

Achieving pro-poor growth through investment in rural feeder roads: the role of impact evaluation

By Christian Kingombe

Impact evaluation was high on the agenda at the recent 3rd Global Review of Aid-for-Trade (AFT). Since the mid-2000s, interest in the analytically robust evaluation of the impact of projects, programmes and policies has increased amongst policy-makers (Estache, 2010). With growing recognition of the links between high transport costs and poverty, this trend also encompasses an increasing interest in undertaking detailed evaluations of the impact of public investment in rural roads. This begs the question: how do we identify what kind of public spending, including AFT, is most effective in reducing poverty and generating equitable agricultural growth?

How, for example, do partner countries and donors define the success of donor investment in rural feeder roads? These Aid-for-Trade (AFT) interventions – categorised as either labour-based or equipment-based rural transport infrastructure (RTI) – are engineered earth roads that connect rural areas to urban centres via the connection to secondary district roads (Howe, 1984). Despite the large amounts spent on rural roads, there is remarkably little formal evidence on their benefits to households or to enterprises. What has been lacking is a general methodology, using micro-data, to estimate these gains.

It has been argued that RTI and provision of RTI services – including rural feeder roads – could be considered pre-requisites for growth and the achievement of the Millennium Development Goals (MDGs). Improving access to markets, for example, can lower agricultural input prices and increase production (MDG1). Improving RTI and services can

help children get to school (MDG2). But what actual impact have these AFT interventions had to date? How could future research enhance this impact? And what are the policy implications? This Background Note provides suggestions on what state-of-the-art AFT impact evaluations could look like, and why they should be part of a project's design from the outset in order to improve policy conducive to achieving the MDGs.

The key issues

All countries are confronted with a range of growth constraints, however some of these are more severe and visible in many agriculture-based low-income countries. Carrying out an analysis at the micro-level can help improve our growth diagnostics as well as our understanding of the transmission mechanisms that could lead to rural growth and poverty reduction. It can, therefore, produce policy-relevant insights that go beyond what is known from the cross-country growth literature at the macro-level.

The general practice adopted by the UN Panel on Monitoring and Evaluation (M&E) is that ex-post evaluations are designed as in-depth studies of the impact of an intervention and are usually carried out every five to ten years after the completion of its funded implementation (Box 2, overleaf).

A good example following these guidelines is Chen et al. (2008), who revisit the site of a large, World Bank-financed rural development programme in China ten years after it began and four years after disbursements ended. The authors collected data on 2,000 randomly sampled households in project

Box 1: A snapshot of Aid for Trade (Aft) on the ground in Africa

A call for Aid for Trade (Aft) case stories was launched as part of the Third Global Review of Aid for Trade, to capture the wealth of experience accumulated by recipient countries and development partners since the Aft Initiative was launched at the Hong Kong Ministerial in 2005. The result of these efforts have been captured in *Aid for Trade at a Glance* (OECD and WTO, 2011), which compiles 269 Aft case stories received, including a total of 114 case stories on Africa.

When outlining the kind of contributions that may be submitted, the WTO categorised three types of case stories: (i) case stories on approaches; (ii) case stories on processes, and (iii) case stories on projects or programmes. The first category documents experiences of approaches that help identify binding constraints to trade, indicators which may help evaluate and monitor Aft, and formal empirical studies. However, this category is less represented in the African sample, with only one case story from a regional organisation, namely UNECA. Nonetheless, this single contribution documents the impact of Aft on binding trade constraints across the African continent, providing an overall picture of how Aft is helping overcome different constraints that reduce the competitiveness of African trade, and hence improve the continent's ability to take advantage of multilateral trade liberalization.

Though several case stories deal with the 'soft side' of infrastructure under the Aft subcategory of trade facilitation, only one case story from the African sample covers trade-related infrastructure. Morocco's experience with Aft relates to its National Programme of Rural Transport, aimed at reducing regional disparities, fighting poverty, promoting the inclusion of the rural sector and development of local resources, and finally, affording the rural population access to trade through the reduction of transport costs. The programme benefitted from the financial assistance of the African Development bank (AfDB) and the Agence Française de Développement (AFD) (through soft loans) for the first tranche. In total 7,950 km of rural roads were built during its first tranche and 7,550 km are envisaged for the second tranche, which still requires financing. Further, the rehabilitation of 1,000 km of rural roads was also undertaken thanks to the assistance of the Arab Fund for Economic and Social Development during the first tranche of the programme.

