamberlain, 2007)

1. Macro Studies establishing links between poverty and other indicators and provision of roads

Brief methodology	*Data requirements*
- Establish relationship between the poverty indicator (headcount index) and existing road provision (road density) using cross-sectional data - May involve visual analysis using GIS - Use secondary data	Unit Geographical areas (states, provinces, districts)
Advantages	*Disadvantages*
- Simple, quick and less costly - Provide an overall assessment of the relationship between infrastructure availability and other indicators including poverty indicators - Does not require primary data collection	- May not be able to provide the direction of the causes and effects - A geographical area based approach
Comments	
Often used to show the relationship between poverty and access/ infrastructure conditions as done in Mozambique by Simlar & Nhate (2005) and across SSA Dorosh et al., 2009; Seetanah, B (2012)	

2. Sector Studies establishing the relationship between poverty and expenditure in the road sector using time series data

Brief methodology	*Data requirements*
- Use time-series data of investment in different sectors including roads, poverty and other variables - Develop statistical relationship (with econometric techniques) between poverty reduction, investment in different sectors and other variables (with dummy variables)	Unit geographical areas (provinces or districts)
Advantages	*Disadvantages*
- Quick and less costly - No need of collection of primary data - Provide the statistical relationships between a dependent variable and independent variables (e.g. the relationship between the poverty reduction and road expenditure) - Econometric techniques able to establish the road investment elasticity of poverty reduction	- Only provides an indication of overall changes but will not provide any indication on the subtle changes at the household level; - Secondary data may be difficult to find - A geographical area based approach

Comments
- Recently used in a number of countries including Uganda (Aguma, 2005), China (Fan & Chan-Kang, 2005) and Bangladesh (Ahmed and Hossain, 1990) - Dercon et al. 2005 and 2008; Mwakubo et al., 2004; Owuor, et .al., 2007

3. Cross sectional study using with-without ex-post data

Brief methodology	*Data requirements*
- Collect cross sectional data of treatment and control groups - Only compares the averages between treatment and control groups. - Implemented in combination with qualitative methodology	Household/ community
Advantages	*Disadvantages*
- Less costlier than the similar studies that collect panel data; - May able to provide good social and poverty impact assessment if proper analysis framework is used to establish the counterfactuals.	- May overestimate/underestimate the benefits/ dis-benefits due to the bias arising from the non-establishment of counterfactuals; - Due to the contamination of the observable characteristics by the effects of the project the propensity score matching may be not entirely reliable.
Comments	
- Widely used in the impact evaluation of road projects including in Mozambique. - However, usually without controlling for biases (I.T. Transport, 1998), (CID, 2010, CNER, 2011).	

4. Longitudinal studies: with/without and before/after roadside data

Brief methodology	*Data requirements*
- Uses treatment and control groups for comparison of outcome indicators - Compares outcome indicator averages	Mainly roadside
Advantages	*Disadvantages*
- Easy to design and to implement - Suitable for comparison of transport related indicators (e.g. traffic and cargo volume, transport tariffs etc.)	- From the roadside interview it is difficult to establish the travelers' social class - May involve several round of data collection - Suitable only for assessment of transport related indicators
Comments	
- monitoring and evaluation of transport related indicators - Recently used in Bangladesh Ghana and Mozambique (Scott Wilson, 2004, I.T. Transport 2004, SCDS, 2012) and in SE Asia Hettige (2006)	

5. Panel surveys of before-after and with with-without data

Brief methodology	*Data requirements*
- Compare the before and after difference in outcome indicators between treatment and control groups (e.g. households) - Sometimes also estimate the "double difference" (or Difference-in-differences) - Often used with propensity score matching to eliminate/reduce biases - Both quantitative and qualitative techniques are used concurrently to complement each other	Household/ community
Advantages	*Disadvantages*
- When used with a proper method to eliminate biases it is the most comprehensive and costly methodology - In theory, it is able to provide the most robust results	- Expensive and involves considerable data - Collection effort - Require a lot of computational resources. - Technically challenging - May be subjected to "attrition bias" – due to drop-out problems in repeat surveys
Comments	
- Being increasingly popular in the impact evaluation of road projects - Recently used in many countries including Bangladesh (BIDS[5]) - 2002; Khandkar et al. 2006), Viet Nam (Van De Walle & Cratty, 2002; (Van De Walle and Mu 2007), China (Ravallion, 2006)	

Macro and sector studies

Both techniques tend to use secondary data to test existing theories and hypotheses on the relationship between rural transport and the development process and predict for example the likely poverty reducing impact of an investment policy. These techniques tend to use multiple regression analysis or allied econometric techniques to estimate the relationships between variables, as measured by indicators. The aim of these techniques is to establish a statistical relationship or elasticities between a dependent variable and one or more independent variables. The direction and causation of these relationships may not be explored and their resolution is such that they fail to pick up small-scale changes at the community and household level. As a result, these studies are mainly used at the policy level to ad-

[5] Bangladesh Institute of Development Studies

vocate or justify national and/or international investment in the transport sector and do not lend themselves to project level impact evaluation.

In the case of **macro studies,** the scale of study tends to be international and the dependent variables are reliant on international and national data sets e.g. a poverty indicator and road network length or density. The age and accuracy of this data may be less than reliable and steps may be taken to adjust for this.

In either case, a wide range of independent (explanatory) variables are used to understand and even quantify how the typical value of a dependent variable changes when any one of the independent variables is varied. Thus, the macro study of the impact of transport investment on poverty reduction in SSA by Seetanah (2012) uses a basic economic model with an independent variable POV representing the number of people below the poverty line, and several explanatory variables including GDP per capita. The data were all obtained from internationally published data, notably the World Development Report, which was cross-checked or adjusted with data from individual Country Statistical Office (CSO) reports, the International Monetary Fund (IMF) and the International Road Federation (IRF).

Alternatively, Stoneyard's macro research adopts a regression analysis to model the relationship between transport costs, urban growth and inter-urban trade in SSA. To overcome the lack of secondary data, satellite imagery of the light generated by cities; geo-referenced road data by road surface type and generalized road transport costs were used to model the effect of oil price shocks on the flow of trade between coastal primate cities and other cities in the urban hierarchy. The analysis provides evidence that transport costs impact urban economic activity in SSA by making access to critical cities more expensive (p. 23, Stoneyard, 2012).

In contrast, the macro study of crop production and road connectivity (Dorosh et al., 2009) used crop production data, agronomic potential, population of local markets and road connectivity, as measured by estimated travel time to the nearest market. This data was analyzed for 42 SSA countries using the International Fund for Agricultural Development's (IFPRI) Spatial Production Allocation Model (SPAM). The use of GIS makes it possible to undertake subnational analysis but the lack of detailed household and subnational data preclude analysis of the impacts of transport infrastructure on agriculture for most of African countries (p. 1, ibid). IFPRI have also developed a conceptual framework and Multiple Regression Analysis (MRA) modeling approach to throw light on the factors that influence

household poverty in Asia (Fan et al 2000, 2002 and 2004) and have adapted this to some African countries.

Sector studies are not common in SSA and usually rely on subnational data sets collected by Country Statistical Offices (CSO) or as part of a research project. They often use time-series data to develop a statistical relationship between poverty reduction, investment in different sectors and other variables. Thus, Dercon et al. (2005 and 2008) reported on a longitudinal study on changes in access to roads and agricultural extension services in Ethiopia, from 1994 to 2004. The study examined the relationship between household consumption of own grown, purchased food and non-food items with a number of road dependent benefit channels like the costs of acquiring inputs, output prices, household consumption, rainfall and price shocks. Their conclusion was that access to good roads increased consumption growth by 16.3% and reduced poverty by 6.9%. This was a statistically significant relationship and reflected the role of good roads in facilitating access to local market towns that in turn are linked to larger urban centers.

Gachassin used econometric techniques to analyze the second National Household Survey (ECAM II) in Cameroon. Access to roads was measured through two questions in the survey. Households were asked how far (in kilometers) they were from the nearest paved road and how much time (in minutes) was needed to reach it. In its analysis, the team used the time rather than distance variable since it was regarded as a more precise measure of accessibility. The results throw doubt on the belief that road access automatically leads to poverty reduction by stimulating increased agricultural production and marketing. They concluded that the non-agricultural opportunities opened up by roads were much more important in reducing poverty.

Cross sectional, longitudinal and panel studies

Introduction. These types of impact studies have tended to be applied to the evaluation of rural transport projects and pose major empirical challenges since 'natural' experiments involving large and permanent changes in transport costs are rare, if non-existent (Jacoby and Minten, 2008). This constraint explains the widespread use of quasi-experimental designs beginning with simple with-without/cross sectional and longitudinal evaluations culminating in the "gold standard" statistically sophisticated and complex longitudinal randomized control trial (RCT) panel survey. These studies largely collect their own primary data for analysis although some of the project relies on secondary data to varying degrees.

Conventionally, impact studies have adopted a "quasi-experimental design" to undertake a cross sectional comparison of randomly selected communities and households, as a baseline study or benchmark. This is followed up several years after the project has finished with a before/after, with/without comparative survey. The rigor of the analysis associated with this follow-up survey is used to identify two types of impact study (longitudinal and panel studies). The first is a simple approach that uses descriptive statistics to explain differences between the cells. The second is a much more complex approach that uses statistical techniques, notably propensity score matching, to identify before and after groupings or "panels" of closely matched "treatment" and "control" households to isolate differences and attribute them to the intervention. This approach is considered the "gold standard" evaluation for RCT quantitative approaches but does not preclude the use of other evaluation methodologies.

The next three methodologies all derive their analytical framework from the application of a quasi-experimental design to a project (Table 2-5).

Table 2-4 The Quasi-Experimental Design

		Cross-sectional comparison	
		With	Without (Controls)
Longitudinal comparison	Before	Communities and Households situated directly on the road.	Communities and Households situated outside the road corridor/zone of influence.
	After	Communities and Households situated directly on the road.	Communities and Households situated outside the road corridor/zone of influence.

Cross sectional impact studies

Cross sectional comparisons are the weakest one of the three methodologies. They assume that different social groups and the poor in the "with" communities will enjoy full travel and transport benefits from road access and project improvements, while the different social groups and the poor in the "without" communities will have no travel and transport benefits from road access or project improvements. Simple cross-sectional studies define the zone of influence of the intervention and comparative analysis between the with/without cells is used as a predictor of likely project effects and impacts in a baseline study. Alternatively, such comparison might be applied in a post intervention situation to compensate

for the absence of baseline data. In this situation, cross-sectional analysis can only be used to estimate project effects (Bamberger et al., 2006).

Cross-sectional studies were common in the 1990's when used to quickly highlight a policy concern or gap. I.T. Transport's Village Level Travel and Transport Surveys (VLTTS) leading up to the publication of "Roads are not enough" (Dawson and Barwell, 1993) were based on cross-sectional comparisons between accessible and inaccessible communities. They used a mixture of quantitative and qualitative techniques to (i) estimate the time and effort spent on transport; (ii) analyze local transport as a factor in agricultural development and in the utilization of essential services; (iii) understand the role of transport and the impact in women's daily lives; and (iv) identify the scope for improvement in traditional transport modes so as to enhance mobility and accessibility. The VLTTS approach was last used in Ethiopia in 1998 to inform its emerging rural transport policy.

The cross-sectional study of the benefits of rural roads on the income of poor households in Peru was able to use propensity score matching to overcome endogenous biases (Escobal and Ponce, 2002). They re-analyzed impact survey data for a road improvement project and were able to identify a sample of 1,625 "treated" and 413 "control" households. This was sufficiently robust to enable them to construct a counterfactual grouping of untreated households and establish causal welfare relationships. Their analysis indicated that the most important short-term impact was an increase in income particularly from non-agricultural sources. Interestingly, this was not matched by a rise in consumption patterns and households increased their livestock holdings as it was assumed that the road improvements were not likely to be permanent, due to poor maintenance.

Longitudinal (With/Without and Before/After) Impact Studies. Like cross-sectional studies, simple longitudinal impact studies have become discredited due to their intrinsic weaknesses to control for placement biases and capture defensible welfare benefits and impacts. Nevertheless, they are quite commonly used to assess project effects, focusing on identifying the traffic and travel changes brought about by project interventions and using adjacent control roads to isolate these. A good example of this is I.T. Transport's impact study of Rural Development Project (RDP) 6 in Bangladesh (1997).

More recently, Hettige undertook an in-depth analysis of the impact of roads on the rural poor in Indonesia, the Philippines and Sri Lanka for the Asian Development Bank (2006). The study had an ambitious agenda of applying double difference analysis to quantitative data. However, the absence of useful baseline information and suitable control sites meant that this approach was abandoned and the

team relied on recall techniques to compare before and after conditions. The fieldwork effort subsequently focused on traffic outcomes and Participatory Rural Assessment (PRA) methodologies to construct a series of case studies with which to inform policy and programming.

Before-After combined with With-Without Panel Surveys. Longitudinal studies invariably adopt a *double difference methodology* to make comparisons between the four cells in Table 2-5. There are a number of "gold standard" RCT impact studies in the development literature but all of them have been outside the SSA region. These include (i) the impact assessment of DANIDA support to rural transport infrastructure (PAST) in Nicaragua; (**ii**) the impact assessment of road improvements in Bangladesh (Khander, Baht, and Koolwal, 2006); (iii) the social impact assessment of the Viet Nam Rural Transport Project I (RTP I); (iv) the impact assessment of the Southwest China Poverty Reduction Project (a ten-year impact study); and (v) the Georgian impact study of Rural Infrastructure Rehabilitation.

All examples show the difficulty of controlling project endogeneity and heterogeneity and the need for sophisticated statistical and econometric techniques to overcome this and other difficulties. This improvement in evaluation methodologies requires the support of highly qualified specialists and increased resources for data collection and analysis. Yet, the findings from this increased effort can seem rather disappointing. Thus, the Nicaraguan impact study identifies travel timesaving as the "*least surprising and the most important evaluation finding*" (op. cit. p.13). Confirmation of these savings is both routine and vital since such savings, if sustained, are the main driver of the economic and social impacts that follow road improvements. The steps for the double difference methodology are as follows.

Table 2-5. How to Do a Double Difference Impact Study

Step 1	Undertake a baseline survey before the intervention is in place, and the survey must cover both non participants (non-beneficiaries) and participants (beneficiaries). If you do not know who will participate, you have to make an informed guess.
Step 2	Undertake one or more follow up surveys after the program is put in place. These should be highly comparable to the baseline survey (in terms of the questionnaires, the interviewing, etc.). Ideally the follow up surveys should be of the same sample observations as the baseline survey.
Step 3	Calculate the mean differences between the after and the before values of the outcome indicators for each of the participant and non-participant groups.
Step 4	Calculate the differences between these two means differences **[the double difference]**. That is your estimate of the impact of the program.

Source: Ravillion, 2001

Currently, simple longitudinal surveys are mainly used to identify and analyze project effects, which mean that they mainly focus on traffic and transport. In the past, they were much wider ranging and considered not only the direct impact on (i) transport infrastructure and services but also the indirect impact on (ii) the agricultural economy, (iii) the social sectors such as health and education and (iv) the environment. A typical example is the Impact Evaluation Report on the Socio-economic Influence of Rural Roads in Morocco (Operations Evaluation Dept. 1996). It used questionnaire surveys and focus group discussions to compare current conditions (in 1995) with those before the investments and, second, it compared conditions in the project road relative to a control road, which did not benefit from improvements over the period of the study. The study found that the traffic using the roads increased with associated reductions in transport costs and charges. It also reported positive benefits in the agricultural economy, encouraged a shift from low-value cereals to high-value fruit orchards. Similarly, improved access to health and education facilities increased enrollment rates in rural education as well as frequency of visits to health care services. This positive outcome was qualified by several methodological concerns:

- *The concept of control ("without project")*. The study team put special emphasis to select control roads which had not been the subject of improvements during the project period, and which were geographically near the project. These were judgmentally selected at the end of the project. In contrast, communities on the project roads attracted other developments so that not all the identified changes could be attributed to improved transport services alone.
- *Baseline data*. No baseline data was collected before the road construction and retrospective questions were included in surveys to capture the pre-project conditions. It was then felt that this failing made reporting some indicators highly unreliable.

These methodological concerns were rather prescient and subsequently addressed by a new wave of evaluation specialists who highlighted the dangers of the simple approach to longitudinal studies. Ravallion (2001) noted a number of problems that relate to such project evaluations, which begin with the "knowledge market failures" due to asymmetric information and externalities. Development agencies are also prone to adopt quick and less rigorous methods that promise affirmative results at minimum cost. Finally, the "project home" of many evaluations means that the project management has little or no interest in applying the lessons learned from an evaluation, which may raise more questions than it answers.

