Role of Infrastructure in Poverty Reduction

Assessment of quantitative evaluation tools in capturing effects of Infrastructure Investments: Application to PAMS

Submitted to:

JBIC

by

Dr. Ceema Z. Namazie

ICF Consulting

powered by perspective

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Contents

Tables & Figures

Page

About the Author

Dr. Namazie has over thirteen years experience as an economist providing advice to international organizations, UK and developing country governments, on social welfare issues, as well as restructuring and regulation issues. She has is an economist with a background in welfare and is currently specialising in the utility sector.

Dr. Namazie was originally commissioned to undertake this assignment while at Stone & Webster Consultants Ltd, which became TRC Global Management Solutions UK Ltd in April 2005; she has recently joined ICF Consulting.

Disclaimer

1 Introduction

JBIC has a well established reputation of supporting the sustainable economic and social development of developing countries. As part of this commitment, India has contributed over US$ 14 billion from JBIC mainly for infrastructure projects. Poverty reduction has been a strong focus in the international community by introducing the United Nations' Millennium Development Goals (MDGs), and hence there is value in assessing the effectiveness of infrastructure projects in reducing poverty. Over the past two decades JBIC have provided financial assistance to eight large scale infrastructure projects in the state of West Bengal, (see Table 1 later in report). To assess the extent of the impact of infrastructure investments on poverty reduction, a qualitative and quantitative evaluation of the infrastructure projects on poverty has recently been commissioned by JBIC and undertaken by TERI (The Energy Resource Institute). The qualitative evaluation presents an assessment of the current status of the infrastructure projects, based on the DAC evaluation criteria, while the quantitative evaluation, based on the Poverty Analysis Macroeconomic Simulator (PAMS) - an analytical framework developed by the World Bank - assesses the impact of the infrastructure projects on the economy, and what the impact of these projects are to poverty.

Dr. Namazie has been appointed as Advisor to JBIC for this project, providing guidance on the quantitative evaluation that was undertaken as part of the overall of assignment.

The aim of this report is to discuss the applicability of the PAMS as a quantitative evaluation tool for assessing the impact of infrastructure investment projects on poverty.

The report is structured as follows:

- Section 2 provides a brief discussion of poverty and aspects of measurement;
- Section 3 provides an overview of the PAMS, and a summary of the approach undertaken in the quantitative evaluation by TERI; and
- Section 4 discusses the applicability of quantitative tools such as the PAMS for evaluating the effectiveness of infrastructure investment projects on poverty reduction.

A copy of the ToR is at Annex 1, while Annex 2 includes specifications of the PAMS framework applied by TERI in the quantitative evaluation report.

2 Policy, Poverty and Measurement tools

2.1 Capturing policy interventions and relevant outcomes

Policy instruments implemented at the macroeconomic level have impacts throughout the economy; examples include fiscal adjustments, such as changes in tax policy or spending on social sectors; monetary policy reform, such as money supply adjustments; or trade liberalising policies that can enhance export potential.

Impacts of a policy feed through the economy with varying degrees of effect. It is not necessary the case that all policy instruments are intended to directly effect all sectors in the economy, and consequently the whole population. However the interaction of the policy intervention with other policies or legislation, both existing and subsequently introduced, can result in implications wider than the initial intention of the intervention.

In order to understand how effective a policy intervention has been there needs to be a way of measuring the impact of the policy: we need a way of capturing where the impacts have been, who have been affected, and the extent of the impact. Knowing this can lead to improvements in policy design so that interventions can have the desired outcome and can better impact the designated target groups.

2.2 Assessing impacts to welfare

Poverty is a multi-dimensional attribute. While lack of income is widely recognised as one, albeit important, attribute of deprivation there is extensive literature of the importance of deprivation in non-income aspects: such as quality of housing, access to drinking water, electricity and other utilities, lack of medical facilities, inadequate education facilities. Many of these aspects can lead to long term effects on welfare in terms of poor health or limited opportunities in the future, to name but a few.