Source: UNECE (2011).

Box 2: Monitoring and evaluation of rural development

The UN Panel on Monitoring and Evaluation of the UN ACC Task Force on Rural Development has set out common principles and basic concepts of monitoring and evaluation in the various UN agencies and organisations. It refers to agricultural and rural development projects and programmes benefitting the poor and to programmes which are multi-sectoral with health, nutrition, education, housing and similar components.

Ex-post evaluation was defined by the December 1976 Copenhagen Meeting organised by the World Bank as an analysis after completion of a project (or a distinct phase of it) of its effects and impact. Among other things it may draw on information provided by monitoring and ongoing evaluation, though supplementary special studies may sometimes be needed. The purpose of ex-post evaluation is to provide policy-makers with information and analysis for future planning and/or to inform donors and the general public on project results. The depths of the analyses and the nature of the reporting will depend on its potential end-use and benefits.

In addition the UNECE, FAO, OECD, World Bank and Eurostat published the Wye Group handbook on *Rural Household Livelihood and Well-Being – Statistics on Rural Development and Agriculture Household Income* in 2007, which is of special interest to those in the public sector responsible for setting targets and monitoring policies related to: the standard of living and well-being of rural households vis-à-vis urban and all households; and the standard of living and well-being of agricultural households vis-à-vis households of other socio-professional categories.

(112 public works programme (PWP) villages) and non-project (86 non-PWP villages) areas, spanning ten years.¹ The 1996-2000 and 2004/05 surveys included community, household and individual questionnaires. The community schedule collected data on natural conditions, infrastructure and access to services. The household survey collected data on (inter alia) incomes, consumptions and assets. The Individual questionnaire covered gender, age, education and occupation. Another recent example of a similar approach can be found in Kingombe (2011).

In terms of rural feeder roads, Van de Walle (2009)

adds that it is useful to start by thinking about the nature of roads and the ways in which they may differ from other rural policy investments. To justify public sector investments in rural feeder roads it is vital to show that they have a more positive project impact (i.e. a change in standard of living and increased capacity for self-sustained development of a group of beneficiaries or communities resulting from immediate project objectives)² when compared to available alternatives (Roemer and Stern, 1975). This can be shown by incorporating the construction of robust counterfactual scenarios to the analysis.

Measuring the impact of rural feeder roads

Three main methods are used most commonly to rank transport infrastructure investments, including trunk roads, district roads and primary rural feeder roads: (1) multi-criteria analysis (MCA); (2) cost-effectiveness analysis (CEA); and (c) cost-benefit analysis (CBA) (Van de Walle, 2002).

According to Van de Walle (2009) a key difference between CBA and CEA calculations is that the latter work only in situations where total expenditures for a programme are fixed. Thus, although CBA and CEA both measure the ratio of benefits to cost, the ‘benefit’ units are different. The author further argues that to put the CEA indicator in a broader context would require a comparable measure of the social value of the project outcomes.

A number of projects in the World Bank and elsewhere have turned to CEA calculations to take account of a broader set of benefits – such as potential health and education benefits – yet avoid the problem of putting a monetary value on them. This method is sometimes referred to as MCA (Cook and Cook, 1990), and has typically been used when traffic volume is too low (<50 vehicles per day) for conventional consumer surplus measures to make sense, yet, it is strongly believed that there will be important social benefits. In general, a least-cost approach is adopted (Van de Walle, 2002).

It is evident, however, that there is no standard methodology employed in these studies with the exception of the highly criticised CBA. However, because traditional CBA approaches do not take account of many of the benefits of RTI investments, the extension of the CBA framework holds promise for improved analysis. In short, appraisal needs to be holistic in nature, in the sense that it needs to cover economic, social and environmental impacts of the project in a coherent and consistent manner (Institute for Transport Studies, 2003). Economic development from RTI investment can be measured either through the real effects (changes in factor productivity, the location of households and firms, in production and consumption decisions and in agglomeration economies) or through the capitalised effects of, for example, changes in relative accessibility. These effects, in turn, stimulate the so-called real effects. Accessibility effects are further capitalised as land rent and consumer surplus.