In addition to generic problems, evaluations of projects present a number of specific challenges:

- Rural transport investments are not directly productive but enable other productive and non-productive investments or initiatives to operate more efficiently and effectively. This enabling role means that the benefits of rural transport improvements will reflect the opportunities and constrained afforded by the national political economy, social and other characteristics of the areas affected.
- There is considerable "endogeneity" between the road network and the hierarchy of settlements and communities situated along the different road links. In many SSA situations, it is difficult to decide whether the road has attracted and stimulated the growth of settlements/communities or vice versa. This synergy makes it difficult to isolate and establish control communities as required by the quasi-experimental model. This Jacoby referred to as reverse causation (Jacoby and Minten, 2008).
- The community and household focus of the research effort may overlook inter and intra-household differences in economic decision-making, social needs and interaction.
- Spillover from other development investments and the anticipated changes may take a long time to emerge.
- Finally, rural road improvements must be sustained through maintenance to have long-term impacts. All too often, maintenance fails to reach the rural network and the improved roads slide back to their pre improvement status.

Accordingly, current evaluation specialists advocate a number of statistical techniques to ensure that randomly selected households and individuals in "with" and "without" groups are as closely matched as possible (Baker, 1999, Van De Walle , 2001). Thus, the evaluation team in Viet Nam used an approach that combined the "double difference methodology" with propensity score matching methods (see Annex 1) for the impact evaluation of a rural road rehabilitation project (Van De Walle , 1999, Van De Walle and Cratty, 2002). This helps in the unbiased estimation of the counterfactual and from this identification of project impacts. However, the approach requires considerable primary data collection and analysis effort and depends on availability of good quality secondary data along with other commune level secondary information. These technical, financial data resource

demands are very high, which explain the few "gold standard" quantitative surveys in SSA rural transport projects to date.

Conclusion

The advantages and disadvantages of the main impact methodologies outlined in Table 2–3 point to the relative costs, data needs and ease of understanding of macro and micro analytical studies as a guide for policy makers. The use of these studies reflects data availability, and findings rely on establishing sound causal links between rural road or access indicators and a range of developmental indicators. Invariably this causal link is taken from the impact literature and there is very little triangulation or cross checking of findings by qualitative methods.

The three project impact methodologies show increasing sophistication, resource needs and complexity. They tend to use primary data collected through a structured questionnaire administered to a head of household randomly sampled from a secondary data source e.g. census returns, community lists etc. Qualitative research methods are used to varying degrees to often guide the sampling process in tandem with the administration of the questionnaire.

Cross-sectional studies have now been discredited as a reliable methodology and should not be used. Their inability to establish good controls means that comparative analysis is likely to under or over state true project impacts.

Longitudinal studies have a role to play in the monitoring of direct effects on traffic and transport, provided the roads have been carefully selected as suitable counterfactuals. They rely heavily on the project logical framework to identify appropriate transport and access indicators against which the project can monitor its performance. Unfortunately, their weakness in identifying "poorer" households in the travel stream means that these studies fail to highlight the impact of interventions on the poor.

Finally, *panel surveys* have become the most robust and acceptable methodology employed to assess the indirect impact of interventions on the wider rural economy, household welfare and poverty. The panel data has to be statistically manipulated to control for endogeneity and heterogeneity before a double difference statistical comparison is made. This is the "gold standard" of RCT impact methodologies but rural transport projects may not be large enough to warrant the technical and financial resources needed to collect and analyze the large quantities of required impact data. The resultant findings, while defendable, may be insubstantial

and less than conclusive. This perceived failure of quantitative techniques to establish a definitive impact study has led "*other specialists [to] argue that the analysis of impact is best grounded in participatory and qualitative methodologies*" (p.12, IFAD 2009). Nevertheless, Estache claims "*the overall policy message of this research is quite robust. Rural roads provide substantial benefits to households in low-income countries, especially the poorest. But not all roads beneficiaries get the same benefits. There is indeed a wide range of outcomes, including situations in which a specific outcome is present in one project and not in another one within the same country. Moreover, they also show that rural roads are not a panacea for poverty alleviation and the mechanics of poverty alleviation can vary quite a lot across projects*" (p.17, 2010).

Qualitative methods

Qualitative methods are now commonplace in most IEs when used to build up information on likely outcome indicators, baseline attributes and controls for heterogeneity and other exogenous factors (Van De Walle , 2009). They also serve to triangulate findings from quantitative tools as well as to explore the causal processes in statistical associations and correlations. They usually fall into two types — *Rapid Rural Appraisal* and *Participatory Rural Appraisal*.

Thus, RRA techniques like focus group discussions and stakeholder analysis may be used to explore the common travel patterns and map the location, distance/travel times to health, education and agricultural services, as well as understanding of the power relationships, influence, and interests of various groups benefiting from an intervention. It is argued that well designed and facilitated, qualitative methods are rigorous as they can count the uncountable, and generate statistics for relevant dimensions otherwise overlooked (Chambers, 2009). The Nigerian Community Service Delivery spreadsheet outlines such a qualitative approach to the monitoring of results and if sufficient time is allowed the impact of rural infrastructural improvements (see Annex 4).

Table 2-6 The Two Main Types of Qualitative Methods

Rapid Rural Appraisal	*Participatory Rural Appraisal*
Definition	
Rapid appraisal methods are quick, low-cost ways to gather the views & feedback of beneficiaries and stakeholders, in order to respond to decision-makers' needs for information	Participatory methods provide active involvement in decision-making for those with a stake in a project, program, or strategy and generate a sense of ownership in the M&E results and recommendations
Common Types	
▪ Mini-survey ▪ Key informant interview ▪ Focus group discussion ▪ Community group interview ▪ Direct observation	▪ Stakeholder analysis ▪ Social mapping ▪ Wealth or well-being ranking ▪ Beneficiary assessment ▪ Participatory Monitoring and Evaluation
What can we use them for?	
▪ Providing rapid information for management decision-making, especially at the project or program level ▪ Providing qualitative understanding of complex socio-economic changes, highly interactive social situations, or people's values, motivations, and reactions ▪ Providing context and interpretation for quantitative data collected by more formal methods	▪ Learning about local conditions and local people's perspectives and priorities for more responsive and sustainable interventions. ▪ Identifying problems and trouble-shooting during implementation ▪ Evaluating a project, program, or policy ▪ Providing knowledge and skills to empower poor people
Advantages	
▪ Low cost ▪ Can be conducted quickly ▪ Provides flexibility to explore new ideas	▪ Examines relevant issues by involving key players in the design process ▪ Establishes partnerships and local ownership of projects ▪ Enhances local learning, management capacity, and skills ▪ Provides timely, reliable information for management decision-making
Disadvantages	
▪ Findings usually relate to specific communities or localities—thus difficult to generalize from findings ▪ Less valid, reliable, and credible than formal surveys	▪ Sometimes regarded as less objective ▪ Time-consuming if key stakeholders are involved in a meaningful way ▪ Potential for domination and misuse by some stakeholders to further their own interests
Cost	
Low to medium, depending on the scale of methods adopted	Low to medium. Costs vary greatly, depending on scope and depth of application and on how local resource contributions are valued
Skills Required	
Non-directive interviewing, group facilitation, field observation, note-taking, and basic statistical skills	Several days' training for facilitators
Time Required	
Four to six weeks, depending on the size and location of the population interviewed and the number of sites observed	Varies greatly, depending on scope and depth of application

2.3 Existing impact evaluation frameworks

There are a number of existing impact evaluation guidelines and standard documentation for development projects including rural transport improvements. They tend to be unique to each development agency, reflecting the need to plan and improve their development programs as well as demonstrate that development aid is targeted and delivering tangible benefits to the poor. Annex 2 outlines the more important of these guidelines. They tend to distinguish three broad methodological approaches to assessing socio-economic impacts, which are outlined below. The first and third are generally applied to specific DP-funded road projects and rural transport programs while the second group is more often applied to policy level analysis and exploratory research.

Cost-benefit analysis or cost comparisons.

Conventionally cost-benefit analysis, using a version of the World Bank's Highway Design and Maintenance [Standards model] (HDM III or IV), is applied to the economic evaluation of rural road projects. As a rule of thumb, depending on the improvement costs, such analysis requires a minimum of 50 motorized vehicles per day, excluding motorcycles, for the road to generate a high enough economic [internal] rate of return (EIRR). Thus, the first phase of the Secondary, Tertiary and Rural Roads Project in Morocco, constructed three roads with some 192, 275 and 640 motorized vehicles per day. HDM III was applied to calculate the EIRRs and the results ranged from 21% to 39% comfortably exceeding the 12% threshold applied at the road selection and appraisal stage. This pattern was repeated in the second phase, which ended in 2001 when similar traffic levels generated EIRRs in excess of 15.9%.

In the absence of traffic levels as high as this, the impact researcher looks to the agricultural, education, health and other social benefits to justify the investment. Thus in Ghana, the Road Prioritization Methodology (RPM) used a cost effectiveness procedure to prioritize feeder roads for improvement assuming that bicycle and head loading traffic would shift to motorized transport services once the road was improved. A preliminary impact assessment of traffic levels showed that this modal shift did not develop strongly as there was little or no evidence that the improved roads had attracted regular transport services (DFRMST, 2006). These findings affected the planning of further feeder road improvements to favor connecting rather than access feeder roads.

In Ethiopia, Stifel et al. estimated the households' willingness-to-pay for transport services as a road planning indicator. Using a quasi-experimental setting, they suggest that the benefits of reducing transport costs by US$50 per metric ton of goods would result in benefits worth roughly 35 percent of household consumption. They estimate that a 21-kilometer gravel road will have an IRR of up to 34 percent, using conservative assumptions, over its first ten years (Stifel et al., 2012).

Financial a cost-benefit analysis (CBA) is also used to assess the impact and IRR of feeder roads built by the Productive Safety Net Program (PSNP) in Ethiopia. Construction costs are averaged at the household level, while benefits are the estimated transport cost savings involved in moving agricultural inputs and outputs. Other travel benefits are estimated in time saving terms for household members to access schools, water points and health centers (Metaferia Consulting Engineers, 2013).

The assumptions behind these last three examples emphasize the difficulty of applying CBA techniques to investments on roads and tracks carrying low traffic volumes. Increasingly, governments and development partners have looked to socio-economic and service benefits to justify improvements. The challenge for impact studies is to identify the direction and scale of these socio-economic benefits so they can be quantified in economic and well-being terms.

Macro and micro modeling

Statistical modeling has tended to be used by researchers to test or justify policy or hypothetical RT subsector impacts on the national or regional economy.

Macro modeling. The IFPRI approach to macro modeling has relied on a variety of multiple regression techniques to highlight the factors, which include rural transport access, that contribute to household poverty and estimate the direction and strength of the relationships. One of the early examples of this type of modeling is from Uganda, using time-series district data. Access was measured in terms of the average distance of households from three different types of roads, paved, murram, and feeder roads. The analysis identified investment in feeder roads as second to expenditure on agricultural research & development with a cost-benefit ratio ranging from 9.19 to 4.88 in Western and Northern Uganda. It estimates that 34 people were lifted out of poverty for every million shillings of government expenditure on feeder roads compared with a ratio of 12 and 58 people lifted out of poverty for agricultural research & development (Fan and Zhang, 2004).

Another example of this approach is provided by the same authors' study in Tanzania, which uses a different data set to model total household income. Household access to socio-economic services is represented by the proxy indicator: distance (in km) of the household from public transportation facility. The results indicate that distance to public transport has a statistically significant inverse relationship with household income. This relationship weakens in three of the regions and even becomes positive in Lake Victoria. The study goes on to use the findings to predict the returns to investment, each kilometer of road built will increase income by 8.5%, which is equivalent to lifting 27 people out of poverty with a cost-benefit ratio of 1:9.3 (Fan, Nuegen et al. 2005).

Micro modeling. This approach tries to estimate the benefits of interventions at the household level, which in SSA is synonymous with the agricultural household. This has been tried in several ways:

Travel time savings are a major benefit of transport investments in the developed world where the time saved for journeys is valued at the augmented wage rate for the person traveling and for non-work journeys by the willingness to pay for the time saved. This relatively straightforward calculation is more difficult to apply to developing countries because formal employment is limited and travel tends to be for multiple reasons often with very low economic returns. Nevertheless, it is suggested that if travel time were included in both impacts and appraisals this would lead to "*higher returns for RT projects and redress the bias against rural infrastructure investments*" (p.xiii, I.T. Transport, 2005).

Revealed and stated preference analyses are mainly used to model travel choice or-journey behavior in terms of destinations, routes, modes etc. In the first, the respondent's choice is hypothetical and involves ranking or rating a set of journey options in preference terms associated with the comfort, convenience, time saved, willingness to pay for travel and/or its environmental impacts (Wardman, 2005). In the revealed preference model, the journey attributes are based on actual travel patterns and behavior. Stated preference techniques therefore tend to be used at the appraisal or forecasting stage of a project when they may predict demand, benefits or costs of an intervention.

2.4 RT project and policy indicators

Introduction

Rural transport indicators are variables that help measure changes brought about by projects and as such should be specific to the sector and objectively verifiable. In Table 2.1, each monitoring stream will use objectively verifiable indicators, outlined in the project Logical Framework Matrix–LFM (Annex 3), to monitor the progress, performance and impact of the intervention:

- What progress a rural transport project or program has made?
- The efficiency and effectiveness of project performance in meeting targets,
- That the predicted effects/outcomes are happening, and
- To what extent its development goals have been met?

However, indicators only provide an indication that something has happened — they are not proof and cannot tell us:

- Why a project has made a difference
- Why and how the changes have occurred

Rural transport project monitoring indicators

Effect and Impact indicators. Effect and impact indicators cannot be constructed without clarifying what aspect of the socio-economic environment is being "impacted" and what the indicators will "indicate" beyond their intrinsic properties. There are two possible starting points for the identification and selection of indicators. For research programs which feed into policy formulation, indicators are derived from hypotheses based on suppositions made about the positive role that interventions play (transport changes, economic growth, social development or poverty alleviation). This positivist perspective stresses benefits, identifies and mitigates negative effects and seeks confirmation that the investment was worthwhile. For projects, this positivistic logic is distilled into a project logical frame in which project outcomes/effects and impacts are identified as objectives and goals or purposes. Invariably this includes a preliminary selection of objectively verified indicators (OVI), sources of verification and assumptions made that might affect the achievement of the objective or purpose in the form of a LFM (Annex 3).

This distinction is important and ultimately explains the difference between performance and impact monitoring (Figure 1-1). Performance monitoring is effectively project monitoring and is relatively straight forward since expected effects

and impacts have already been defined and even quantified in the logical framework. That said there is a danger that this very simplicity will lead to a blueprint approach to assessing project achievements, reducing evaluations to quantitative methodologies that produce two-dimensional cause-and-effect explanations within a simple with/without longitudinal project sampling frame (No 4 of Table 2-).

Policy impact studies are less constrained and as a result, much more complex since they need to take account of interactions between the complimentary or competing goals of stakeholders/actors involved in rural development as well as overall development goals. It is therefore good practice to distinguish between effect and impact indicators. For rural transport interventions, outcome performance indicators are associated with traffic and access effects as captured by the first group of direct effect indicators in Table 2-8.

These indicators respond quickly to the intervention and are easy to collect and report on as elaborated below. Access indicators do not require a traffic response since they reflect changes in physical accessibility of the affected population or beneficiaries. Both these effects are measurable within the project period but on their own may not be enough to stimulate the behavioral changes that cumulatively bring about an impact.

These behavioral changes emerge over time in the form of increased income, health, education and general well-being (Table 2-8) of the RT affected population. The strength of impacts are subject to policy changes, road maintenance and random fluctuations in rainfall, market prices, cost of fuel etc. These background changes and fluctuation will increase over time making the identification and attribution of impacts much more complex and the need to be factored into the timing of the follow-up survey(s).

Finally, indicator data and impact analysis should be disaggregated and presented for different population subgroups e.g. by gender, vulnerable and/or the poor and capable of aggregated and generalized at the national, regional or global level. (World Bank, GDPRP, FAO, 2012 p 23).

In summary, the impact evaluators need the foresight to decide the scope of impact, to design a research methodology and select appropriate indicators that can be used to test relevant RT hypotheses before constructing the planned interventions of the project. This selection involves understanding and integrating the project logical framework with the development literature. Once finalized, the indica-

tors are framed into data collection tools and applied as a baseline against which first performance and then impacts can be assessed.