Measuring the incidence and prevalence of poverty can be equally challenging, and there is no single method that encapsulates all dimensions of poverty by its very nature. It is important to consider what aspect should be analysed and its relevance to the policy context of the environment under investigation. For example measuring monetary expenditure in a highly rural low monetarised area where a large proportion of the population are involved in agriculture, and barter agricultural produce, may present an accurate picture of a household's monetary spending ability but may result in an inaccurate picture of their food/calorific consumption. Similarly in remote areas, there may be communities that have sufficient household income from market-based activities or remunerations from abroad, but may lack

infrastructure-based facilities, such as drinking water, due to the very nature of the terrain, constraining their living conditions.

Practical applications of measuring welfare often take the form of measuring how far household income falls short of a specified monetary cut-off level i.e. poverty line, below which an individual or household is deemed not to achieve an acceptable standard level of welfare. There are various statistical measures that take into account the severity of poverty, by accounting for the depth of poverty and also the frequency of poverty (data allowing) on the length of time the same individual/household falls below the poverty line. While poverty measures that provide point estimates that summarize poverty in a single number can be useful, other techniques assessing the distribution of income across the population illustrate how unequal resources (income) are distributed. These measures allow for the analysis of inequality across different groups in the population, such as at the bottom of the distribution.

2.3 Infrastructure investments and the impact on poverty

As briefly mentioned above, capturing income dimensions of poverty reflects a household's purchasing ability, but does not take into account the surrounding conditions and available resources. While it is important that households have the ability to purchase goods and services, providing facilities and infrastructure, utilities, such as roads, medical facilities, schools, electricity, drinking water, sewerage systems, waste disposal facilities etc, are aspects that are not necessarily captured in income based measures of poverty but do impact household welfare and the opportunities available to individuals/households.

Infrastructure investments have immediate impacts on the surrounding economic sector. This could be not only in terms of creating employment opportunities but also in terms of enabling greater market-based activities, increasing electricity supply, improving transportation facilitates, etc. It is expected that the effects of the increased economic activities will lead to growth in the economy from which a greater share of the population will benefit. In addition infrastructure investments like rural electrification or improvements to the water supply system go along way in increasing the resources available to households in poorer communities and improving the quality of life, even if there is no immediate measured increase in household income.

The success of any intervention, or in this case infrastructure investment, is dependent not only on policies implemented in conjunction with the investment but also the interaction with other existing or subsequent policies introduced. Also the very nature of large scale infrastructure projects is such that their impact is hard to isolate as they are often designed to have wide reaching impacts on the economy: across regions, across sectors.

An evaluation of an infrastructure investment can be carried out based on various criteria depending on the area of interest. For example concerns of

profitability will examine financial indicators; implications to the environment will examine incidences of pollution, site contamination, impact to wildlife; a socio-economic assessment may focus on the impact to the local economy and users of the infrastructure. These types of evaluation involve direct effects of the infrastructure investment.

Evaluating the impact of the infrastructure project on poverty often involves capturing outcomes on agents or targeted groups who may or may not directly use the infrastructure investment. In addition benefits to direct and indirect users may be hard to quantify, e.g. reduced travel time that can be alternatively used on productive activities or to enjoy leisure time.

When evaluating the impact on subgroups or agents whether or not they are direct users it is important to understand the other factors that affect the outcome on these groups.

It is important to take into account these aspects or be aware of how they can influence any outcomes when evaluating the impact of infrastructure projects on household welfare.

3 PAMS: a policy evaluation tool

3.1 Overview of PAMS

Differing evaluation models are often designed with the intent of capturing a particular focus or dimension; each have their own strengths and weaknesses, though can often be applied to a variety of circumstances[1]. This report examines an analytical framework that has been applied to examine quantitatively the projected impact of infrastructure projects on poverty reduction; namely the Poverty Analysis Macroeconomic Simulator, known as PAMS.