Figure 1 (overleaf) describes possible multiplier effects from further investment into the local economy (Banister and Berechman, 2000).

The distinguishing features of rural roads compared to district and trunk roads suggest a number of researchable evaluation questions,³ which have important implications for evaluation design and methods, as well as for data requirements. These

methods can be applied to retrospective project evaluations to explain success or failure (Van de Walle, 2009).

There is little in the literature about the time it takes for the full welfare impacts of an improved road to emerge. In contrast to interventions with relatively rapid impacts (such as cash transfer programmes), the welfare impacts of RTI are, in general, expected to take some time to appear. This creates problems for an impact evaluation that does not allow sufficient time for the linkages to come into play (*ibid.*). In fact, very few of the many AfT-financed rural road projects have been subject to rigorous evaluations. According to Estache (2010) the reason is simple: such evaluations are too hard to do using (quasi-) randomised evaluation techniques.

Three impact evaluation approaches

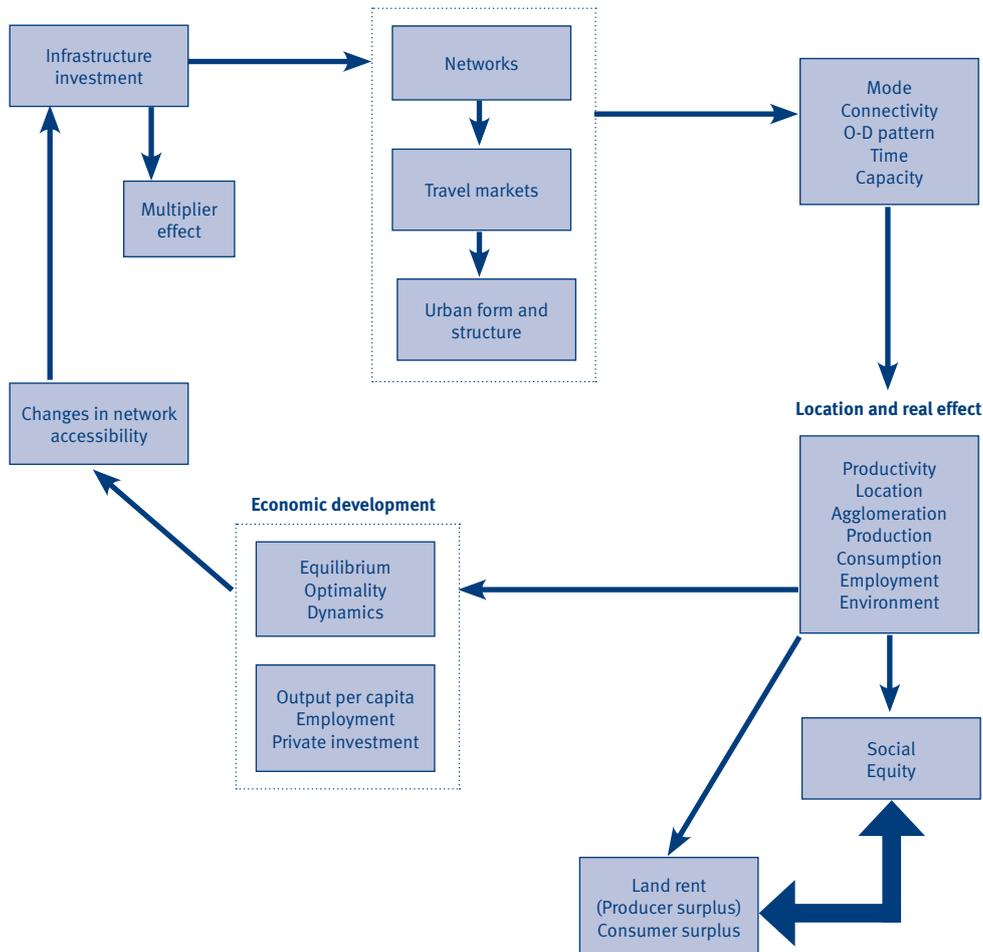
There has been a proliferation of employment intensive investment programmes (EIIP) since the 1980s, especially in Asia and Africa. Many reviews of these public works programmes (PWPs) have been undertaken (see Kingombe, 2011). The studies carried out by the International Labour Organization (ILO) and the World Bank since the 1970s have shown superior benefits accruing to the rural poor and higher financial and economic (i.e. actual resource) benefits through the adoption of labour-based, compared to equipment-based, methods of road construction, rehabilitation, extension and maintenance.