Table 2-7 Indicators for the socioeconomic impact assessment of rural transport

1. Direct Effects Traffic, Transport and Access Outcome Indicators
Traffic volume (vehicles per day, frequency of service)
Data collection point (indicative only): Roadside census site
Disaggregated by: Transport mode including motorised, non-motorised and pedestrians; season
Road passability (number of days of road closure)
Data collection point (indicative only): Roadside census site
Disaggregated by: Transport mode and season
Transport Tariffs per Passenger (passenger-km) and Freight (tonne-km)
Data collection point (indicative only): Roadside census site
Disaggregated by: Transport mode and season
Travel and transport patterns (number of trips, duration, purpose)
Data collection point (indicative only): Household
Disaggregated by: Transport mode, gender and social class
Vehicle ownership (motorised and non-motorised)
Data collection point (indicative only): Household
Disaggregated by: Transport mode, gender and social class
Accidents (injuries and fatalities)
Data collection point (indicative only): District/Region Police Offices
Disaggregated by: Social class, age and gender
Access to education (school enrolment, attendance and drop-out)
Data collection point (indicative only): Household/ community
Disaggregated by: Social class and gender
Access to health facilities (number of visits over past month, access time for EmONC)
Data collection point (indicative only): Household/ community
Disaggregated by: Social class, age and gender
Time use of household members (time spent on water and fuel wood collection and other transport tasks)
Data collection point (indicative only): Household
Disaggregated by: Social class, age and gender
Other (Access to credit, migration patterns)
Data collection point (indicative only): Household
Disaggregated by: Social class and gender

2. Direct Effects Traffic, Transport and Access Outcome Indicators
Quality of education (attainment, absenteeism, qualifications and commitment of teachers, availability of school supplies)
Data collection point (indicative only): School/ community
Disaggregated by: Social class and gender
Quality of health facilities (qualifications of staff, availability of medical supplies)
Data collection point (indicative only): Health centre/ community
Disaggregated by: Social class, age and gender
Prices (prices of key commodities, agricultural inputs, land)
Data collection point (indicative only): Household/ community
Disaggregated by: Social class and gender
Impact on agricultural activities (crop mix, cultivated area, intensity, use of inputs, visits of extension agents)
Data collection point (indicative only): Household/ community
Disaggregated by: Social class and gender
Impact on non-agricultural activities (activity mix, off-farm employment, trading, businesses)
Data collection point (indicative only): Household/ community
Disaggregated by: Social class and gender
Income structure (type of income sources)
Data collection point (indicative only): Household
Disaggregated by: Social class and gender
Composition of expenditure (share of food, transportation)
Data collection point (indicative only): Household
Disaggregated by: Social class and gender
Health status (incidence of illness, number of work days lost due to illness, treatment strategy)
Data collection point (indicative only): Household
Disaggregated by: Social class and gender
Education status (literacy, average years of education)
Data collection point (indicative only): Household
Disaggregated by: Social class, age and gender
Social interaction (number of visits to other villages and cities, participation at social events)
Data collection point (indicative only): Household
Disaggregated by: Social class, age and gender
Political participation (number of visits by government officials, participation in community or political events)
Data collection point (indicative only): Household/ community
Disaggregated by: Social class and gender

Based on Chamberlain, J. (2007) and Grootaert, C. (2002)

Transport service indicators. Transport service indicators are usually collected to monitor project effects by longitudinal impact studies and focus on the cost, speed, comfort, reliability and safety of the vehicles transporting people and goods. In rural areas of SSA, transport vehicles tend to be of a lower standard than the conventional vehicles using the national primary and secondary network. There tends to be a wider range of modal types, including a number of locally adapted intermediate means of transport (IMT), and both the transporter and their vehicles are poorly regulated. A number of publications, notably those by Starkey et al (2002, 2007 and 2010) as well as I.T. Transport (2003), give an idea of issues and indicators used to assess the supply and demand for rural transport services. The latest publication by Starkey et al. suggests that six headline indicators should be used for each vehicle 'class' encountered on a rural road network:

- Fare price per passenger kilometer
- Transport frequency on normal days
- Costs per tonne-kilometre of small freight (50 kg loads)
- Costs per tonne-kilometre of consigned medium freight (200 kg loads)
- Rural Transport Service reliability and predictability index for return trips to the market/services hub
- Rural Transport Service disruption index (Starkey et al, 2013)

These indicators have been collected by *the Ministère de l'Équipment, du Transport et de la Logistique* (METL) in Morocco in addition to household travel and transport data as a means of addressing the gap between demand and supply of services. This gap exists because of METL/regional authorities are obliged to issue transport operator permits on its improved roads and some 60% of these permits are not utilized. Instead, informal operators are providing transport services on an ad hoc unregulated basis and the ministry is concerned about this trend.

RT development policy indicators

Background. The 2005 African Ministerial Meeting on the Transport and the Millennium Development Goals which took place in Addis Ababa identified seventeen interventions that would support the achievement of the 2015 targets, twelve directly and indirectly involved the road transport sector:

1. Halving the proportion of the rural population living beyond 2 km of an all-season road (Rural Access Index).
2. Narrowing the difference in average transport costs within Africa as compared to Asia by 50%.

3. Eliminating constraints on the time that children spend in obtaining quality education safely by improving rural access and urban mobility.
4. Facilitating affordable access for all households and cost effective outreach of health activities.
5. Ensuring that the transport sector stops to be an agent for spreading HIV/AIDS.
6. Reducing road accident fatalities by half.
7. Halving the number of urban and rural residents who have limited access to employment and essential services due to mobility constraint.
8. Promoting environmental sustainability in all transport operations and development programs.
9. Phasing out leaded gasoline, a target, which has been achieved.
10. Reducing by half transport costs for landlocked and transit countries and improving their access to global markets.
11. Dismantling all non-physical transport barriers including journey time, customs clearance, and border delays that impede the flow of goods and services.
12. Mainstreaming gender issues in transport policies and programs.

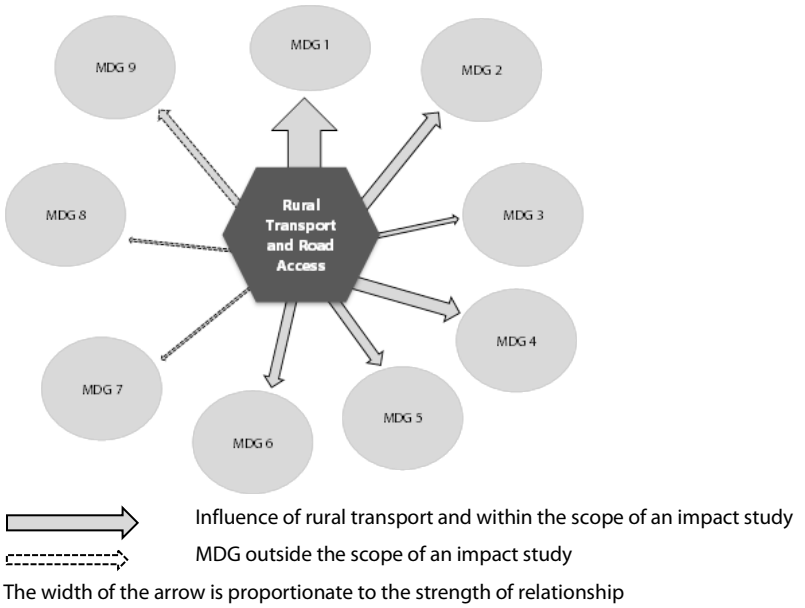
They all impinge on RT investments but six (1, 2, 3, 4, 5, and 12) are particularly important for a robust impact study and for their contribution to the MDGs.

Millennium Development Goals

The United Nations Millennium Summit of September 2000 sets out the achievement of nine Millennium Development Goals (MDG) as part of a global commitment to development up to 2015. In policy terms, the MDGs and their agreed indicators and targets have driven the development agenda and the national Poverty Reduction Strategies (PRS) for most SSA counties. The focus is on the economic and social well-being of developing country populations with no explicit reference to transport infrastructure, the role of transport as a precondition to the achievement of many MDG's was initially overlooked. This oversight was addressed by the 2005 Ministerial Meeting, which led to a Declaration on Transport and the MDGs (African Union and UNECA, 2005). This set out the road sector MDG related targets outlined above which subsequently became a central feature of international development policy in the road transport sector.

For the rural transport subsector, Figure 2-1 illustrates the strength of the linkages between rural transport/roads and each of the nine MDGs.

Figure 2-1 Rural Road/Transport Investments & Achievement of the MDGs



MDG 1 – eradicate extreme poverty and hunger. Some 80% of the population of Sub-Saharan Africa is directly dependent on agriculture for their food needs and income. The role of rural transport in stimulating and supporting the development and growth of this sector has the potential to improve food supplies and cash crop earnings. Transport provides the rural poor with greater access to markets and employment. Rural roads also reduce transport costs and improve market access for enterprises and service providers, bringing further indirect benefits.

MDG 2 – universal primary education. Section 0 elaborates the SSA evidence that shows substantial links between RT development and increases in primary school enrolment and attendance rates for both boys and girls by improving the accessibility of primary schools.

MDG 3 – gender equality and empower women. Empirical evidence outlined in the section above on Education suggest a positive link between rural transport development and the achievement of some of the indicators connected to this goal, especially by extending the travel horizon of women, increased school enrolment

of girls, and increased interactions between women, government and NGO workers. An impact study may be able to shed some light on this process by disaggregating its findings by gender.

MDG 4 on child mortality, MDG 5 on maternal health, and MDG 6 on HIV/AIDS, malaria and other diseases. These three health-related MDGs show a strong relationship with the rural road network and its physical access. Empirical studies across SSA suggest that child illnesses are more likely to be treated the closer the child is to a health clinic. Similarly, child nutrition and health outreach programs are likely to be more effective as access improves. The perinatal and postnatal care of pregnant women is equally sensitive to transport services and the distance involved in access maternity/mother and child clinics. Rural transport improvements also support routine medical visits, provision of emergency services, health care provider access, and mobile health service delivery to isolated communities and populations. In addition, transport networks and services play a vital logistic role in assuring the distribution of drugs and supplies.

Conversely, by encouraging greater mobility, transport has stimulated an increase in road traffic accidents one of the leading causes of death in SSA. Mobility has also increased the spread of transmittable diseases like HIV/AIDS.

MDG 7 on environmental sustainability, MDG 8 on global partnership for development and MDG 9 on de-mining and victim assistance

Rural transport interventions do not have a strong record of increasing environmental sustainability. Typically, improvements intensify the exploitation of resources. The study in Mozambique noted that road rehabilitation in the Zambézia province led to increased exploitation of natural resources such as land, water and timber and there seemed to be no long-term efforts to protect these resources and local community rights to use them (SCDS, 2012).

Rural transport improvements are considered a positive manifestation of the global partnership for development. This arises from their perceived pro poor focus, which often has stressed the application of labor-intensive technologies that use local male and female young people to construct access roads. The International Labour Organization has been in the forefront of this advocacy and has piloted a number of projects like the Quick Impact Employment Creation Project (QIECP) in Sierra Leone (ILO 2012).

The Rural Access Index (RAI)

Besides the Declaration on Transport and the MDGs, the transport sector ministers endorsed the development and application of the Rural Access Index (RAI) as a headline indicator, which highlights the critical role of access and mobility in reducing poverty (Roberts et al, 2006). This index measures the number of rural people who live within two kilometers (typically equivalent to a walk of 20-25 minutes) of an all-season road as a proportion of the total rural population. Although it appears to be a simple indicator it remains to be carefully defined:

- An "all-season road" is motorable all year round by the prevailing means of rural transport (typically a pick-up or a truck that does not have four-wheel-drive). Occasional interruptions of short duration during inclement weather are accepted, particularly on lightly trafficked roads.
- Time/distance equivalence is assumed uniform but in undulating countryside, time differences between uphill and downhill sections can be considerable and local ground truthing is needed to correct for this. This assumption of equivalence is further complicated by the tendency of researchers to focus on travel time as their access indicator. They and their respondents think of time passing in 30 and 60-minute units and typically use a 30-minute threshold when assessing travel or access times. This makes distance equivalence calculations more complex than the RAI envisaged.
- Who is travelling is also important. In South Africa, the Labor Force Surveys used to measure the journey to primary and secondary schools, assume that schoolchildren walk at 15 minutes per kilometer not the 10 to 12.5 minutes assumed by the RAI (p.82, Directorate of Monitoring and Evaluation, 2006).

Subsequent experience in the use of RAI has identified other concerns:

- In emphasizing physical access, the index assumes that transport services will automatically be available on the all-weather road network—a road impact myth according to Beuran et al. (2013). Thus, in low rural population density areas like Malawi where motorized service exist they are usually unaffordable and often non-existent, which means that most households will continue to be isolated and reliant on cycling or more probably walking to travel outside the community (Raballand, et al., 2011). Similarly, RAI access tracking in Ethiopia indicates that 38.6% of the rural population lives within 2 kilometers of an all-weather road but

only 28.4% within 2 kilometers of a transport service delivery station (W.T. Consult, 2013). The central message of "Roads Are Not Enough" (Dawson and Barwell, 1993) seems to have been overlooked and RAI is not fully capturing the complexities of "access" which includes the availability, affordability and reliability of transport services.

- International and intranational comparisons can be misleading because of differing population densities, proportions of land available for arable cultivation and settlement patterns. The well-watered densely populated equatorial and savanna zones of West and East Africa will have much higher RAI values than the more marginal savanna and miombo woodland zones of Eastern and Southern Africa with their dispersed settlement patterns. Similarly, RAI comparisons between Ashanti and Northern Regions in Ghana will produce different values reflecting population density and contrasting nuclear and dispersed settlement patterns.
- Measurement differences between the use of subjective household surveys and more objective use of GIS systems to calculate RAI have also been highlighted by Vincent (2010). The latter seem more common as they can be routinely generated by an updated geo-referenced network database but this very simplicity is insensitive to local barriers, which may constrain access.
- From a planning perspective, a 2010 study questioned the use of the RAI in network planning (Raballand, Macchi, and Petracco, 2010). They argued that the index could overestimate the needs for rural roads and lead to over-investments compared with main and secondary road networks. They propose instead a reference distance of 5 kilometers, not 2 kilometers. Some SSA countries appear to have already adopted this 5-kilometer standard e.g. the published Performance and Impact indicators for Senegal show that 62.5% of the rural population lives within 5 kilometers of an all-season road. In contrast, Morocco uses a one kilometer threshold to define its National Rural Road Access Indicator (NRRAI).
- Another example of this ambitious agenda is Uganda, which has invested heavily in the road sector, especially in rural roads. Yet, its RAI is less than 30% and reaching a RAI of 100% will not be cost effective as the expected benefit of such investment given existing transport patterns would be minimal, while the investments required to achieve it are unaffordable. (Raballand et al., 2009).

- Finally, maintaining the initial momentum in collecting RAI indicator data has not been successful. It is claimed that there is very little explicit monitoring of rural transport impacts on MDGs within national programs and projects and the calculation of RAI shows wide variations in its temporal and spatial application since its first SSA-wide application in 2006 (Vincent, 2010).

In conclusion, RAI is better seen as a measure of network density rather than as an absolute indicator of the required level of investment. It is best used in the framework of a mixture of different standards of road and a vibrant rural economy generating sufficient demand to attract a supply of different and competing transport services. Where this is absent then the need to improve the overall access of rural communities and deliver the last "mile" is best served by footpaths or IMT tracks built and maintained by communities to a level that reflects their importance and use (Gachassin et al., 2010). For this reason, Walker calculated a second measure of access, which was district-level road density (kilometers of road length per sq. km. area). This measure is also highly-scale dependent, but it provides a population independent measure of road network availability. (Walker, 2009).

From an impact perspective, RAI is mainly of value for international and intra-national multifactorial regression or econometric analysis. Here the above concerns have to be taken into account when making comparisons and drawing associations between RAI and socio-economic indicators.

2.5 RT indicator data collection tools

The first three tools are associated with measuring traffic outcome indicators, which precedes and predates any attempt to assess a rural transport impact. Intervention rationale indicates that if there are no traffic outcomes there can be no development benefit or impact since the former, through lower transport charges, drives the latter. This emphasis on transport charges rather than costs reflects the importance of transport services. In SSA, the majority of people living in a road's zone of influence or corridor tend not to own or have access to private motor ve-

hicles[6]. They rely on transport services provided by transport operators and while these operators may benefit from lower operating costs, they may not pass these savings on in the form of lower transport charges. If this is the case that the affordability of transport services remains unchanged and the wider impact will be reduced. Equally, the road must be maintained so that its transport service and access benefits are sustained.