The PAMS is one of many empirical tools developed by the World Bank to measure macroeconomic policy effects.[2] The PAMS model was developed to be able to capture the effects of the Poverty Reduction Strategy Programs supported by the World Bank, with the purpose of assessing the social impact of economic shocks and policies on households. This is reflected in one of the main features of the PAMS; its ability to assess macroeconomic level interventions and the expected distributional impacts of this intervention on income at the household level.

The PAMS is a simulation model and estimates what the effects of an intervention, in this case the infrastructure projects, will be on reducing poverty. Results are derived from estimating growth in sector output that the intervention (infrastructure investments) will contribute to, and thus allocates this share of contribution across sectors/groups of households in the economy. The PAMS is designed to assess what the impact of the intervention is expected to be on income levels. Hence the PAMS is a useful tool for analysing policy effects and the progress in meeting the MDGs, where targets, such as poverty reduction, are often measured at the household or individual level.

The section below summarises the application of the PAMS approach.

[1] See Essama-Nssah, B. “Poverty and Distributional Impact of Macroeconomic Shocks and Policies: A review of modelling Approaches” PRMPR, World Bank, Washington DC. Draft 2005

[2] For details see 'A PAMS Linking Household Surveys with Macro Models,' Pereira da Silva et al. (2002); and 'Linking aggregate macro-consistency models to household surveys: (PAMS),' Pereira da Silva et al (2003), from Toolkit for Evaluating the Poverty and Distributional Impact of Economic Policies.

3.1.1 Structure of the PAMS Framework

PAMS has three interrelated components:

- **Macro-level**: a standard aggregate macroeconomic framework (taken from any macro-consistency model) that projects GDP, national accounts, the national budget, the balance of payments, price levels etc. in aggregate consistent accounts;

- **Meso – level**: a labor-market model with labor categories broken down by skill level and economic sectors, whose total production is consistent with that of the macroeconomic framework; and

- **Micro-level**: an income-growth simulator model that uses the labour model's results to simulate the income growth for all individuals within a household from each labor category. Welfare measures are then applied to the projected household income to assess poverty or inequality outcomes.

Text Box 1 below summarizes the simulation estimation steps of the PAMS.

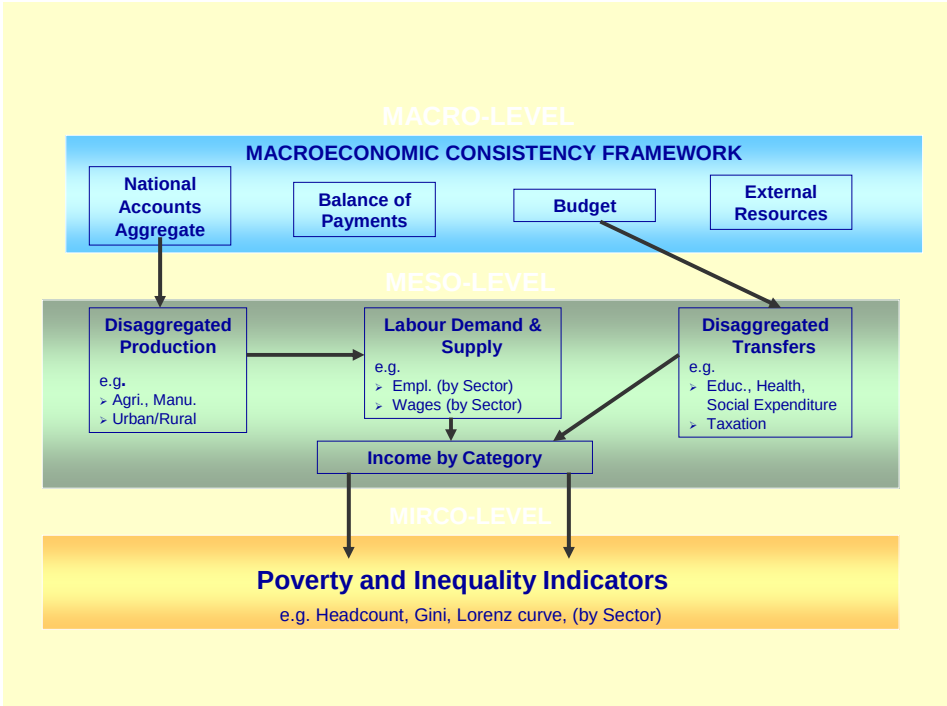
Text Box 1: Summary simulation steps of PAMS[3]