Lipton (1996) argues that the long-term effects of EIIPs are diverse and complex and doubts persist about the benefits to the poor of the assets created through PWPs. These doubts could, according to Van de Walle (2002), be because existing methods of project appraisal for rural roads do not properly reflect the potential benefits to the poor.

In fact, most of these ILO studies on rural roads lack a proper counterfactual analysis, limiting the availability of evidence on the impact of these investments on key development outcomes. This is shown in a study by Chipika (2005) that, drawing on a review of more than 90 ILO baseline and impact studies, concluded that they fail to classify the potential beneficiaries of EIIPs according to the status of their welfare and/or well-being.

Instead, more rigorous evaluation studies undertaken at the micro-economic level make it possible to allow for differences in the form of (unobservable) individual (e.g. regional) effect, which are not captured by single cross-country regressions. On the other hand, macro-level evaluation studies provide a source of inspiration for both the choice of regressors and the specification of the consumption growth models conducted at the micro-level (Dercon

Figure 1: The relationship between transport infrastructure investment and economic development



Note: O-D = Origin to Destination. Source: Banister and Berechman (2000:38).

Box 3: Case study: impact evaluation of Zambia’s Eastern Province feeder road project

Zambia’s Fifth National Development Plan (2006-2011) identified two priority areas for public spending to accelerate and broaden economic growth: strengthening the relevant economic and social infrastructure; and enhancing agriculture and rural development.

Kingombe (2011) focuses on Zambia’s experience to fill the gap in the literature on how labour-based-RTI investments in the medium to long term affect rural growth, poverty reduction, equity and trade. The analysis is based on a series of five micro-level studies of the ILO-executed Eastern Province Feeder Road Project (EPFRP) implemented in Zambia from 1996 to 2001. The success of the EPFRP has been substantial and it has had much influence on the design of other labour-based projects being implemented within and beyond Zambia. It relies on the analysis of data from, respectively, the post-harvest survey, rural household survey, community survey and transport survey. Each of the four core chapters in Kingombe (2011) present a different framework used to estimate the impact of rural road development, because reliance on any one technique is unlikely to be appropriate.

Kingombe (2011) suggests a non-robust linkage between household consumption growth and feeder road improvements in rural areas in Zambia’s Eastern Province. He also finds that the squared poverty gap for most districts in the Province was not reduced, which suggests that the changes experienced have not been relatively pro-poor. While inequality was higher in the pre-treatment region in 1998 compared to the control region, this is no longer the case in 2004 after the EPFRP treatment had occurred.

On the other hand, through a more qualitative analysis using focus group interviews within communities, Kingombe (2011) finds that only 42% of the communities covered by his own primary survey had seen their quality of life go up because of the impacts associated with the EPFRP. However, in 63% of the reporting communities the life quality situation was considered better than before the start of the EPFRP. Amongst these communities, 45% considered that the major determinant was directly associated with feeder road rehabilitation. His regression results lend support to the qualitative findings, which leads him to conclude that the EPFRP treatment has an impact on poverty, which seems to have been sustained in the medium term after the completion of the project due to maintenance of the feeder roads.

and Hoddinott, 2005; Kingombe, 2011).

Finally, structural form models such as ‘macro-style’ simultaneous-equation models of the economy (Fan et al., 2004) identify impacts on the basis of economic assumptions about how the world works. The upside of these structural approaches is that they add to what we can learn as long as the assumptions are valid. In contrast, impact evaluation is a highly theoretical and basically reduced form. Nevertheless, the latter two approaches are considered to be complementary (Van de Walle, 2009).

Key results

Of the more than 200 rigorous impact evaluation studies that have been catalogued in selected areas such as local development, only a few focused on rural feeder roads. The results of some of these studies show that:

- markets in Viet Nam are more likely to develop as a result of road improvements where communities have access to extended networks of transport infrastructure (see Mu and van de Walle, 2007)
- benefits from improving access to basic education in Uganda depend, for example, on complementary investments in infrastructure (see Deininger and Okidi, 2003)
- road improvements in Bangladesh, for example, led to lower input and transportation costs, higher production, higher wages and higher output prices (see Khandker et al., 2006)
- access to roads in Nepal improves the productive capacity of poor households (see Jacoby, 2000)
- road rehabilitation in Georgia increases the opportunities for off-farm and female wage employment (see Lokshin and Yemtsov, 2005)
- rehabilitation and maintenance of roads in Peru improved some measures (access and attendance to schools and child health centers) but had no significant impact on others (agricultural production, income, poverty) (see Escobal and Ponce, 2003)
- the mean distance to services and community assets diminished significantly thanks to the rehabilitation of feeder roads in Zambia’s Eastern Province (see Kingombe, 2011).