Traffic census and surveys

The data collection format of the traffic census varies by country and the organization carrying out the survey. The key characteristic of the census form has to provide a clear definition of the transport modes likely to be encountered in the survey. These should include intermediate means of transport and pedestrians, the latter are often differentiated by load carrying or not. It is common practice to break up the notation of the count at hourly intervals over a 12-hour day, starting when people are known to be moving. Impact evaluations should also undertake a survey of the traffic stream to ascertain the characteristics of each mode (who is travelling, for what purpose, cost of the journey, time taken, etc.). This will involve using sample surveys of transport operators and users to ascertain their characteristics. It might be possible to widen this to capture the economic status of those travelling in order to asses if the poor are affected by or benefiting from the intervention. Different data formats along with practical advice on the organization of traffic counts are given by Fouracre and Starkey (Fouracre, 2001 and Starkey, 2007).

Road user satisfaction surveys

Road user satisfaction surveys (RUSS) are a relatively recent introduction to impact evaluations and they vary in their intensity and scope. Their origin lies in the institutional reforms that have separated policy setting and regulation from the execution of works and maintenance in the transport sector throughout much of SSA. More emphasis on "governance" and "accountability" was therefore placed with the new ministries, executive agencies, road funds, etc., and the resultant "service culture" seeks and responds to feedback from its "clients" i.e. the road users. Thus, the logical framework for TANROADS in Tanzania identifies "road

[6] It should be noted that the availability and widespread ownership of low cost Chinese motorcycles has had a profound impact on rural access and mobility as well as transport - "*okada*" services in much of SSA.

users satisfied" as a performance indicator of its primary road development and maintenance activities. This indicator is addressed by satisfaction surveys (Lyatu, 2000). More recently, the Federal Road Sector Development Team (RSDT) of Nigeria developed a road user satisfaction survey to:

- Measure customer satisfaction of road network outcomes or attributes through a few sets of major indicators (including all key performance indicators from the Project Appraisal Document), each with a number of sub-indicators.
- Measure customer perceptions of RSDT at state and national levels through a few sets of major indicators, each with a number of sub-indicators.

Again the outcome of these services was to strengthen the performance monitoring and accountability of the road sector.

An example of a typical RUSS is a survey carried out on behalf of the Himachal Pradesh Public Works Department to identify drivers of user satisfaction, measure satisfaction levels and capture expectations of road users (Marketing & Development Research Associates, 2007). It undertook a sample of more than 6,500 road users stratified by road type and proportion of traffic using each type of road.

Cordon surveys

Cordon surveys are targeted surveys on all access routes leading to a market, town or discrete area (a national park). Their objective is to survey all traffic entering or leaving the area around the point of interest. In transport terms, they are often used to build up a picture of traffic flows in an urban area as part of the preparation of a master plan. In rural transport terms, they are occasionally used to assess traffic accessing an important rural market.

Community/household surveys

Community or household surveys usually serve to assess the indirect impact of a rural transport project. They rely on questionnaires or interview schedules to collect impact indicator data from the project area. Their function is to quantify the travel, transport and access characteristics of the household as well as its socio-economic attributes by interviewing the main community and household decision makers. The compilation of the questionnaire follows a number of principles.

Table 2-8 Recommendations for the preparation of household survey questionnaires

- Phrase each question so that the information it provides tests a hypothesis or quantifies an indicator that contributes to answering an evaluation question.
- Adopt a concentric approach i.e. beginning with the household then taking the respondent through a logical sequence of events that are interconnected and are likely to be remembered by association.
- The questionnaire should contain a mix of open and closed questions that allows the respondent to articulate his/her reasons rather than be obliged to use a preconceived framework of stock answers.
- Include one or more repetitive questions as a means of testing the reliability* of the respondent's answers. Ideally, these questions should replicate those used by the Country Statistical Office (CSO) in their Household Surveys and Demographic Health Surveys**.
- Use tested questionnaires and adjust them to reflect the focus of the impact study as well as the social and cultural environment in which they will be applied. This adjustment process involves:
  - Fine-tuning the number of variables to the impact study area and time period envisaged between the baseline and follow-up survey. For example, the mix of "modern" farm inputs available in an impact area reflects current agricultural extension effort and advice on best practice. Similarly, government efforts to encourage free primary schools may affect the applicability of school enrolments as an impact indicator and might be replaced by a literacy variable if the follow up survey is planned for some 4 to 5 years after the RT intervention.
  - If the objective of the evaluation is to estimate RT's impact on poverty then it is essential that the questionnaire include income and expenditure/consumption data. Most questionnaires use of the latter, because it can be collected with lower measurement errors than household income. Others rely on surrogate welfare indicators such as asset holdings. In the latter case, the availability of Living Standards Measurement Surveys (LSMS) would enable the researcher to validate the use of expenditure and asset data through correlation or regression analysis.
  - The draft questionnaire should be pretested and piloted. Pretesting will involve translating it into the local language or languages and retranslating it back using different translators. This will help identify and eliminate poor phrasing and ambiguities as well as provide the researcher with cultural insights and an understanding of local courtesies needed to allay any interviewer resistance. At the end of this process, it may be possible to finalize the translation of the questionnaire and print it into the local language.
  - It is important that methodological continuity is maintained by a detailed description of the randomization process, the location of the individual respondents or the timing and/or sequencing of the survey. This should be backed up by a map and GPS coordinates of the household and community locations.
  - Anticipate attrition rates and compensate by increasing the number of respondent in the baseline. The follow study needs to check if attrition is neutral and does not affect the representativeness of the sample.

* In research terms reliability is a measure of consistency and a respondent is regarded as reliable if their answers are the same for the repeated questions.

** This will not only improve the reliability of the findings but enable them to be generalised and scaled up to the regional or national context.

The community questionnaire is usually shorter and less structured than the household questionnaire. This difference reflects the fact that it is usually administered to a group of community representatives, or other social and gender groupings. Its function is to overlap and crosscheck household data as well as provide a picture of access constraints, normal patterns of travel and transport, etc. Worth mentioning in this context are community service delivery surveys. These surveys are particularly effective for monitoring community-driven RT projects, because the survey can actually become part of the project, and the responsibility for its monitoring can be progressively passed on to the community itself. One of the big advantages of a community survey is that a relatively large number of communities can be covered in a relatively short time.

Preparing questionnaires is not an exact science and fortunately, there are a number of models that have been applied to RT projects and studies. These include the Annotated Prototype Household and Community Questionnaires in Technical Notes 6 and 7 of Murphy's elaboration of a rapid survey method for assessing poverty reducing impacts of ILO employment intensive projects (1998). Grootaert (2002) also provides detailed guidelines on how to conduct an impact study with prototype questionnaires and interview schedules. Starkey (2007) Methodology for the Rapid Assessment of Rural Transport Services illustrates another approach, which does not provide prototype questionnaires but a checklist of questions to be asked of a wide range of stakeholders including households and communities.

These models will need adjustments to reflect the focus of the impact study as well as the social and cultural environment in which they will be applied.

Agricultural surveys

Given the importance of agriculture and both the subsistence and income generating needs of most of the rural population in SSA, an impact study will need to include agricultural variables in the household and community questionnaires. From a rural transport perspective, this will provide indicator data able to test the agricultural impacts outlined in Section Rural Economy. The prototype questionnaires mentioned above partially provide for this by including activities such as the crop mix, use of inputs, visits of extension agents, marketing of crops etc. with an emphasis on who is responsible, where did they travel, how much did they transport, prices received and cost involved. Table 2-10 illustrates the typical agricultural access related concerns of a rural transport project.

Table 2-10 Typical Agricultural Concerns of an RT Impact Study

Did the household use any farm inputs in last season? for each input (e.g. fertilizer, insecticide, herbicide, and improved seeds) give the following details:

Source: Baseline Study of Community Transport Infrastructure in Zambia.

Input, amount used and unit cost	Amount used and cost/ unit	On which crop was it used	Where from*	By whom	How do they travel Mode Time & Cost
1. Fertiliser					
2. Insecticide/ herbicide					
3. Improved seed					
4. Other					

Rapid rural assessment/appraisal (RRA)

The methodology used in rapid rural assessments has been advocated as a pragmatic and efficient response to heavy resource demands for data collection. Data collection is expensive and usually consumes more than half the budget set aside for an impact study (Baker, 2000). The ILO's Development Policies Department initiated the establishment of a system for the rapid assessment of poverty impacts (RAPI) (Murphy, 1998). The ILO, like many other development partners involved in the subsector was faced with the problem of collecting primary impact data in order to demonstrate the effectiveness or results of its employment-intensive projects. The mini surveys Murphy were designed to address this need by: (i) the use of short questionnaires, (ii) a reduced sample size and (iii) the use of computers in data collection and analysis. These steps reduced data collection costs and led to fast feedback of impact results to decision-makers. Bamberger endorses such an approach to reduce the length and complexity of the surveys but warns there are trade-offs—smaller samples reduce the statistical precision of resultant findings and the level of disaggregation of the analysis. This in turn limits the generalizability of the findings, which remain unique project-centered "case studies" anchored in the "gray literature" rather than as published contributions to international development literature (Macintyre et al., 1999).

Participatory rural assessment (PRA)

Participatory methods are used at various stages of a project cycle. They are valuable to an impact study because they seek the opinions and perspectives of the beneficiaries who can be disaggregated into appropriate socio-economic and gender groupings. In the past, they were perceived as less "scientific" research tools, which provided case studies or anecdotal information of limited value to mainstream quantitative surveys. Even now when a PRA is accepted as a means of providing insights into statistical findings and results, it is still "*not well appreciated or used*" by the transport sector (p. 77, Banjo, et al., 2012).

In conclusion, qualitative methods work well and provide insights that structured formal surveys can seldom do on their own. Importantly, they are not a "quick and dirty" way of measuring impact but need expertise and time if they are to be effective impact monitoring tools.

Further discussion of these techniques and the role of participatory rural assessment (PRA) in rural transport projects can be found in Davis, A. S. C. (2001), while Start and Hovland (2004) and Catley et al. (2007) introduce the PRA techniques in impact assessment of development policies and non-rural transport projects. Hettige is the most widely available example of the application of RRA techniques to transport impacts (2006).

Geographical information system (GIS)

Starkey recommends that all M&E data collected for an impact evaluation be georeferenced. For this, Global Positioning System (GPS) coordinates should be recorded for all relevant locations and the distance between them calculated. In many situations, basic GIS data may already exist for villages and the road network but may need verification (Starkey, 2007). In other studies, a vehicle-mounted camera was used to record speed, GPS position and video each road and geolocate every market. This data enabled the researchers to calculate average speeds and distances to local and urban markets and used as variables in their regression analysis (Casaburi et al., 2013).

A good example of the widespread use of GIS is Lesotho where the Ministry of Public Works and Transport has committed itself to use GIS in its management of the road sector. It is used as a planning tool to (i) target investments more efficiently at areas of poverty; (ii) coordinate data across sectors, (iii) monitor indicators and impacts, and (iv) facilitate stakeholder communication and participation.

The Ministry also piloted the integration of participatory sketch mapping and GIS. The maps are drawn by focus groups who locate key destinations, services, and routes (e.g., footpaths and roads) in their community. They also identify opportunities as well as transport and access barriers (e.g., cost, time, mode, seasonal disruptions). The maps are then georeferenced via global positioning system (GPS) points for key destinations and paths. These are then incorporated as layers in the GIS database of the ministry, extrapolating from the GPS points and place names on the sketch map. The layers can be viewed alongside base maps and other layers, thereby integrating local stakeholder perspectives and issues into decision-making.

Walker et al. have been able to integrate this road sector GIS data with Demographic and Health Survey (DHS) results by georeferencing the locations of survey enumeration areas or clusters. The DHS highlights a number of transport and access constraints facing households seeking healthcare as well as other health service barriers associated with quality of facilities/personnel or cultural restrictions. DHS surveys also emphasize gender differences in access and use of health services and can therefore help better understand gendered differences in access and mobility. The resultant spatial data also lends itself to planners of rural transport and health care interventions as well as monitoring the achievement the MDGs.

2.6 Existing data sources for monitoring of the impacts of projects

A number of surveys and studies on rural transport impact evaluation regularly funded by governments and executed by the CSO are of value. Some refers to large countrywide surveys with little opportunity to add access questions. Nevertheless, they are important sources of secondary data, which an impact study needs in the planning and execution of its surveys as well as a source of triangulation data during the analysis phase. The most important of these country surveys is the *population census*, normally undertaken every ten years. The census results and its enumeration areas usually provide essential information for preparing sample frames for any rural transport impact study and enable the findings to be generalized to other rural areas. The census is often closely linked with an *agricultural census*. This is undergoing some changes as the new World Program for the Census of Agriculture (WCA) 2010 advocates a separate system of integrated agricultural census and surveys. It is possible that the new agricultural surveys will include socio-economic community attributes as well as access and use of community agriculture-related infrastructure, which may provide useful information for an impact study (World Bank, GDPRP, FAO, 2012 p. 45).

Other country surveys usually rely on sample data and include Living Standards Measurement Studies (LSMS) and Household Budget Surveys (HBS). Depending on the country context, these may contain access data, which may be comprehensive enough to undertake econometric analysis (Gachassin, 2010, Fan, Nyange et al., 2005) or may be supplemented by specifically designed transport surveys as in Ghana. The availability and usefulness of these secondary data sources tends to be country specific as the M&E success stories show.

In addition, access as measured by distance or time may feature in other sector surveys. Thus, a study of barriers to the care of HIV-infected children in rural Zambia used an existing medical cohort study to highlight role of rural transport on HIV treatment (van Dijk J. H. et al, 2007). Walker et al. have also been able to use Demographic and Health Surveys (DHS) in Lesotho, Ethiopia and Ghana to explore access and mobility to health care services (2009). Similarly, road access is one of the indicators collected in the Ghana Living Standards Measurement Survey and Lavy et al were able to use this to calculate elasticities for primary school attendance (1996).

2.7 M&E success stories

Ethiopia

Country Commitment. Ethiopia has shown a considerable commitment to the road sector which has seen its network increase from 26,550 km in 1997 when the first Road Sector Development Program was launched to 85,966 km in 2013 (a 224% increase). This impressive achievement underlines the ability of the road authorities to lead and manage the current Road Sector Development Program (RSDP). The government has funded some 77% of RSDP IV investments as part of its "Growth and Transformation Plan (2010/11-2014/15)". This stresses the importance of road transport as a means of developing other productive sectors such as agriculture, industry, mining, tourism as well as the delivery of education and health services.

This commitment has also seen the expansion of the rural network and the initiation of the Universal Rural Road Access Program (URRAP) in 2011, in order to provide all-weather road access to all kebeles in the next few years. The success of this strategy can be judged by the RAI, which has reportedly increased from 13%

in 1997 to 39% in 2011/12 (WT Consult, 2013). Furthermore, if URRAP achieves its construction targets, the RAI should increase to about 80% (ERA, 2013).

Rural road construction is also important in other sector activities. Thus, the Productive Safety Net Program, one of the largest social protection programs, uses labor-intensive methods to construct community infrastructure like feeder roads, health posts, and primary schools as well as to rehabilitate natural resources in some of the poorest weredas. The agricultural sector is also cooperating with the Ethiopia Roads Authority (ERA) in the construction of access roads in areas of high agricultural potential.

However, this rapid expansion of the road network seems to have stretched the human and managerial resources of the regional and wereda administration. A recent review of M&E capacity highlighted the weaknesses of regional road sector M&E systems, which were reportedly non-existent in some weredas. These weaknesses extended to regional staff who were unclear as to current M&E reporting requirements and the definition and purpose of the management indicator data they were collecting (Central Statistical Agency, 2012).

Existing and planned impact assessments. ERA has commissioned several impact studies. The first one, Transport and Poverty Observatory ran from 2005 to 2011 and involved an assessment of the poverty impacts of trunk road project investment at the community and household levels undertaken by two consultants. The first consultant dealt with the baseline when some 1,100 households were interviewed within and outside the Project Road Influence Area (PRIA). The sampling frame included both urban and rural households and the identification of homogenous segments of the road corridors as a means of minimizing exogenous factors. The second consultant was responsible for the follow-up surveys and their final analysis in 2011. At this follow-up stage, the sample size was reduced by 25% and the adopted analytical approach was a simple cross-sectional rural/urban comparisons of baseline and follow-up data presented as descriptive statistics and percentages in a tabular format. The uncertain validity and reliability of the baseline survey and the high attrition rate of the panel survey meant that findings were tentative and qualified "*the decreasing rate of literacy may be the result of the missing households that were reported during the baseline as literate people*" (p. 111, Selam Development Consultants, 2012).