- Takes a macroeconomic framework from any macro-consistency package;
- Takes the initial poverty headcount and income distribution from the household survey (regrouping individual observations into representative groups RHS defined by labour category of the household head);
- Disaggregates production into economic sectors to match labour categories created from the household survey, where each economic sector employs one labour category (one RH) only;
- Simulates labour demand and supply in a disaggregated labour market; hence determines wage income for each RH;
- Endogenises the price level (production price only) through a mark-up on wages, hence can project a poverty line accordingly;
- Simulates the effect of applying different (average) income tax outcomes across labour categories;
- Simulates the effect of applying different budgetary transfers across labour categories, consistent with the budget constraint within the macro-consistency framework;
- Calculates income growth for each labour category;
- Feeds these growth rates into household survey information broken down by representative agents of each labour category; and
- Simulates the new poverty head count and the new level of inter-group inequality (Gini).

[3] See Pereira da Silva, Luiz A, B. Essama-Nssah and Issouf Samake, "A Poverty Analysis Macroeconomic Simulator (PAMS) Linking Household surveys with macro-models" DECVP and PRMPR, The World Bank, Washington DC, Draft August 2002

Figure 1 illustrates the three levels of the PAMS and how they interact.

Figure 1: Functioning of the PAMS



Input requirements

The full three layer simulation model requires data in the form of a macro-consistency model and nationally representative household survey. Macro-consistency models are developed to reflect country-specific macroeconomic features: reflecting the GDP aggregates, government budget sector, trade sector, etc, and estimates the size effect of any policy intervention on the economy. Macro-consistency models can take time to develop and requires information to be disaggregated into categories that are consistent with household survey data. For the PAMS, the household survey data itself needs to include household or individual information on income/expenditure for calculating household consumption, labour market activity data as well as regional distinctions such as urban and rural categories.

Given the long gestation lags between building and operating large scale infrastructure projects any effects of economic growth can take many years to impact household income. Appropriate data series need to be applied that will reflect the relevant time periods.

3.2 Application of PAMS to the evaluation of JBIC financed infrastructure in West Bengal

The features of the PAMS framework make it a useful tool for measuring the impact of infrastructure projects as it links the increased level of investment at the macroeconomic level with impacts at the household level, capturing to some extent the distribution of the these impacts across (specified category groups) households. The PAMS has been applied to evaluate JBIC assisted projects to estimate what the impact of the infrastructure projects will be on household income, and thus estimates the poverty levels with and without the effect of the infrastructure projects. A list of the eight JBIC-assisted infrastructure investments in West Bengal are listed in Table 1.