In summary, most of these studies highlight the importance of rural roads in promoting growth and development. However, only a few of them provide information on the distributional and poverty impacts of road investments and, in most of their specifications, many studies also fail to take into account road quality.

Box 4: The relevance of the triangulation in impact evaluation

Both Chung (2000) and Kingombe (2011) take the position that all research paradigms are valid, even if they are distinct and philosophically irreconcilable (i.e. a paradigm of ‘pragmatism’). This philosophy suggests that quantitative and qualitative methods can, logically, be combined and that epistemological positions need not predetermine the choice of research method.

Rigorous empirical evidence is needed to support the underlying economic analysis of the view that investments in the rehabilitation and maintenance of rural feeder roads are beneficial to the broad-based growth of the rural (farm and non-farm) economy and rural livelihoods. The approach to resolving this issue lies ‘outside’ the CBA framework and needs to be within realistic informational constraints (e.g. data availability and comparability across the potential treatment roads’ zones) (Van de Walle, 2002; Banister and Berechman, 2000).

Dercon and Hoddinott (2005) find that, in Ethiopia, an increase of 10 km in the distance from the rural village to the closest market town has a dramatic effect on the likelihood that the household purchases inputs. However, they get mixed results in terms of the likelihood of people engaging in various productive activities when roads of poor quality (accessible only to carts, animals or people) are replaced by good quality roads (reasonable access to any motorised vehicle).

This finding is corroborated by a number of other studies. One IPFRI study by Fan and Chan-Kang (2004) for example, finds that low quality (mostly rural) roads have benefit/cost ratios for national GDP in China that are about four times larger than the benefit/cost ratios for high quality roads. Another study by Minten and Kyle (1999) shows that road quality in the Democratic Republic of Congo is an important factor in transportation costs.

Which way forward

Export-oriented growth with equity depends on macro-economic policies and non-trade policies, as well as trade policies. The so-called complementary non-trade policies are crucial, as they promote the development of productive capabilities. Public Investment Programmes are, in general, considered as public policy instruments. They present one of the few remaining government policy instruments through which productive employment opportunities can be created and more economically and socially balanced development promoted.

An explicit focus on the distributional impact or the poverty dynamics of the government expenditure