ERA's reaction to this report has been understandably cautious and its findings are used selectively as anecdotal evidence rather than as authoritative statements of

impacts. They have also tried to learn from this experience and have engaged the services of an international consultant to undertake a second Poverty Observatory Impact study. The methodology outlined in this service contract is impressive and commits the study to panel surveys that will be propensity score matched and econometrically analyzed to isolate and attribute road impacts. The baseline and second round of data collection has been reported on in a descriptive way but there are a number of characteristics of this study that may undermine its ability to identify impacts. First, the study is monitoring changes on an annual basis from 2012 to 2016 with a final analysis in 2016. It is reported that none of the trunk roads will be completed until 2015 so the monitoring effort will largely capture outcomes or effects with too little time allowed for impacts to emerge. Second, the baseline cross-sectional sampling frame is compromised by URRAP road improvement activity in the four trunk road corridors. URRAP-funded feeder road construction is affecting the access criteria used to define the zones of road influence ("ZORI") which identify with/without communities and households in the sample road corridors. It is also likely that the 960 household baseline sample will not be large enough for the level of robust impact analysis envisaged some five years after road completion.

Finally, ERA is in the process of engaging consultancy services for the impact evaluation of the URRAP across the country. The Terms of Reference (TOR) for these services envisages a widespread impact study with "representative" samples drawn from all regions and weredas benefitting from feeder road improvements. This study represents an opportunity for both ERA and SSATP to dialogue and if possible strengthen the qualitative assurance management of the contracted consultancy services to ensure that Ethiopia can pioneer the application of "gold standard" RCT-based road impact evaluation in SSA.

The PSNP (Productive Safety Net Program) has also initiated a number of impact studies with a distinct focus on micro catchments as their M&E unit. This reflects PSNP's emphasis on the productivity gains arising from their soil and water conservation efforts. This focus on a small number of micro catchments enables the impacts to use innovative proxy indicators like transport cost and travel time savings within a financial CBA framework. These impacts also use qualitative techniques to explore change processes and explanations (Metaferia, 2013).

Impact evaluation. Both the RSDP and the PSNP recognize the importance of impact evaluations in affirming the government's policy focus on rural infrastructure improvements and have set aside considerable resources for several impact

studies. The contract value of the current Transport and Poverty Observatory study is some $750,000.

All of these studies tend to utilize a range of qualified in-country consultants to deliver the impact services and rely on in-house staff to manage the impact evaluation team. The high workload of ERA contract management staff is such that they in turn rely on the integrity of the procured consultants to deliver rigorous and defensible impact findings. This has resulted in poor quality impact assessments, which have failed to confirm the poverty alleviation impact of the RSDP and PSNP. These "knowledge market failures" (Gallouj, 1997) are a reoccurring feature of SSA road impact studies and need to be addressed if either ERA or PSNP are to produce a "gold standard" RCT impact evaluation.

Impact evaluation expertise. There is considerable evidence of in-country expertise in the application of econometric skills and statistical analysis in the evaluation of road sector/RSDP impacts. Thus, the Ethiopian Development Research Institute (EDRI) has undertaken a number of road sector related studies notably a review of the impact of RSDP expenditure on GDP using time series secondary data from Central Statistical Agency (CSA) and ERA. Econometric analysis of this data indicates that the expansion of paved road has had a positive and statistically significant impact on overall economic growth, but this is not the case for the gravel road network. The study was unable to show a statistically significant relationship between the length of the gravel road network and the agricultural sectors contribution to overall GDP. It goes on to argue that more investment is needed to improve rural accessibility but due to the lack of data, is unable to explore how the expansion of the rural road network would improve productivity (Worku, 2012).

A similar macroeconomic study conducted by both diaspora and in-country university staff explores the relationship between road infrastructure and enterprise development using time series secondary data from the CSA and ERA. The largely urban and trunk road data was georeferenced to enable the team to develop GIS-derived transport service proxy indicators rather than use capital expenditure or road asset capital values (Shiferaw et al., 2012). The study identified that "*the non-random placement of roads across locations ….. makes identification of the impact of road infrastructure quite difficult*" (p. 14). Nevertheless, by adopting panel GMM[7] estimators, the study was able to control for the endogeneity of road placement,

[7] Generalized methods of moments

and show that improved road accessibility brought about by the RSDP increases "*a town's desirability for manufacturing firms…. This suggests that the public investment on roads is not only expanding the size of the manufacturing sector, it is improving the distribution of manufacturers across towns*" (p. 24, ibid).

As yet, this expertise does not appear to have been applied to the analysis of rural transport—a missed opportunity by researchers and road stakeholders alike.

Availability of secondary data. The Central Statistical Agency has a range of time series data on topics that are of value to and may be incorporated into a rural transport impact evaluation. These include:

Household income, consumption and expenditure (HICE) or welfare monitoring (WM) surveys. These surveys overlap to some extent insomuch as the HICE survey tries to capture the income and expenditure dimension of poverty while WM surveys provide socioeconomic data that reflects other dimensions of poverty (health, education, nutrition, access to and utilization and satisfaction of basic facilities/services and related non-income aspects of poverty). The HICE and WM surveys have been conducted every four-five years since 1995/96. The latest is for 2010/11 and its findings have recently been published. They contain a number of objectives, one of which being to provide basic data to enable the authorities to design, monitor and evaluate the impact of socioeconomic policies and programs on households/individuals living standard. From a rural transport point of view, these surveys are a vital means of triangulating and strengthening the methodological weaknesses that one-shot questionnaire surveys have in collecting income and consumption data.

Demographic and health surveys. These surveys were undertaken in 2000, 2005 and 2011 to collect national level data, used to calculate key demographic and family health attributes including the utilization of health services, such as immunization coverage among children, prevalence and treatment of diarrhea, other ailments among children under age five, maternity care indicators, including antenatal visits and assistance at delivery. This data has been used to benchmark Ethiopia's access to health services against other SSA counties (Walker and Vajjhala, 2009).

These and other CSA surveys represent a source of secondary data that can be used to both crosscheck findings and then generalize them across the country. It is understood that, if the right protocols are followed this data will be released as a data set rather in the report format that appears on the CSA website.

RSDP MDG Monitoring Data. ERA has been funding the collection and analysis of MDG and Road Sector indicator data, which largely revolve around the results or performance of ERA. This data indicates that ERA's achievements are impressive and its access and traffic/transport effects are noteworthy.

- The RAI, first measured in 1997 as 13%, is now 43% (2013) which reflects a 231% increase in the road network.
- 70% of the network is today in good condition compared to 22% in 1997.
- Traffic has grown by 9% per year over this period.
- Savings from reduced operating costs are estimated to be some 13% for the paved roads and 10% for the gravel road network (ERA, 2013).

The methodological basis for the collection of these indicators is not clear but it does represent an impressive set of time series data that once again can be used to cross check and triangulate any findings.

Morocco

National Commitment. The road sector has received substantial commitment from the Government and the development partners over the last twenty years and the construction of national and regional road network is largely completed. The focus is now on the maintenance of this network and the extension of the rural road network to (i) reduce provincial road network inequalities and (ii) increase rural accessibility to motorable roads and their associated transport services.

The *Ministère de l'Équipment, du Transport et de la Logistique* (METL) is in the final stages of implementing its *Deuxième Programme National des Routes Rurales* (PNRR2) which aims to increase the access of some three million rural people to economic and social services by building 15,560 kilometers of rural roads in all sixteen regions of the country. At appraisal, some 650 million dollars were to be invested in the sector, with some 62% of funds provided by loans from a wide range of development partners including the World Bank, European Investment Bank, Japanese Investment Cooperation Agency and Agence française de développement. The Government of Morocco and the *Caisse pour le Financement Routier* (CFR) provide a further 23% while local authorities fund the remaining

15%. The success of this Program can be judged by the increase in the National Rural Road Accessibility Index[8] (NRRAI) from 54% in 2005 to 75% in 2012.

The experience of PNRR2 also highlights a gap between the demand and supply of transport services using the improved rural roads. A series of regional studies on transport services was commissioned to explore the gap between supply and demand as well as the operational, financial and logistical characteristics of the transport service providers. The studies make recommendations on how these services can be improved. These studies will inform the preparation and scope of the next rural road program, giving it a stronger transport service focus.

Existing and planned impact assessments. METL has commissioned a number of impact studies since the publication of its first impact study in 1996. Currently, METL's "Direction des Routes" has overseen an impact study of the PNRR2 which has out sourced data analysis services to assess the impact of PNRR2 on six improved and six control roads[9] (*Conseil Ingénierie et Développement*, 2010). The *Centre National des Études et des Recherches Routières* (CNER) has also undertaken in-house evaluations across the whole program, as and when resources allow (CNER, 2011). In reality these studies are part of a project-based M&E system established by the "*Direction des Routes*" (Road Department) at the start of the PNRR2 to measure and report on the progress of works and its accessibility outcomes or effects or results.

In addition, the *Direction de la Stratégie, des Programmes et de la Coordination des Transports* (DSPCT) under the METL is also undertaking a global project evaluation of PNRR1 and PNRR2 to estimate long-term impacts, the results of which will inform the preparation of a third Program. These studies use the same methodology and are typical examples of results monitoring, and as such, fall short of authoritative impact studies. Moreover, the indicators used focus on access to and use of motorized vehicles and the impact hypotheses/logic behind some of some indicators understates other dimensions of access[10].

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[8] The NRRAI measures the percentage of population living in communities (douars) located within one (1) kilometer of an all-weather road.

[9] CID claim that this impact study is more authoritative because its control roads closely match the pre improvement conditions of the improved roads.

[10] For example, it is unclear how a motorable road will affect pupil enrolment, attendance and attainment at primary schools, when the majority of pupils walk to school.

This approach to results monitoring builds on the methodology employed in PNRR1. This involved the use of a cross-sectional sampling frame which was applied to project completed roads and parallel or unimproved roads or sections in the same location. No baseline data was collected and "before improvement" attributes were identified either by retrospective questions or by the use of time series secondary data gathered from service providers (schools and health clinics at the provincial or commune level). The difference between treatment and control communes/households i.e. the "counterfactual" is expressed in descriptive statistics and this difference is assumed to represent "the benefit" of road improvement.

It is understood that the Government of Morocco, with the World Bank support will be carrying out an impact evaluation of the National Initiative for Human Development (INDH), which has constructed rural roads under a poverty targeted community infrastructural improvement initiative. This impact evaluation will compare changes in conditions in 62 INDH targeted rural communes with 61 communes that are nearly as poor but not covered by the national initiative. The evaluation is designed to show (i) whether INDH has made a difference in household revenues and expenditures; (ii) changes in participation of households in collective activities; (iii) use of and satisfaction with public services and infrastructure; and (iv) changes in nutrition, health or education status (World Bank, 2012).

A baseline study was conducted in 2009 and the first follow-up survey of initial outcomes in 2011. The findings of the results survey should be available now and METL will be particularly interested in the third objective of the study.

Other M&E good practice. The ministry (METL) has developed an internet MIS system (SYGER) that tracks and monitors the progress of inputs, outputs and other aspects of road asset management. Thus, new additions to the rural road network are georeferenced in the field by GPS. These data are then transferred to the GIS Unit in Rabat and the gazetted road network is updated and the road entered into the maintenance management system.

The HDM-IV vehicle operation costs (VOC) and road costs modules have been calibrated to Moroccan conditions and these outputs now inform the Road Economic Decision (RED) model which was used to select candidate roads for PNRR2 improvement.

Road accident data is logged by the *Gendarmerie royale*, the *Direction Générale de la Sécurité Nationale* (DGSN) and METL provincial staff. METL established a re-

porting system supported by prepaid Short Message Service (SMS) using the mobile phone network with the CNER in Rabat. This incident log is followed by a site visit and the completion of an accident report form, which is coded and entered into a national road accident database. It is understood that the use of the mobile phone network was introduced some six years ago and this has enhanced real time reporting and management of road accident data.

The same SMS is also used by provincial METL and administration staff to report road events e.g. interruptions and emergencies affecting the passability of the network. This has speeded up the emergency maintenance efforts of METL thereby reducing the travel days lost to heavy rain or snow, flooding, landslides, etc.

Impact evaluation budgets. The ministry undertook the impact study of the PNRR2 in 2010 for an estimated total budget of $100,000. This budget includes $50,000 for outsourced consultancy services to the *Conseil Ingénierie et Développement* (CID) for data entry, cleaning and analysis of survey data with another $50,000 of in-house/government resources for data collection. The latter has been collected by in-house planning and economic staff in the regional (*Services de planification et des études économiques*) units of the METL. The staff is trained and managed by the CNER and their capacity is such that the surveys were phased in three stages across the country rather than executed at the same time.

In contrast, the DSPCT Global impact study requires the consultants to collect primary data from the field to test the achievement of project objectives and as a result is reported to cost some $300,000.

Impact evaluation expertise. There is limited social survey/econometric expertise in METL. The CNER is largely focused on materials, pavement and other applied engineering research and its staff is mainly qualified engineers with a range of engineering skills and expertise. Similarly the regional staff are reported to be less well qualified and since their function is to collect and collate regional and provincial social and economic indicator data. The focus of both management levels is the collection and use of predefined indicator data in order to assess the progress and performance of the PNRR2 and there is some appetite to change the current methodology so that it meets the demands of a gold standard RCT impact study. That said, senior management is aware that the preparation of its next road im-

provement program (PR3), scheduled to be launched in 2014, may require a more sophisticated approach to impact monitoring[11].

Availability of secondary data. As expected the *Haut Commissariat au Plan* (HCP), Office of the High Commissioner for Planning, has undertaken a wide range of statistical surveys on topics that may be of value to the results monitoring of the METL and a potential Rural Transport Impact Evaluation. These are often broken down by region and province; an initial review of these documents indicates some of the more interesting sources of secondary data for the road sector.

2004 Census (Recensement général de la population et de l'habitat de 2004). The 2004 Census has been analyzed for each province and provides data on a wide range of social and demographic characteristics for the whole country and is scheduled to be repeated in 2014. Importantly, the 2004 Census included a question on access to road infrastructure by the rural population and this is summarized for Berrechid province below:

Table 2-11. Distance to a paved road, household size and rate of illiteracy in Berrechid Province

Classes of distance to an asphalt road	*Average distance from a paved road*	*Households (%)*	*household size*	*household illiteracy rate*
Less than 2 Km	0.3	54.2	5.9	52.9
Between 2 and 6 Km	3.1	37.6	6.3	59.2
6 Km and over	8.1	8.3	6.4	63.5
Total	2.0	100.0	6.1	56.3

Source: Table 35 HCP: Caractéristiques démographiques et socio-économiques de la province de Berrechid (RGPH 2004, Juillet 2011

The commentary notes that more than half of households (54.2%) live within 300 meters of a paved road and only 8.3% of rural households live some 8.1 Km from a paved road. The census also notes the influence of distance on the size of an household and the degree of illiteracy of its members. The causal links of this relationship are not explored but if the forthcoming 2014 Census repeats the question then there is potential to explore these and other relationships by macro modeling and produce subnational patterns of road sector social and possibly economic relationships from the census. This would be a worthwhile addition to the SSA road sector literature but funding would lie outside the scope of most project-based

[11] This reflects the need for PR3 to embrace an integrated approach to the delivery of community infrastructure in more economically and socially marginal communities.

impact evaluations. Furthermore, the seven year time delay between the 2004 census and the publication of these provincial reports implies that access to the database will be required if this analysis is to be expedited quickly for policy and programming purposes.

National Survey on Standards of Living of Households (Enquête nationale sur les niveaux de vie des ménages). A national survey was undertaken in 1990/91, 1998/99, 2006/07 and uses a stratified random cluster survey to determine the overall socio-economic situation and measure inequalities in the standards of living between different social groups and regions of the country. It also provides a database on the access of the population to basic social services. The reporting of the analysis of the latest of these surveys is very condensed (HCP, 2007), but indicates that expenditure on transportation and communications has increased by some 112% and is now the third most important item of household expenditure. The report indicates a relative decline in rural poverty and suggests that this will be investigated further in the form of an impact evaluation of the National Initiative for Human Development (INDH). Unfortunately, there appears to be no reference to changes in access to social services.

The Implementation Completion and Results Report for the INDH indicate that rural road investment has an IRR ranging from 17% to 50%. It was also noted that there was a tendency to prioritize projects that brought services close to the rural population. This overlooked the improvement of transport links as a means of improving access to better equipped centers as a more cost effective solution (p. 59, World Bank, 2012).