Table 1: Eight JBIC assisted infrastructure investments

	Project name	L/A Date	Sector	
1	CALCUTTA METRO RAILWAYS(PHASE II) CONSTRUCTION PROJECT	1983	Transportation	Railways
2	TEESTA CANAL HYDROELECTRIC PROJECT	1986	Electric Power and Gas	Power Plants
	TEESTA CANAL HYDROELECTRIC PROJECT (II)	1991	Electric Power and Gas	Power Plants
3	HALDIA PORT MODERNIZATION PROJECT	1986	Transportation	Ports
4	BAKRESWAR THERMAL POWER PROJECT	1994	Electric Power and Gas	Power Plants
	BAKRESWAR THERMAL POWER STATION PROJECT(II)	1997	Electric Power and Gas	Power Plants
	BAKRESWAR THERMAL POWER STATION UNIT 3 EXTENSION PROJECT	1995	Electric Power and Gas	Power Plants
	BAKRESWAR THERMAL POWER STATION UNIT 3 EXTENSION PROJECT(II)	1999	Electric Power and Gas	Power Plants
	BAKRESWAR THERMAL POWER STATION UNITS EXTENSION PROJECT	2003	Electric Power and Gas	Power Plants
5	PURULIA PUMPED STORAGE PROJECT	1995	Electric Power and Gas	Power Plants
	PURULIA PUMPED STORAGE PROJECT(II)	2004	Electric Power and Gas	Power Plants
6	INDUSTRIAL POLLUTION CONTROL PROJECT	1995	Social Services	Strengthening of Administrative Management
7	WEST BENGAL TRANSMISSION SYSTEM PROJECT	1997	Electric Power and Gas	Transmission Lines and Distribution System
	WEST BENGAL TRANSMISSION SYSTEM PROJECT(II)	2002	Electric Power and Gas	Power Plants
8	CALCUTTA TRANSPORT INFRASTRUCTURE DEVELOPMENT PROJECT	1997	Transportation	Roads

Source: JBIC documentation

A detailed report on the qualitative and quantitative evaluation of the infrastructure projects, undertaken by TERI (The Energy Resource Institute,

Delhi) report is published in full in an associated report. Here we present a summary of TERI's implementation of the PAMS framework to illustrate the PAMS approach and what is being estimated at each stage.

3.2.1 Overview of Approach to TERI's Application

The infrastructure investments in Table 1 cover not just a range of sectors, but have impacts to other states, not just West Bengal, as power is transmitted to other states and transport projects impact the ability to access wider markets outside of the state. This can make it hard not only to state the full impact of the infrastructure investment but also not all the impacts are easy to capture; such as the Industrial Pollution Control Project, which provides institutional strengthening. For this reason the quantitative evaluation undertaken by TERI has focused on the effects of the four power projects and the Haldia Port project (projects 2,4,5,7 in Table 1).

Constraints on West Bengal modelling input

Currently a macro-consistency model for West Bengal, or India-wide, is not available. While the full simulation model could not be applied, the three levels of estimation calculations were applied to derive results consistent with state level aggregates and household income. Given the differing implementation periods of the various projects, and the long gestation lags between construction and operation, a sufficiently long time period is needed over which to capture any outcomes in output growth. As a result, the two time periods over which the evaluation was based span a relatively long period of time; roughly a decade.

Estimation methodology

The main estimation approach applied at the macro and meso level of analysis is based on statistical techniques; regression analysis, which calculates the effect of specified indicators on an outcome under observation. Regression analysis is able to evaluate the size of the impact, i.e. regression coefficient, of the indicator variable on the outcome variable, and whether the effect makes a notable difference i.e. statistically significant. For the macro-level this will include indicators such as quantity of electricity generated for the state, while the outcome variable is the level output per capita in the state.

The data applied for the estimations is the National Sample Survey, state wide household panel data. Panel data is a sequence of years of data for the same data series. Often panel data is not available as it requires the collection of the same survey information over a long period of time across the same set of observations, whether state level variables, households etc. The use of state wide household panel data has advantages as it controls for the unobserved differences in individual characteristics that stay constant, across individuals and over time, but may contribute to differences in outcomes. Controlling for these characteristics allows the estimates to reflect non-individual specific characteristic differences which may impact behavioural outcomes.

A summary of the estimation approach is provided below: the specific estimation equations used by TERI are presented in Annex 2.

3.2.2 Summary of TERI's estimations using PAMS

The three levels of estimations applied in TERI's application of the PAMS involved the following:

- ***MACRO LEVEL ANALYSIS***

What is being estimated: Effects of the infrastructure projects on agricultural, industrial and service sector output growth.

What data was applied: National Sample Survey, 50th - 55th rounds, conducted by the National Sample Survey Organization; state level household panel data for 1989/1990 to 2002/03, converted to 1993-1994 prices.

Indicators used**:** Effects of the power projects were captured by aggregating total energy availability within the state of West Bengal, and dividing by state population. This indicator attempts to account for changes in electricity generation compared to changes in the population.