Table 1: Summary of key impact evaluation studies

Author	Country covered	Data	Method	Major Findings
Mu and van de Walle (2007)	WB financed rural road rehabilitation project implemented in rural Vietnam between 1997 and 2001	The "Survey of impacts of rural roads in Vietnam" consists of a panel of 200 communes and 3,000 households. The survey design implicitly takes the commune as the project's zone of influence.	Double difference and matching methods	Significant average impacts on the development of local markets
Deininger and Okidi (2003)	Uganda	Micro-level survey and panel-data evidence of about 1,200 households spanning 1992-2000	Proceed in three stages: i) estimating determinants of economic growth at the household level, ii) expanded to consider poverty reduction, and iii) perform simulations	Access to key public goods such as infrastructure, and the avoidance of civil strife has been a critical determinant of households' ability to increase their income and reduce the risk of falling into poverty
Khandker et al. (2006)	Bangladesh	Household-level panel data	Use a household fixed-effects technique to estimate the returns to road investment in terms of impact on household per capita consumption	Road investments are pro-poor, meaning the gains are proportionately higher for the poor than for the non-poor
Jacoby (2000)	Nepal	Nepal Living Standard Surveys	A method for non-parametrically estimating the benefits from road projects at the household level	Large benefits from extending roads into remote rural areas, much of these gains going to poorer households. But rural road construction is not the magic bullet for poverty alleviation
Escobal and Ponce (2003)	Peru	Using information from rural households living in some of the poorest districts of Peru	The propensity score matching methodology is used, after adapting it to the specific characteristics of the data used	Rehabilitated road accessibility can be related to changes in income sources, as these enhance non-agricultural income opportunities, especially from wage-employment sources
Lokshin and Yemtsow (2005)	Georgia: Rural infrastructure rehabilitation projects for schools, roads and water supply systems between 1998 and 2001	Community-level panel data from a regular household survey augmented with a special community module	Propensity score-matched difference-in-difference comparisons	Plausible results regarding the size of welfare gains from a particular project at the village level and allows for differentiation of benefits between the poor and non-poor
Dercon et al. (2008)	15 Ethiopian villages, 1994-2004	Making use of new longitudinal household survey data that were not used in earlier Dercon papers	An instrumental variables model using Generalised Methods of Moments and controlling for household fixed effects	Access to all-weather roads: reduces poverty by 6.9 percentage points and increases consumption growth by 16.3%. These results are robust to changes in model specification and estimation methods
Dercon and Hoddinott (2005)	15 Ethiopian villages	Data taken from the Ethiopia Rural Household Survey (ERHS), a unique longitudinal household data set covering households in 15 areas of rural Ethiopia. Data collection started in 1989 and the survey was expanded in 1994 to yield a sample of 1,477 households. An additional round was conducted in late 1994, with further rounds in 1995, 1997, 1999, and 2004	Estimate a series of probit regressions. Fixed effect IV regression	An increase of 10 km in the distance from the rural village to the closest market town has a dramatic effect on the likelihood that the household purchases inputs, controlling for the effect of other factors. Increases in road quality have strong positive growth effects
Kingombe (2011)	Zambia (Eastern Province)	(Pseudo-panel) household surveys (LCMS), pooled repeated cross-section Post-Harvest Surveys (PHS), community survey, transport/firm survey	Average treatment effects, differences-to-differences estimators, parametric and semi-parametric regression models, Tobit models, multinomial logit	Improved accessibility led to changes in land allocation and in yields to the cash crop – cotton. Although, the mean cotton sales share of household income more than doubled, the estimation results only show small gains to mean consumption

Source: Kingombe (2011)

side of the budget is a suggestion that was first promoted within the Poverty Reduction Strategy Paper (PRSP) process. That is to know whether feeder road improvements through an AfT intervention will help the very poor, e.g. through the analysis of household consumption patterns (e.g. expenditure data on the household's use of RTI related public services) (Levinsohn, 2003).

A number of studies have shown that low quality feeder roads raise more poor people out of poverty for every dollar than high quality trunk roads, making them a win-win strategy for growth and poverty alleviation (Dercon and Hoddinott, 2005). Transport is an important contributor in the development process, and investment in RTI should preferably be a response to demand from other economic and social sectors. One example is the requirement for improved RTI as a result of higher agricultural production (Kingombe, 2011).

The lack of rigorous impact evaluations is particularly problematic in the current climate, as most OECD-DAC donors are mired in a sovereign debt crisis, which potentially could put a lid on continued aid budget expansion. These donors need to know

more about how benefits compare to costs in order to make an informed choice between investing in a rural road and, for example, an education intervention.

Estache (2010) concludes that not all 'AfT' infrastructure interventions are suitable for impact evaluations based on experiments or quasi-experiments in order to increase accountability for intervention selection, implementation and sustainability.

Future research should, therefore, be devoted to:

- improving the rigorous impact evaluation methodology for rural road projects, together with its powerful complements of CBA, good M&E and the judicious use of indicators
- discussing how ex-post impact evaluations can best influence policy by drawing implications for the ex-ante evaluation of rural road investments.

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Endnotes and references

Endnotes:

- 1 The original plan for the impact evaluation of PWP was to do a baseline survey in 1995 and to only do follow-up surveys during the Bank's disbursement period up to 2000. However, a decision was made to re-survey the original sampled households in 2004/05 to try to resolve issues about longer-term impact.
- 2 Increased production, higher crop yields, increased employment, more traffic, increased use of health services, higher attendance at schools etc.
- 3 Rural roads are often treated as the last link of the transport network. Despite this, they often form the most important link in terms of providing access for the rural population. Their permanent or seasonal absence will act as a crucial factor in terms of the access of rural communities to basic services such as education, primary health care, water supply, local markets and economic opportunities (Donnges et al., 2007).

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