National Household Consumption and Expenditure Survey (Enquête nationale sur la consommation et les dépenses des ménages). These surveys determine household expenditure and consumption patterns; they also provide the necessary data for updating the inflation coefficients. They have been undertaken in 1959/60, 1970/71, 1984/85, 2000/2001 and are based on a random sample 15,000 households (8,520 urban and 6,480 rural households). A review of the publications using these surveys suggest that they indicators collected by these surveys are asset and utilization based and do not provide a time/distance access dimension to the use of social services (Ezzrari, 2009). Nevertheless, such a report might be used by the METL monitoring team to support or triangulate its findings.

Other HCP Surveys and Publications. A review of the HCP website identifies other access data and survey findings. Thus, a survey reporting on accessibility to health services summarizes the time taken for patients to travel to health facilities (HCP,

2002). This type of data is important to support and triangulate METL results monitoring findings.

MDG monitoring data. The HCP reported that Morocco had reached its MDG targets in 2009, some six years ahead of the 2015 deadline (HCP, 2010).

Conclusion

The METL has adopted a pragmatic approach to impact monitoring. It uses an unsophisticated methodology to collect and collate PNRR2 outcome data (Study Type 3 of Table 2-3. The absence of a baseline means that the comparability of the controls is crucial to the identification and attribution road improvement benefits. The researchers believe that these controls have been "*wisely chosen to present the maximum physical, demographic and economic similarities with the improved roads*" (p. 8, CID, 2010). Yet experience shows that the analysis will tend to over or under estimate the benefits of the project roads due to inadvertent biases between project and control roads. Thus, Table 7.3.2 of the CID Study shows wide variations in the number of communities and populations served by the project and control roads. It is likely that these variations alone will affect transport demand and levels of traffic plying these roads.

Furthermore, METL presents its evaluation findings as impacts but in reality they are the outcomes or effects of project interventions (results monitoring) and are best used on a case study or anecdotal basis. As such, they show a strong institutional preference for traffic and transport data while the social and economic indicator data is used to highlight the impacts of the earlier PNRR1 and PNRR2 projects fall short of the high standards required for a "gold standard RCT impact assessment". Nevertheless, METL seems willing to improve the methodology of impact evaluation of rural roads within the PR3.

3. Key Principles and Steps for Effective M&E of RT Impacts

3.1 Introduction

There has been a gradual recognition among SSA governments and those involved in implementing rural transport programs that the impacts of their efforts in the subsector are not well documented. There is a lack of evidence on both the development impacts of improvements and more importantly, the benefits they bring to the rural poor. This knowledge gap is mainly due to methodological weaknesses of existing SSA impact studies, e.g. Morocco[12], Ghana[13], and Liberia[14]. *This weakness begins before the project starts when they fail to undertake baseline data collection in both suitable control and treatment areas.* (p. 47, Grootaert, C. 2002). It continues in the analysis of data, which assumes the autonomous nature of road impacts, overlooking the importance of road access in the investment and planning decisions made by other sectors, NGOs and entrepreneurs.

Likewise, the traffic and transport focus of these studies has tended to gloss over the fact that "*the poor and very poor inhabit a localized, walking world, and as such make little use of medium or long distance transport links*" (p. 18, Hettige, 2006).

3.2 Key principles

Government/Sector interest in impact evaluations

Terminology. There is a multiplicity of terms and definitions used in the impact literature and it is important that countries and development partners agree on a standard set of definitions and terminology that are internationally acceptable. The

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[12] 1st and 2nd Secondary Tertiary and Rural Roads Projects (Operations Evaluation Dept. (1996).

[13] The Baseline and Impact Monitoring Study of the Road Sector Development Program (Ado J, 2009).

[14] Evaluation of the Liberia Swedish Feeder Road Project (internal Project Document, 2012).

OECD-DAC definitions of impact seem the most widely used and appropriate in this regard (2004).

Commitment. There has to be a strong government and sector interest in the need for and commitment to a rural transport impact evaluation. A number of factors influence this commitment:

- A conducive policy environment is necessary. The findings of the evaluation are much more likely to be used if they address current policy concerns and implementation priorities.
- The evaluation should be launched when decision-makers have clearly defined information needs. The findings must be ready in time to affect decisions, and key results communicated informally before the final report is completed.
- An evaluation is one part of an information stream that influences policy makers and sector programs. The evaluation needs to reflect the context in which it will be used, the program being justified for poverty or road access reasons[15].

Involvement. Similarly, the aid relationship as defined in the Paris Declaration and other international agreements also has implications for rural transport impact studies. There is now an onus on development partners to follow country systems and strengthen capacity to carry out evaluations as part of normal administrative, sector and governance functions asking "what works? and for whom?" This favors the involvement of governments, country statistics offices and university staff in joint evaluations and participatory approaches (Stern, 2012). This in turn requires many SSA countries to re-examine their data access policies and work with development partners to their mutual benefit (p. 42, World Bank, GDPRP, FAO. 2012).

Bamberger endorses this approach and stresses the importance of actively involving national universities, think tanks and research institutions in the evaluation process (2009). This approach has the added advantage of tapping into the academic networking of "research findings" through peer reviewed and conference

[15] The former demands a process analysis of income/expenditure impacts by different socio-economic groups the latter requires an emphasis on mobility and access by the different socio-economic groups.

papers, research fora and open access publication web sites, which widens the dissemination of findings beyond the immediate circle of interested parties.

Execution of the evaluation. The evaluation may be carried out in many ways. The more common ones are listed below, but before the decision is made, it might be appropriate to undertake an initial diagnostic study to understand the context in which the evaluations will be conducted. This work has already started this process in Section 2.7 but further work is needed to assess the resources and capacity of the likely organizations involved, the nature of the program(s) to be evaluated; the kind of issues to be addressed; and the likely approaches that will be required (Bamberger, 2009). A decision has also to be made as to how the services are to be managed and procured, four possible approaches stand out:

1. **The evaluation is conducted by the M&E unit of the sector or subsector managing the project.** This usually has the advantage of better access to the key stakeholders, secondary data along with a better understanding of the political and organizational context within which the evaluation is taking place. However, sector M&E is usually focused on progress and performance monitoring which has a strong engineering and contractual bias limited capacity in statistical/econometric techniques, which will need to be addressed by appropriate technical assistance and support. The evaluation will have difficulty maintaining its independence since the evaluation team is invariably affected by the politics of both the ministry and government of the day and may find it difficult to explore sensitive areas.
2. **The evaluation is conducted by a national organization or body (CSO, university, research organization).** In theory, this approach will still have access to key stakeholders, to secondary data, etc. but in reality, this may be hampered by the "silo" thinking that characterizes most civil service organizations. Nevertheless, the evaluation will be independent, will bring in experience from other sectors and databases and be able to explore sensitive issues such as local political pressures or the exclusion of vulnerable groups. However, capacity constraints due to the selective out-migration of the more able researchers and technical assistance might be needed to address this.
3. **Evaluation services with the appropriate mixture of national and international consultants are procured and managed by the sector.** This is the more common approach to address the capacity and resource weaknesses of the earlier approaches but information asymmetry makes it difficult to

manage the contract. Thus, technical assistance may be needed to prepare terms of reference and contract documents and evaluate the tenders as well as monitor performance and peer review the analysis and findings.

4. **The evaluation is led by the development partners supporting the sector who take full responsibility for the approach and findings.** This approach is likely to produce the best product but limited involvement of stakeholders and partial knowledge transfer encourage dependency and a status quo.

The best solution combines the advantages of all of the above approaches, while minimizing the risks involved.

Communication. An effective communication between the evaluation team and the client in reporting the progress and findings of the evaluation is necessary. The client should have confidence in the team. They in turn need to establish a good relationship with the client and key stakeholders, understand their needs to avoid surprises when the findings are reported. It is also important that results be presented in a user-friendly format.

Scope of the evaluation. It is possible to ask a wide range of questions[16] in an impact study and there is a wide range of quantitative and qualitative techniques that can be used to answer these questions. This means that the client has to exercise some discipline and make sure that the right questions are asked and Client/Development Partners/Technical Assistance with the evaluation team resist the temptation to widen or broaden the scope of the evaluation. Evaluations that collect too much data analyzed in an unfocused way often fail to produce useful results—even when they are methodologically sound (Bamburger, 2004).

Budget

The cost of impact studies is estimated to range from "*$200,000 to $900,000 depending on program size, complexity and data collection*" (p. 23, Clark et al., 2004). The largest and most expensive are the "gold standard" RCT-based studies. Thus, the survey and data entry costs of the Vietnam Impact study were budgeted at

[16] The fundamental questions asked are: 1. Is the intervention making a difference, achieving its goal? 2. What are the results on the ground, i.e. how is the intervention performing? and 3. How can we do better, i.e. do we need to adjust the program and policy? More detailed questions are associated with the preparation of the research tools.

US$85,000 in 1997 (Baker, 2000), this is equivalent to US$123,860[17] in current terms. Three rounds of data were collected totaling some US$370,000 for overall data collection costs. As a rule of thumb, analysis and reporting costs are at least equivalent to those of data collection but for the complex analysis of "gold standard" RCT surveys these rise to as much as twice those of data collection. This suggests that a Vietnam-type study would cost upwards of US$1 million in today's terms. Such a commitment is feasible only when there is a long-term commitment to the road sector. Thus, Ethiopia's RSDP is in its fourth phase and some $10 billion has been disbursed over the past sixteen years (p.2, ERA, 2013). This has enabled ERA to justify expenditure on several impact studies, which unfortunately failed to deliver authoritative and defensible findings.

Such expenditure exceeds the normal budgetary provision for M&E in most funding agencies—ILO allows a minimum of 2% of total project funds to be set aside for independent evaluations and 3% for reviews, monitoring and internal evaluations (ILO, 2012). Special budget provision has to be prepared and its value assessed, like any other project or program expenditure, in terms of its cost-effectiveness or value for money. Most development partners funding rural transport projects to date seem unconvinced that a RCT-based gold standard study is cost effective and have focused on the well-trafficked road network where outcome traffic-based impact studies can deliver acceptable rates of return.

However, the poorly trafficked network and the incorporation of rural transport investments into community-based poverty alleviation projects may encourage one or more long-term impact evaluations in order to justify a policy stance that favors the poverty reducing effectiveness of rural transport investments as well as to quantify welfare benefits of access improvements (Bamberger et al., 2004).

Elapsed time and timing of surveys

Impact studies have a minimum of two and possibly three stages in their execution (Table 3-1). Each stage has its own characteristics and difficulties but all need to be organized in the same way, with the same tools and seasonal timeframe. This suggests that there should be a long-term relationship/partnership and trust between the agency contracting the impact evaluation and those charged with carrying out the work. In addition, Grootaert suggests that peak periods of economic activity

[17] Adjusted by the cumulative rate of CPI inflation in the USA (see website page on US Inflation Calculator: www.usinflationcalculator.com).

(seeding, harvest time) are also avoided (2002). This strict adherence to the baseline timetable is needed to "*ensure that recall errors are held constant as much as possible over successive survey rounds*" (p. 36, ibid).

The first baseline or benchmark stage is the most critical in this regard. The mobilization of fieldwork sets the timing of the study. The baseline also sets out the impact methodology and the scale and direction of the data collection effort before the rural transport project begins implementing the physical works. Invariably, the project management is focused on planning and executing these works and the danger is that the resource needs and importance of the baseline are neglected. The project logical framework can be vital in this regard. If it sets explicit welfare goals as well as traffic and access outcomes, management is obliged to recognize that the project's contribution to goal achievement may need to be addressed. Usually, this involves a dialogue between project management, its funding agency and its counterpart subsector ministry to decide the approach and resources needed to identify and procure an appropriately qualified impact research team (see Section Execution of the evaluation above). If the record of successful impact studies is anything to go by, this dialogue or resource constraints have favored short-term outcomes.

The timetabling of the outcome surveys is usually in the last year of the project or immediately after its completion. The purpose of the surveys is to assess the project effects—by asking if the traffic and access objectives have been met and what are the short-term changes to household and community access and welfare. A positive finding at this stage is a precondition for the achievement of any welfare goals that are the long-term impact.

The final follow up survey is scheduled at least 5 years after the project completion to capture all its welfare impacts with a concomitant emphasis on household and community data (ADB, 2011). There is no agreement on the exact timing of this stage as it relies on the emergence of behavioral and agricultural changes that reflect household investment decisions and demand adjustments (Kingombe, 2012). However, the review of the impacts that have been applied (Table 3-1) suggests that attrition, unforeseen shocks and spillover effects from other or parallel projects affect both the data sources and the integrity of the quasi experimental design in the longer term IEs (Van De Walle et al. 2009).

Table 3-1 Time between project completion and impact evaluation

*Years elapsed**	*Data Source*	*Comments and timing*	*Source*
		Recommended	
5	Primary	Minimum number of years	Murphy, 1998 (RAPI) Long-term impacts on poorest
5 to 10	–	Range of years	UN Panel on Monitoring and Evaluation (M&E), cited in Kingombe, 2012
2 to 5	Primary	Depends on socio-economic attributes within the road corridors	Chamberlain, 2007
7 to 8	Primary	Time required before agricultural yields/income changes can be identified (seasonal variability).	World Bank, GDPRP, FAO., 2012
		Applied	
1 to 7	Primary	Quantitative techniques inapplicable and sites became case studies.	Hettige, 2006 (Indonesia, Philippines and Sri Lanka)
4 to 7	Secondary	Post-Harvest Data Surveys: Baseline 1996/7, 2nd Round 2001/2	Kingombe, 2012 (Zambia)
4	Secondary & Primary	National Household Survey Baseline 2001, 2nd Round 2005	Goss Gilroy Inc. and Orbicon, 2010 (Nicaragua)
8	Primary	Baseline 1996/7, 2nd Round 2001/2, 3rd Round 2005	Khander, et al./BIDS, 2006, 2011 (Bangladesh)
6	Primary	Baseline 1997, 2nd Round 2001, 3rd Round 2003	Van De Walle et al., 2002, 2007 (Vietnam)
10	Primary	Baseline 1995, Annually until 2000, 3rd Round 2005	Chen, Mu and Ravallion, 2008 (China)
3	Secondary	National Household Survey data: Baseline 1998, 2nd Round 2001	Lokshin et al., 2005 (Georgia)

* After completion

Methodology

The adopted methodology is the outcome of a dialogue between project management, the funding agency and counterpart subsector ministry along with the budget constraints outlined in the previous section. This approach has favored the adoption of quantitative methodologies to evaluate projects by identifying transport cost savings enjoyed by road users. Thus, many project logical frameworks specified traffic or access changes as objectively verified indicators with a supplementary expectation that there will be a similar reduction in transport charges. Access indicators associated with attendance and use of markets, health

centers, schools, etc. might be included as objectively verified indicators. These performance or outcome indicators are easy to collect and analyze while project management and the subsector ministry alike will readily understand the findings.

This approach has worked where the road network is well trafficked, which is not the case for an increasing number of rural transport projects. In this situation, the proponents of quantitative techniques have argued that traffic-based evaluations underestimate the real impact of a road. Wider impacts captured by household and community surveys are needed to calculate the full treatment impacts of improvements. This inevitably leads to the "gold standard" RCT approach in which panel data for project and comparable control villages is used to capture changes in household economic and social behavior before and after the road investment (Khander et al., 2006). "*This approach is especially suited to unpicking 'causal packages' – how causal factors combine and what might be the contribution of an intervention. However such approaches are not good at estimating the quantity or extent of a contribution*" (p. 81, Stern, 2012).

To address this latter concern, the gold standard RCT methodology has incorporated a range of qualitative methods. These typically include key informant interviews and participatory rural assessments (PRA) and have either used them "*sequentially, to inform the next phase or cumulatively to validate the data*" (p. 3 Hettige, 2006). Thus, the Nicaraguan impact evaluation used qualitative impact assessments at community, municipal and regional levels to test and inform the preliminary findings of the econometric impact analysis (Goss Gilroy Inc. and Orbicon, 2010). Combining methods in this way helps compensate for the distributional weaknesses of quantitative methods but further increases the required resources and skills of the impact team.

This trend towards increasing resources and sophistication of impact evaluations has been questioned by Woolcock, who stresses the importance of understanding a known or likely impact trajectory over time of a project (2009). He argues that the rural transport subsector has "*a weak understanding of the shape of the impact trajectories associated with its projects, and even less understanding of how these trajectories vary for different kinds of project operating in different contexts, at different scales and with varying degrees of implementation effectiveness*". Thus, the long-term impact analysis of Khander and Koolwal (2011) and Van De Walle and Mu (2007) both indicate that the positive trajectory of many of the impacts identified shortly after project completion had declined over the longer term. They attributed this decline to other unobserved processes like agglomeration, political patronage, and

distance from cities becoming important as road impacts are attenuated. These processes do not act in a uniform manner; they encourage development and growth in some communities and displaced them in others (Van De Walle , 2009). Furthermore, Khander's findings suggest that these benefits accrued to the better off sections of society as the initial income gains of the poor were lost. Similarly, Chen et al. concluded for the Southwest China Poverty Reduction Project "*we cannot reject the null hypothesis that the longer-term average impact [on poverty] was in fact zero*" (p. 30, 2008).