The effects of the port rehabilitation were captured by aggregating the cargo handling capacity over different ports and dividing by the distance to the port from the centre of the State.

How was the estimation done: Based on the results from the regression estimations, total aggregate sector effects of the projects are calculated by summing the separate project effects (regression coefficient multiplied by total unit outlay of the project) times by the total population. This result is compared with the sector base case scenario of total output in 1999/2000, to derive what percentage of the base case can be attributed to project effects for each sector.

Summary results: the estimated size of the effect of the infrastructure projects on sector output were then applied to the project outcome variables to ascertain the contribution of the projects to sector output. As expected the greatest impact was in the industrial sector where 30% of industrial output was estimated to be attributed to the impact of the projects. However the results also suggest sizeable effects of the infrastructure projects on agricultural and service sector outputs; 8% and 10% respectively.

- ***MESO LEVEL ANALYSIS***

What is being estimated: the share/allocation of the effect of the projects on the different household groups by sector (i.e. groups - urban and rural, sectors - agriculture, industry, services). This is based on the premise that the share of a group's effect from the projects is a function of the group's contribution to the sector output.

What data was applied: National Sample Survey: household data for the principal occupations of households 1993/94 and 1999/2000.

Indicators used: Total output per capita, industrial and service sector output shares and agricultural sector times wage.

How was the estimation done: Based on the effects of the projects on sectoral output per capita for the different groups (urban and rural) calculated from the macro level estimations, the share of the effects for each group are estimated combining sectoral project effects and principal occupational status in agriculture, industry and service sectors.

Summary results: effect of the investment projects has lead to a decrease in the proportion of rural households (with principal occupations) engaged in agriculture sector, an increase in rural households involved in services and urban households engaged in the industrial and service sector. These results again reflect consistency with the sector activity of the infrastructure projects.

- ***MICRO LEVEL ANALYSIS***

What is being estimated: projected poverty levels based on sector/group estimates of growth in income from 2000 base year, with and without the effect of the infrastructure projects.

What data was applied: National Sample Survey - 55th round of: household panel data for 1999/2000.

***Indicators used*:** household shares, poverty head count, poverty gap, by sectoral group.

How was the estimation done: simulations on the poverty measures combine the results of the effect of the infrastructure projects on the sectoral output growth from the macro level analysis, and the share of households in these sectors from the meso level analysis, to illustrate the effect on household income due to the effect of the infrastructure projects across the groups by sector.

Summary results: Investment projects are expected to reduce poverty, see Table 2 below for results across the three poverty measures. In particular urban households in the industrial sector are expected to experience the largest falls in poverty. There are also expected to be falls in poverty in rural households involved in the agriculture sector, though in general to a lesser extent. These effects on poverty reduction, both with and without project effects, differed across the type of measures applied. Greater reductions in poverty were estimated for measures that accounted for the depth of poverty.

Table 2: Micro-level estimation and simulation of poverty, West Bengal

Occupational Group		Household share		Poverty Head count		Poverty Gap	
		2000	with project	2000	with project	2000	with project
		(%)	(%)	(%)	(%)		
Rural	Agriculture	51	49	21	16	3	2
Rural	Industry	10	10	17	5	3	1
Rural	Services	15	16	9	6	2	1
Urban	Agriculture	1	1	9	8	2	2
Urban	Industry	8	9	5	1	1	0
Urban	Services	15	16	5	3	1	0
	Total			15	10	2	1

Source: see full quantitative evaluation report, TERI 2006

3.2.3 Conclusions of the PAMS application

The application of PAMS is shown to be a useful tool for providing an estimate of what the expected impact of large scale investment projects will be on reducing poverty at the household level. For the application illustrated here the magnitude of the intermediate results are in general consistent with findings undertaken in other empirical studies, which provides a useful consistency check on the approach and subsequent results that emerge.

It is important that the results of any empirical estimation are interpreted with a clear appreciation of the underlying assumptions that are embodied within the model that has been applied. For the PAMS there are several assumptions upon which the model is based, such as, for example, the transmission effects of policy through the economy; the classification of households in terms of the labour category of a principal member of the household; and assumptions of the distribution of growth across household groupings etc, all of which can effect the interpretation of the results and their effect on the target group. If there are households with many family members in diverse labour occupations, the size of the impact may differ from that estimated from the model. While such assumptions do not cast doubt on the results, the results should be understood within the context of the model that is applied.

It is also important to note that the PAMS technique doesn't capture, and was not designed to capture, the intangible effects that have been noted earlier that infrastructure investments of this nature bring; e.g. as improvements to air pollution, which should be part of any evaluation even if not a quantitative assessment. However the estimates that TERI have provided give a measurable assessment of the impact and these results should be seen in this light, and not as the total expected effect of infrastructure on the population as a whole.

4 Assessment of quantitative evaluation techniques

4.1 PAMS as an evaluation tool of infrastructure investments

Evaluation tools need to assess whether a project has achieved a specified outcome, or assessed what the outcome is. The PAMS is a simulation model set up to be consistent across the three levels: macro, meso and micro economic levels to estimate what the impact of the macro level intervention on the micro level will be. It is not designed to measure what the impact of the intervention will be on household income. Since the PAMS estimates the expected impact on poverty, an assessment of whether poverty levels have achieved the projected levels will have to be undertaken some time in the future to be able to conclude any evaluation process.

An application of the PAMS could set out what the expected outcomes should be, and an evaluation of the expected outcomes using different techniques to measure poverty could then be applied in the future. PAMS could be applied for monitoring purposes, to assess over regular time periods, e.g. 5-10 years, whether the effects were happening at all, or whether the size of the projected impacts were occurring regularly. Since state level actual poverty levels will be a result of all policy effects, and the PAMS estimates the contribution of the intervention under analysis on poverty outcomes, the two figures will need to be adjusted in some way to assess if the infrastructure investments are contributing to poverty reduction as the estimations suggest.

As with any quantitative assessment, the application tool is dependent on the availability of information that can, as best as possible, reflect the underlying intervention to be analysed. Data that contains appropriate information is not always available and it may be the case that the evaluation tool will be chosen depending on the data available. It is important to also fully appreciate the impact of the policy environment and other interventions that have a mitigating effect on the outcome of the infrastructure project which may not be captured, for example legislation restricting expansion of transmission lines to particular areas, route plans for the metro system.

4.2 Wider approaches to quantitative evaluations

What is important in any quantitative evaluation is a clear understanding of what is being assessed and, the channels of the impact on the target group. Supplementary evidence, whether in the form of anecdotal evidence, qualitative surveys, (Rapid Appraisals Methods); a small sample survey of face to face in-depth interviews; a robust underlying theoretical model; or other empirical studies, offer valuable supporting evidence to quantitative

assessments where so often quantitative information is included as a proxy to input and outcome attributes.

As noted previously, many impacts are not easily quantifiable and hence are not captured in empirical-based assessments, which can be equally important as increases to income, such as improved facilities, quality of air (traffic congestion), etc. For evaluating the success of an infrastructure investment, it is important to assess whether the investment is operating at its full capacity and whether there are other factors obstructing its intended purpose. Since this will effect the outcome and hence the evaluation, these factors will also need to be taken into consideration.

To a large extent these issues are captured in the qualitative assessment which is part of this overall assignment. The qualitative evaluation of the 8 JBIC assisted projects has been based on the DAC evaluation criteria, where a project is assessed in terms of five objectives: relevance, efficiency, effectiveness, impact and sustainability.[4] This provides instructive supporting information for any quantitative evaluation that is carried out, as it captures the broader context of the projects under evaluation and provides valuable insight into interpreting any empirical-based assessment. These aspects need to be taken into account when evaluating a project as it offers insights into what can be limiting or enhancing the benefits of the activity.