It would seem that as impact studies engage with social systems, the linear and causal relationships lying at the heart of the gold standard RCT approach no longer apply. "*For example the empowerment of marginalized groups may lead to negative results before they become positive i.e. there will be a J-shaped curve. Or there may be a step-function, where after a long period of no change there may be a dramatic improvement e.g. when a new group is elected to power. Elsewhere, anti-corruption efforts making use of public expenditure tracking surveys may have a high initial impact that then fades over time (as those in power find alternative ways to misuse funds)".* (p. 52, Stern, 2012)

Institutional framework

Impact evaluations require an institutional commitment at national scale and not just in the subsector. A national capacity also needs to understand the need for a rigorous impact study and must be able to carry out it. This capacity includes both the CSO, research organizations and the university sector. The financial and capacity needs of this commitment lie beyond the scope of most SSA countries and it is expected that support from development partners will be needed.

The commitment for impact findings to feed into government development policy is as important as the methodology. Yet, a DFID-funded review of statistical services observed "*the availability of suitably qualified and trained staff was a universal constraint*" affecting developing and developed country alike (p. ix, Strode, M. et al., 2009). Similarly, an OECD study of member evaluation departments indicated that significant resource constraints affected the evaluation departments of the DAC[18] evaluation network. It was also reported that staff levels and the technical evaluation skills (internal and outsourced) was a concern for more than half of its reporting members (OECD, 2010).

[18] Development Assistance Committee

Yet, preliminary discussions for the post-MDG development agenda have stressed the need for a data revolution. *Stronger monitoring and evaluation at all levels, and in all processes of development (from planning to implementation) will help guide decision-making, update priorities and ensure accountability* (p. 3, UN, 2013). Clearly, it will take some time before most SSA countries are able to conduct their own impact evaluations. Given these institutional weaknesses, there is a need for the pooling of technical expertise, experiences and research resources.

3.3 Deciding on an impact evaluation

The above principles suggest that most rural transport projects in SSA should adopt a result-based impact assessment that focuses on the traffic and access improvements brought about immediately after project intervention.

The most complex and expensive "gold standard" RCT impact study should be reserved for one or two SSA rural transport projects that satisfy most of the above principles. This might be confirmed by the use of a diagnostic study following the steps set out by Van de Valle in Table 3-2 below.

Existing and planned impact evaluations

Assuming that Step 1 is in place, the diagnostic study should address Step 2 by adopting a concentric approach. This would start by reviewing current projects and how their logical framework objectives and goals are monitored. The formulation of these frameworks will reflect the current context of improvements and whether performance and impact are monitored in traffic terms or through the more long-term indirect effects on agriculture/rural economy, health and educational services. In either case, a judgment can be made on the in-country capacity to plan, execute and analyze impact studies.

Table 3-2 Steps in the Evaluation of a Rural Transport Project (up to the Baseline)

Step 1: Deciding whether to implement an impact evaluation
Is there sufficient support and cooperation? ✓ From the government ✓ • From the bank project team and bank management ✓ • From funding sources Is a credible evaluation feasible? ✓ Is there in-country capacity (data collection, supervision)? ✓ Are there existing or planned surveys that can be used or questionnaires that can be adapted? ✓ Is there a potential sampling frame in the prospective zone of influence? ✓ Is there time to prepare and field a baseline before the project begins? ✓ Can a counterfactual be identified under seemingly plausible assumptions?
Step 2: Learn from the ex-ante evaluation
Understanding program placement: to understand biases in the ex-post evaluation and define an appropriate counterfactual
Step 3: Set up the evaluation team
Finding a stable in-country home for the evaluation. ✓ Choosing an evaluation team that is reasonably independent of executing agency but can still work with that agency as need be: local counterpart, interviewers, data processors.
Step 4: The evaluation design: deciding what data are needed
Outcome variables (distributional impacts, traffic counts, time use, travel diaries) Control variables (similar road length and function; community size, agro ecology, Project data Choice and definition of: ✓ Zone of influence ✓ Beneficiaries: communities, households, firms, individuals ✓ Comparison areas
Step 5: The evaluation design: Collecting the data
Identify data sources and data collection methods Sampling and sample size Designing survey instruments Deciding on timing of baseline and follow-up rounds *Step 6: Analysis and writing up* Plan adequate time for data processing: entry, cleaning, lessons for follow-up; analysis of baseline Plan for follow-up survey(s) [Source: Van De Walle , D (2009) Impact Evaluation of Rural Road Projects]

Commonly, the subsector outsources these services to national consultants who may operate in other sectors and be able to bring this experience to the assignment. Existing poverty reduction programs may have a monitoring unit and impact agenda, which may welcome external support to strengthen the RAI[19] focus of this research. The tools, sampling frames and counterfactual analysis[20] of this existing research may offer useful insights into national capacity for impact research.

Similarly, the Country Statistical Office may also be undertaking national Household or Budget Surveys and supporting the health sector surveys. These nationally organized surveys may be repeated at regular intervals and thus provide time series socioeconomic secondary data that might be useful to the impact analysis. It is recommended that the questionnaires used for these national surveys are reviewed and critical questions on household consumption and income sources, are repeated in the impact survey. This will enable the impact baseline to test its reliability in these areas as well as generalize out from the project to the wider economy. Several impact studies have also used this secondary data to reconstruct a baseline against which project interventions can be assessed (Van De Walle , 2002, Lokshin, & Yemtsov, 2005 and Goss Gilroy Inc. & Orbicon, 2010).

It is also worthwhile exploring if these wider surveys use any subnational monitoring resources. Chen et al.'s 2008 impact study used supervisors and trained field assistants as part of the Rural Household Survey Team of China's National Bureau of Statistics (NBS).

This ex-ante exploration of subsector and national impact monitoring enables the proposed impact evaluation to outline possible treatment outcomes and hypotheses that interventions may stimulate and help define the counterfactual.

Step 3: The evaluation team

The skills required by the impact evaluation team are associated with the design, management, analysis and reporting of social science research, which involves

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[19] The need for consistent recognition of the RAI goal of living within 2 kilometres (20/25 minutes' walk) of an all-weather road in other rural development sectors is important if generalisations are to be inferred from different impact studies.

[20] Counterfactual analysis makes a comparison between what actually happened and what would have happened in the absence of the intervention. This usually involves the statistical analysis of propensity score matched treatment and non-treatment groups.

wide ranging experience in the application of rural surveys. While the main thrust of the research will be on quantitative data collection, the team should contain qualitative research skills and integrate these into a management plan. The more technical skills, namely econometric or statistical analysis are in short supply but others involved in the operation and management of field surveys and the application of qualitative techniques are more widely available. This mismatch is addressed in many of "gold standard" RCT evaluations by the selective use of international expertise. Thus, Khander et al. were brought in to strengthen the original BIDS impact study due to the use of bivariate analysis (a Difference-in-difference technique) and did not control for endogeneity (Khander et al., 2006, 2011). In Nicaragua, a joint venture between international and local consultants was procured to conduct the evaluation (2010). The former approach has the advantage of using the known expertise of in-house World Bank staff, the latter needed external expertise to assure quality to the procurement or selection process and help redress the information asymmetry that affects the procurement process.

*Proposed impact **evaluation** methodology*

Having decided the nature, composition and procurement strategy for the impact evaluation team, steps 4, 5 and 6 (see Table Table 3-2) outline the design of the research, its data collection tools and the analysis/write up of its results.

The selection of impact data will reflect the impact questions asked. These will range from the traffic and access variables needed to monitor project performance to the welfare variables used to monitor long-term impacts.

The sample or beneficiary units (communities, households, enterprises, individuals) will also need to be defined and once selected, variables included to enable their disaggregation into different welfare groups.

The definition of "control" parameters (roads of similar length and function, zones of influence, community size, agro ecology) used to identify suitable comparison sites also occurs at this stage.

The team will need to select, design and pre-test appropriate data collection tools. It is recommended that a combined methodology in which qualitative PRA techniques support the quantitative questionnaires and that these should be used in parallel and sequentially to ensure integration and feedback of findings. This triangulation of findings is needed to deconstruct the complex calculations of relationships that typify the quantitative techniques used in the "gold standard" ap-

proach. Many of these relationships are not visible to non-statistician and the causal link may not be clear. Thus, the quantitative study of food crop marketing in Sierra Leone found that crop prices fell after road improvement the reverse of what positivist theory expected and qualitative research needed to be undertaken to understand the causal linkages (Casaburi, 2013). Similarly, the Nicaraguan impact evaluation used PRA techniques to test its Difference-in-difference findings and only when they were confirmed by the beneficiaries were the causal links identified as significant.

The sampling procedure and sample size will also need to be outlined. The baseline sample in particular has to be large enough to compensate for the anticipated attrition rates that affect panel surveys. It will also need to be statistically manipulated to produce robust treatment and comparison groups. Typically, surveys envisage household samples in excess of one thousand for each of the treatment and comparison groups.

The timing and sequencing of resultant baseline survey sets the time and spatial pattern for the planned follow-up surveys. Ideally, there should be two follow up surveys, one immediately after project completion and the second at least five years after. This extensive time period means that there has to be a long-term institutional and partners' commitment to an impact study that is capable of withstanding subsector changes in management, staff and policy orientation.

3.4 Conclusion and recommendations

Two main approaches to an impact evaluation are identified and endorsed in this review of impact monitoring of rural transport projects.

The first is results monitoring of project outcomes or effects that is widely applied to rural transport projects across SSA. This type of impact evaluation is methodologically sound if it stays focused on the direct traffic and transport benefits of a project. In this way, it provides a subsector feedback on the success of its planning and appraisal procedures and meets the accountability needs of financing agencies and development partners. However, it has a number of weaknesses and mainly its inability to assess the distribution of benefits in poverty terms. Here it is recommended that PRA techniques in social mapping/modeling and wealth/well-being ranking are explored as a means of answering the question of who benefits from

rural transport interventions. There is also some merit in adopting and applying Road User Satisfaction Surveys (See related Section above).

The second is the panel survey of indirect household welfare benefits. This is called the "gold standard" Impact Evaluation which adopts complex statistical techniques to control for heterogeneity and exogenous time varying factors in order to establish a Randomized Control Trial (Van De Walle , 2009). Its heavy data demands and resource intensive analysis limits its widespread adoption for the reasons outlined in Section on Deciding on an impact evaluation above. Nevertheless, it is recommended that it should be applied to at least one SSA country following the Bangladesh approach (Khander et al., 2006, 2011) and focusing exclusively on the rural transport sector where the unit of analysis is roads rather than communities. This is important since few of these studies continue the traffic and travel analysis of results monitoring into the impact stage.

Finally, both approaches have mainly relied on quantitative techniques with limited use of qualitative methods. Only the impact evaluation in Nicaragua demonstrated the value of qualitative techniques as a quality assurance check on the validity of the statistical relationships generated by its analysis. The other panel surveys rely on theory-based causation as their explanatory framework.

"*Causation without explanation is insufficient for policy learning because policy-makers need to understand why as well as how if they are to use findings from research or evaluation for future policy-making*" (p. 10, Stern et al., 2012).

Annexes

Annex 1. Steps in propensity score matching

The aim of matching is to find the closest comparison group from a sample of nonparticipants (non-road communities) to the sample of program participants (communities with road). "Closest" is measured in terms of observable characteristics. If there are only one or two such characteristics then matching should be easy, but typically there are many potential characteristics. The main steps in matching based on propensity scores are as follows.

Step 1

You need a representative sample of eligible nonparticipants as well as one for the participants. The larger the sample of eligible nonparticipant communities the better, to facilitate good matching

Step 2

Pool the two samples and estimate a probit or logit model of participation in the road project as a function of all variables in the data that are likely to determine participation.

Step 3

Create the predicted values of the probability of participation from the estimated regression; these are the propensity scores. There is a propensity score for every sampled participant and nonparticipant community.

Step 4

Some communities in the nonparticipant sample may have to be excluded at the outset because they have a propensity score that is outside the range (typically too low) found for the treatment sample. The range of propensity scores estimated for the treatment group should correspond closely to that for the retained subsample of nonparticipants. If the road program covers a very large area, for example, it may be national in scope, it is quite likely that propensity scores may not match. In that case, improved matching can be achieved by splitting the sample according to geographic location.

Step 5

For each community in the treatment sample, find the observation in the nonparticipant sample that has the closest propensity score, as measured by the absolute difference in

scores. This is called the "nearest neighbor." You will get more precise estimates if you use, say, the nearest five neighbors.

Step 6

Calculate the mean value of the outcome indicator (or each of the indicators if there is more than one) for the five nearest neighbors. The difference between that mean and the actual value for the treatment observation is the estimate of the gain due to the program for that observation.

Step 7

Calculate the mean of these gains for each observation (community) to obtain the average overall gain. This can be stratified by some variable of interest, such as village size, in the nonparticipant sample.

Source: Grootaert, C. 2002. Socioeconomic Impact Assessment of Rural Roads: Methodology and Questionnaires Adapted from Ravallion (2001.

Other sources include a Youtube demonstration of the procedure: Econometrics – Propensity Score Matching. www.youtube.com/watch?v=-0HVGe0LKLo

Annex 2. Existing guidelines and standard documentation

There are a wide range of M&E guidelines and standard documentation for development projects including rural transport improvements. They tend to be unique to each development agency, reflecting their need to plan and improve their development programs as well as demonstrate that development aid is well targeted and delivering tangible benefits to the poor. Thus, bilateral agencies like the Department for International Development (DfID) indicate that "*high quality evaluations help us spend aid more effectively so that more people are lifted out of poverty. Moreover, because evaluations are published, they provide a direct line of accountability: to Parliament, the British public and our partners in recipient countries*". (DfID website) Their evaluations are therefore designed to assess the relevance, effectiveness and efficiency of the DfID programs.

Organisation for Economic Co-operation and Development (OECD) –Development Assistance Committee (DAC) Criteria

The 24 member countries and seven multilateral agencies who are members of the OECD Evaluation Network tend to use the principles, glossary and criteria laid out in the Principles for Evaluation of Development Assistance (OECD-DAC 1991), updated in the Glossary of Terms in Evaluation and Results-Based Management (OECD-DAC 2004). This defines impacts as "*positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended*" (p. 24, 2004). "*The examination should be concerned with both intended and unintended results and must also explain the positive and negative impact of external factors, such as changes in basic policy environments, general economic and financial conditions*" (p. 10, 1991).

These and other definitions in the Glossary emphasize the differences between the monitoring of project/program efficiency, effectiveness and impacts outlined in Figure 1-1 . This set of project-centered definitions draws heavily on the project Logical Framework Matrix (LFM). The LFM in turn is the product of the project intervention logic and both help frame the impact evaluation questions but they have their limitations[1]. Nevertheless, the DAC guidelines set out the key impact questions that most of its members apply.

[1] The Logical Framework Matrix simplifies development to a cause-and-effect process in which resource inputs create physical outputs, which in turn trigger a series of predicted outcomes that over time accumulate into a development impact.

- What has happened as a result of the program or project?
- What real difference has the activity made to the beneficiaries?
- How many people have been affected?

The OECD-DAC documents have laid the foundation for the impact evaluation activities of its members over the past twenty years. A recent review of their evaluation activities indicates that an increasing number (58%) undertook impact evaluations. In doing so, many members needed to set out their own guidelines to support impact studies as well as identifying skill shortages among staff and consultants to increase the focus and rigor of the resultant reports. This study also noted that cross-cutting issues, such as gender and the environment, were now routinely mainstreamed across all evaluations by a number of agencies (OECD 2010).

Guidelines produced by the DAC Evaluation Network Members

Generic guidelines have been developed by most DAC members undertaking impact studies. These range from generalized approaches as typified by IFAD, to the more detailed approach by the European Union to the more subsector/institution specific guidelines produced for Nepal by ADB funded technical assistance. These different types of guidelines are described below:

IFAD

The IFAD approach to evaluation draws on the above OECD/DAC Glossary to define the impact of its programs as "*the changes that have occurred or are expected to occur in the lives of the rural poor (whether positive or negative, direct or indirect, intended or unintended) as a result of development interventions*" (p. 10, IFAD 2010). The Evaluation Manual is generic in its approach setting out the fundamentals of the different impact methodologies (Chapter 2) that might be used and demonstrating how these might be applied to specific projects (Chapter 3) and country programs (Chapter 4).

European Commission

The European Commission has produced an Evaluation Guideline in four volumes: This first volume outlines basic concepts and methodologies. The second focuses on evaluating country programs, while the third concerns specific projects such as transport. The fourth volume presents the common Evaluation Tools. The documents go on to identify the main .evaluation criteria

Relevance: the extent to which the objectives of the development intervention are consistent with beneficiaries' requirements, country needs, global priorities and partners' and EC's policies.

Effectiveness: the extent to which the development intervention's objectives were achieved, or are expected to be achieved, taking into account their relative importance.

Efficiency: the extent to which the outputs and/or desired effects have been achieved with the lowest possible use of resources/inputs (funds, expertise, time, administrative costs, etc.).

Sustainability: the extent to which the benefits from the development intervention continue after termination of the external intervention, or the probability that they continue in the long-term in a way that is resilient to risks.

Impact: identify positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended.

Coherence: the extent to which activities undertaken (a) allow the European Commission to achieve its development policy objectives without internal contradiction or without contradiction with other Community policies and (b) complement partner country's policies and other donors' interventions.

Community value added: the extent to which the project/program adds benefits to what would have resulted from Member States' interventions in the same context.

Four analytical procedures are identified for impact studies:

- Change analysis, which compare indicators over time and/or against targets;
- Meta-analysis, which extrapolates upon findings of other evaluations and studies, after having carefully checked their validity and transferability;
- Attribution analysis, which compares the observed changes with a "policy-off" scenario, also called counterfactual;
- Contribution analysis, which confirms or disconfirms cause-and-effect assumptions on the basis of a chain of reasoning.

The first analytical procedure is the lightest one and may fit virtually all questions posed by the above criteria. The three last procedures are better at answering cause-and-effect questions that mainly arise from the last three criteria (EC, Volume 3, 2006).

There appears to be no specific impact evaluation guidelines for rural transport but a list of generic transport sector indicators has been identified by the Evaluation Unit, and these are adopted and appropriately used on a country specific basis where transport forms part of the Country Strategy or National Indicative Program (EU, 2009).

Asian Development Bank: Interim Guidelines for Enhancing Poverty Reduction Impact of Road Projects in Nepal

These guidelines are the output of the capacity building efforts of the ADB in Nepal. They were developed to strengthen existing methods and procedures used by the Department of Roads (DOR) in Nepal and to introduce its management and M&E staff to basic poverty concepts, their measurement and the impact of the road sector on poverty. The guidelines fall into two parts. The first part sets the national and sector context in terms of the Government of Nepal's poverty reduction policies and its interaction with road improvement. The second contains detailed guides, and procedures to be followed if the DOR is to enhance the poverty reduction impact of road projects. These are followed by a number of annexes that give specific examples of steps, samples and strategies that be applied. These include:

- A Decision Flow Chart on the Potential Use of Labor-Based Approaches
- A Guiding Note on Social Assessment
- The Design and Implementation an Ex-post (Impact) Evaluation Study

World Bank: Guidelines

There are a number of M&E guidelines emanating from a number of sources in the World Bank. These range from detailed descriptions of the "gold standard" RCT technique to more pragmatic discussions about monitoring under resourced SSA. One of the most recent of these is from a cooperative effort with FAO entitled "On the tracking results in agriculture and rural development in less-than-ideal conditions – A sourcebook for monitoring and evaluation". The less than ideal conditions it refers to are associated with monitoring results (outcomes and impact) in many rural areas. It recognizes that "gold standard" RCT impacts are invariably data-hungry requiring statistical and econometric skills that are in short supply among project and government development professionals alike. The authors therefore advocate the adoption of a service delivery approach, which emphasizes three project outcomes. For a rural road project these outcomes are

a. the percentage of the target population having access to transport services on the new road i.e. the RAI definition of within two kilometers;

b. the percentage of the target population using transport services over a fixed period of time e.g. the last week, and

c. the percentage of users satisfied with the condition of the new road possibly in affordability, speed or comfort terms.

A variation of this service delivery approach has been developed for a community infrastructure improvement program in Nigeria.

Rural transport Guidelines produced by other development agencies

ILO

Current views of evaluation by ILO mirror those outlined above. ILO's Results-Based Management (RBM) Guidebook (2012) defines the evaluation process as "*a distinct, essential and complementary function to performance measurement and RBM*" (p. 4). The latter is in effect a type of performance monitoring used to assess whether results or outcomes have been achieved.

In contrast, evaluations are used to inquire about why and how results were achieved. The evaluation function provides information not readily available from performance monitoring systems, in particular in-depth consideration of attribution, relevance, effectiveness and sustainability. ILO also stresses the importance of an independent judgment on the functioning of its performance system and recommending appropriate management action (ILO 2012). Evaluations are mainly designed to promote organizational learning by highlighting useful lessons that can be applied elsewhere to improve program or project performance, outcome, or impact (ILO, 2013). They also serve accountability purposes by feeding these lessons into the decision-making process of stakeholders, including donors and national partners. The resultant evaluations are essential short-term effect studies rather than long term impacts—evaluations of the Nias Islands Rural Access and Capacity Building Project, Quick Impact Employment Creation Project (QIECP) for Youth through labor-based Public Works in Sierra Leone (ILO Evaluation Unit, 2012). They have the advantage of rapid management feedback of results but lack methodological rigor in the collection and use of impact data.

Nevertheless, ILO has produced several notable guidelines that have some application in rural transport impact assessments. The first is Murphy's elaboration of rapid survey methods to assess the poverty reduction impacts of pilot employment-intensive projects (1998). The document details the methods, tools and procedures to undertake a

Rapid Assessment of Poverty Impacts (RAPI) of rural road project. It sets out four steps in the process:

(1) definition of the (geographically bounded) study area and separate control site

(2) use of rapid, but rigorous, methods of random sampling

(3) household-level analysis

(4) use of five classes of simple poverty indicators, eschewing income or expenditure measures

Unfortunately, these guidelines are rather old and do not take into account the current preference for more statistically rigorous Randomized Control Trials (RCTs).

In summary, the current ILO approach to evaluation focuses on the results of an intervention, identifying what worked, what didn't work, and why this was the case. It is defined as "*an evidence-based assessment of strategy, policy or program and project outcomes, by determining their relevance, impact, effectiveness, efficiency and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipients and donors*" (p. 4, ILO Policy Guidelines, 2012).

MCC

The Millennium Challenge Corporation (MCC) see independent impact evaluations as fundamental to its core mission since they help answer three fundamental questions:

- Was the investment implemented according to plan? (This is the key to *transparency)*.
- What are the changes in income for program participants that are attributable to MCC's investment? This is key to *accountability*.
- Why did or didn't the planned investments lead to changes in income? This is key to *learning*.

MCC argue that impact evaluations are the most rigorous form of evaluations for they make it possible to know whether the observed impacts were caused specifically by an intervention or, alternatively, are the result of external factors that affected program participants and non-participants alike. They do this by comparing what happened with the intervention to what would have happened without it i.e. through the use of a counterfactual. However, MCC's evaluation factsheet indicates that tracking results and being able to use them for future transport planning, and to understand what works and what does not work is still a challenge in SSA (2012).

Annex 3. Typical rural road improvement logical framework matrix

Overall Objective

Intervention logic :	To contribute to poverty reduction by provision of sustainable access combined with income generation through synergies with other donor interventions, primarily in the agriculture sector
Objectively verifiable indicators:	Poverty Reduction Strategy (PRS) objectives achieved and Pillar IV Feeder road reconstruction deliverables met (400 miles or 640 km) reconstructed by 2011).
Source of verification:	MPW/LRDC Pillar IV Monitoring Reports. 90-Day Action Plans Results & Progress Report on PRS Implementation.

Program purpose

Intervention logic :	Improved road accessibility (a) enabling: more agricultural produce to reach markets; (b) facilitating improved social services particularly in the health and education sectors and (c) creation of income earning opportunities for men and women in the rural areas.
Objectively verifiable indicators:	Incomes from farm & non-farm activities increase by **% over life project. Population living along roads have year round access to health and other social services. 1,000 worker days per kilometer of road created with 40% taken up by women.
Source of verification:	Baseline and Follow up Evaluation of Project. MPW, Project and Contractor employment records by gender. Project Semi Annual and Annual Reports.
Important assumptions	PRS reporting is effective. The contractors are willing to employ local labour as much as possible and pay on time. MPW maintain primary and secondary network in project Counties. MPW retains functional responsibility for feeder road network

Outputs 1

Intervention logic:	1. Rehabilitation and regular maintenance of feeder roads in the counties of **** and ****.
Objectively verifiable indicators:	2.1. 300 km of feeder roads rehabilitated and brought to a maintainable standard by labor-intensive methods in **** and **** Counties. 2.2. Routine maintenance carried out by labor-intensive methods on completed project roads

Source of verification:	Project Quarterly Reports. Road maintenance contracts awarded by MPW Resident Engineer (RE) in **** and **** Counties.
Important assumptions	Suitable contractors/CBOs available. Contractors/CBOs complete the work on time.

Outputs 2

Intervention logic:	2. Improved capacity in the public and private sectors to rehabilitate and maintain rural roads
Objectively verifiable indicators:	2.1. 20 MPW staff, 10 contractors and 30 communities trained 2.2. Road reconstruction and maintenance contracts completed in a timely, cost effective manner
Source of verification:	Training reports and evaluations. Site visits and supervision reports.
Important assumptions	Suitable and motivated staff available.

Outputs 3

Intervention logic:	3. A foundation laid for a government strategy and donor coordination for a nationwide rural roads program
Objectively verifiable indicators:	4.1. Feeder Road Design Standards and Specifications disseminated 4.2. Maintenance Management System for the routine maintenance of feeder roads established 4.3. MPW donor co-ordination improved
Source of verification:	Feeder Roads Design Standards and Specifications Manual applied to other projects. Routine Maintenance Management system applied to project roads. Minutes of donor coordination meetings..
Important assumptions	MPW develops and staffs an appropriate organizational structure. MPW develops a donor coordination facility

Outputs 4

Intervention logic :	4. Potential adverse project impacts from land take, environmental damage are minimized and spread of HIV/AIDS slowed down
Objectively verifiable indicators:	4.1. Environmental management plans incorporated in road reconstruction contracts 4.2. Provision for HIV/AIDS awareness is incorporated into contract documents
Source of verification:	Road Construction Contract Documents. HIV/AIDs information disseminated at work sites
Important assumptions	Contractor/MPW are sensitive to environmental and HIV/AIDS concerns

Activities

Intervention logic :	1. The core activities encompass all measures for rehabilitating and maintaining feeder roads (selection, design, procurement of contractors and communities, supervision and certifying works for payment. 2. On-the-job training of MPW counterparts, contractors and communities will be an integral part of preparations, procurement and implementation. 3. Supplementary training theoretical courses will be provided in co-operation with ILO and GtZ for the various categories of MPW staff, contractors and communities
Objectively verifiable indicators:	1. The correct Engineers Estimation and BoQ prepared. Design drawing works done. Efficient bidding, evaluation and awarding of contracts done. MPW ensure supervision and certify payments to contractors and community people. 2. MPW staff are able to carry out the tasks. Training materials prepared and recoded with all concerned
Source of verification:	1. All documents are archived 2. Project quarterly reports 3. Reports on imparted training are prepared and annexed with project quarterly reports
Important assumptions	MPW staff are assigned to perform the tasks

Annex 4. Nigeria's community service delivery survey

	ACCESS					USE				SATISFACTION													
	a. How far away is this service?					b. How much does your group use this service?			c. Who owns or runs this service?	d. If used, how satisfied are users with the quality of the service provided?				e. Do you have any concerns with the service?						f. How the quality of service has changed in the last 5 years?			
	Don't know (Skip to next row)	Within community	Less than 30 minutes away	30-60 minutes away	Over one hour away	Not used at all (Answer c then skip)	Not as often as needed (go to c, d, e, f)	As often as needed/regularly (go to c, d, e, f)	Ownership of service	Dissatisfied	Neither satisfied or dissatisfied	Satisfied	Don't know	Too far away	Too expensive	Poor service	Limited staff equipment	Inadequate building	Other _____	Don't know	Worse now	Same as before	Better now
1. Day care service	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
2. Pre-primary service	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
3. Primary service	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
4. Secondary service	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
5. Hospital	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
6. Health center	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
7. Patent/ dispensary services	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
8. Pre/post natal care	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
9. Immuniza tion/vaccination	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
10. Mobile telephone	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
11. Post office	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
12. Public transport	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
13. Agric. Extension services	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
14. Farm inputs	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
15. Commercial bank	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
16. Police station	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□
17. Customary court	□	□	□	□	□	□	□	□	[__]	□	□	□	□	□	□	□	□	□	□	□	□	□	□

Annex 5. Glossary of impact evaluation terms

The International Initiative for Impact Evaluation in New Delhi, India publishes an open source glossary of impact evaluation terms. Some of the more important definitions from this glossary are given below:

Attrition

Attrition refers to either the number and % of participants who have dropped out from the treatment group during the intervention, or a failure to collect data from a unit in subsequent rounds of a panel data survey. Either form of attrition can result in biased impact estimates.

Baseline survey and baseline data

A survey to collect data prior to the start of the intervention. Baseline data are necessary to conduct double difference analysis, and should be collected from both treatment and comparison groups.

Comparison Group

A group of individuals whose characteristics are similar to those of the treatment groups (or participants) but who do not receive the intervention. Under trial conditions in which the evaluator can ensure that no confounding factors affect the comparison group it is called a control group.

Counterfactual

The state of the world in the absence of the intervention. For most impact evaluations the counterfactual is the value of the outcome for the treatment group in the absence of the intervention. However, studies should also pay attention to unintended outcomes, including effects on non-beneficiaries.

Double difference

The difference in the change in the outcome observed in the treatment group compared to the change observed in the comparison group; or, equivalently, the change in the difference in the outcome between treatment and comparison. Double differencing removes selection bias resulting from time-invariant unobservables. Also called Difference-in-difference. Compare to single difference and triple difference.

Impact heterogeneity

The variation in impact as a result of differences in context, beneficiary characteristic or implementation of the intervention.

Matching

A method utilized to create comparison groups, in which groups or individuals are matched to those in the treatment group based on characteristics felt to be relevant to the outcome(s) of the intervention.

Panel data and panel survey

Data collected through consecutive surveys in which observations are collected on the same sample of respondents in each round. Panel data may suffer from attrition, which can result in bias.

Propensity Score Matching (PSM)

A quasi-experimental design for estimating the impact of an intervention. The outcomes for the treatment group are compared to those for a comparison group, where the latter is constructed through matching based on propensity scores. The propensity score is the probability of participating in the intervention, as given by a probit regression on observed characteristics. These characteristics must not be affected by the intervention. PSM hence allows matching on multiple characteristics, by summarizing these characteristics in a single figure (the propensity score).

Quasi-Experimental Design

Impact evaluation designs used to determine impact in the absence of a control group from an experimental design. Many quasi-experimental methods, e.g. propensity score matching and regression discontinuity design, create a comparison group using statistical procedures. The intention is to ensure that the characteristics of the treatment and comparison groups are identical in all respects, other than the intervention, as would be the case from an experimental design. Other, regression-based approaches, have an implicit counterfactual, controlling for selection bias and other confounding factors through statistical procedures.

Randomized Controlled Trial (RCT)

An impact evaluation design in which random assignment has been used to allocate the intervention amongst members of the eligible population. Since there should be no correlation between participant characteristics and the outcome, and differences in

outcome between the treatment and control can be fully attributed to the intervention, i.e. there is no selection bias. However, RCTs may be subject to several types of bias and so need follow strict protocols. Also called Experimental design.

Sampling frame

The complete list of the population of interest in the study. This is not necessarily the complete population of the country or area being studied, but is restricted to the eligible population, e.g. families with children under five, or female –headed households. For a facility survey, the sampling frame would be all facilities in the area of study. If a recent sampling frame is not available then one needs to be constructed through a field-based listing.

Spillover effects

When the intervention has an impact (either positive or negative) on units not in the treatment group. Ignoring spillover effects results in a biased impact estimate. If there are spillover effects then the group of beneficiaries is larger than the group of participants. When the spillover affects members of the comparison group, this is a special case of contagion.

Unobservables

Characteristics which cannot be observed or measured. The presence of unobservables can cause selection bias in quasi-experimental designs, if these unobservables are correlated with both participation in the programme and the outcome(s) of interest.

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