4.3 Concluding assessment of quantitative evaluations

- √ Simulation models such as PAMS may not be suited for evaluating the current effectiveness of infrastructure investment projects on outcomes but may be a useful tool for estimating the expected impact on poverty of infrastructure investment projects which would form part of an evaluation process of the final outcome;
- √ Simulation models such as the PAMS may be useful as part of a continual monitoring tool for very large scale infrastructure projects;
- √ Establishing who is the target group is important: beneficiaries/users of the infrastructure investment, or a wider population group;
- √ An appreciation of the wider policy environment and channels of outcome effects is necessary to assess how the target group may be effected; and
- √ What effects may not be captured quantitatively and how can they be incorporated into the evaluation or monitoring exercise to judge if the investment has met its objectives.

4 The DAC Principles for the Evaluation of Development Assistance, OECD (1991), Glossary of Terms Used in Evaluation, in 'Methods and Procedures in Aid Evaluation', OECD (1986), and the Glossary of Evaluation and Results Based Management (RBM) Terms, OECD (2000).

Annex: 1 Terms of Reference

Terms of Reference

of

Advisory Services for

The Impact Study: Role of Infrastructure in Poverty Reduction[5]

1. Content of the Advisory Services[6] and Planned Schedule

(1) To give advice and comment on the TOR of the Study (November 2004).
(2) To assist the process of selecting consultant and comment on proposals submitted by several consultants (November to December 2004).
(3) To comment on the following Report.
- Inception Report (February 2005)
- Interim Report (April 2005)
- Draft Final Report (May 2005)

(4) To participate in the workshop in India and report its output (June 2005).
(5) To give advice for the Study when required.

All the comments referred to in (1) to (3) above should be sent by e-mail by the date JBIC set each time.

2. Work Schedule

The total elapsed period and days for Stone & Webster Consultants is 25 business days (within November 1, 2004 to August 31, 2005).

3. Work Record

Stone & Webster Consultants shall submit the work record as evidence for the remuneration of the Services.

[5] Refer to the Attachment.

[6] The Services will cover only for the part of economic analysis of the Study, especially PAMS referred to in the Attachment.

Annex: 2 TERIs Estimation Equations

- ***MACRO LEVEL ANALYSIS***

TERI Equation (2): $\Delta outpc_j = \beta_E^j \Delta eltotpc + \beta_P^j \Delta portdis$

- ***MESO LEVEL ANALYSIS***

TERI Equation (3): $\Delta S_i = \sum_k \gamma_k \Delta outsh_k + \gamma_{totoutpc} \Delta totoutpc$

- ***MICRO LEVEL ANALYSIS***

TERI Equation (5): $\Delta P_i = f\left(mpce_i, pline_{R1U}\right) - f\left(mpcegr_i, pline_{R1U}\right)$

TERI Equation (1): $AggPov = \sum_{i=1}^{6} P_i S_i$

TERI Equation (4): $mpcegr_i = mpce_i\left(1 + \frac{\Delta outpc_j}{outpc_j}\right)$

Variable Names where:

$\Delta outpc_j$	increase in output of the sector j
j	economic sector subgroups (agriculture, services and industry).
β^j_E	coefficient electricity variable
β^j_P	coefficient port variable
Δ	represents the change
eltotpc	electricity indicator (energy availability + non-utility generation)/population
portdis	port indicator (sum over different ports of (major port cargo/distance to port from centre of state)
S_i	Share of the number of households in sub-group i to total households
γ	regression coefficient at meso level for the different values of k
outsh	output share of industry and services
totoutpc	total output per capita
P_i	Poverty index for sub-group i
i	Subgroups: rural agriculture, rural industry, rural services, urban agriculture, urban industry.
$mpce_i$	monthly per capita expenditure for subgroup i
$pline_{R/U}$	poverty line for households in rural/urban areas
AggPov	Aggregate Poverty Index
$mpcegr_i$	monthly per capita expenditure growth rate for subgroup i
$\Delta outpc_j$	output per capita for subgroup j
$outpc_j$	output of the sector j