INTEGRATION OF DISTRIBUTIONAL AND EQUITY ANALYSIS INTO THE APPRAISAL OF RURAL ROADS:

A case of the Mindanao Rural Development Project Phase2 (MRDP 2)

ALVIN PAUL J. DIRAIN
Enschede, the Netherlands,
February 2012

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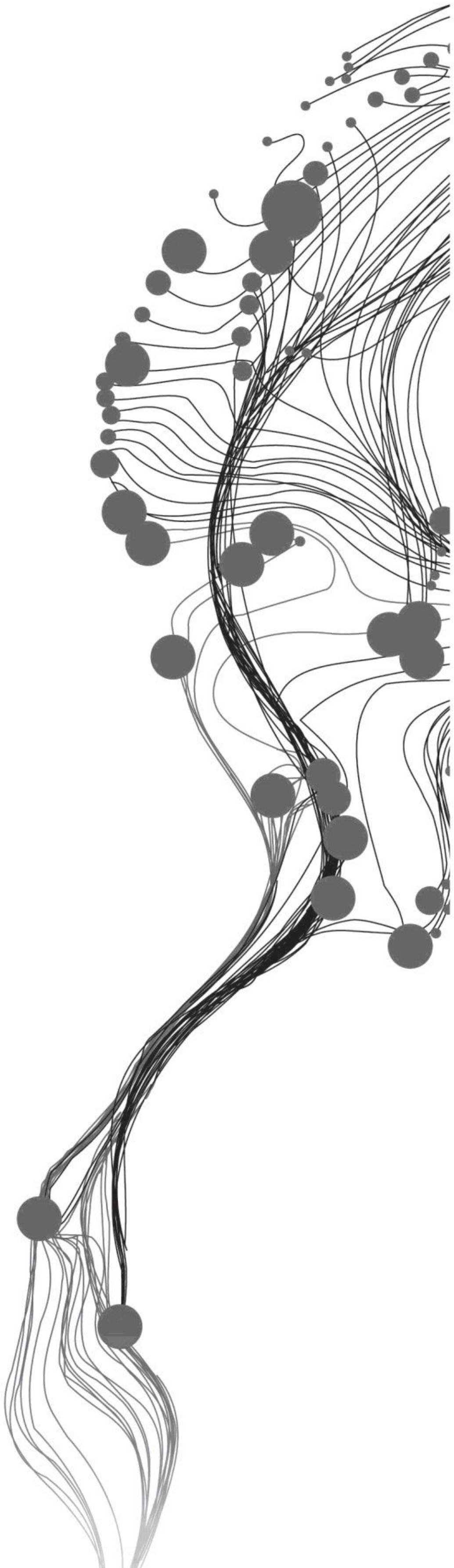

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A thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements of the degree of Master of Science in Geo-Information Science and Earth Observation
Specialization: Urban Planning and Management

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ABSTRACT

The Philippines and the international financial institutions particularly the World Bank and Asian Development Bank (ADB) continued to commit in alleviating poverty through investments in rural development. Rural roads remain among the top priority due to its large contribution in alleviating poverty. Hence, priorities are given to areas with high incidence of poverty.

Traditional cost-benefit analysis (CBA) is still being widely used to justify these investments. This existing appraisal method however, only shows the aggregated benefits and do not account for the distribution across income groups nor across geographical locations. Hence, there is no explicit way to know if the benefits are really reaching the targeted areas and groups. The main aim of the study is to be able to develop an approach to further disaggregate the benefits across spatial units and across social groups and determine whether equity is being achieved within the context of the current CBA-based appraisal of rural roads.

Several methods and tools for analyzing distributional and equity are reviewed. The review shows that methods and tools can be combined in order to come up with an approach that could match the special characteristics of the appraisal of rural roads. Rural road appraisal in developing countries requires different approach because of certain data limitations.

In this research, an approach was developed for a particular road project: the Los Arcos San Lorenzo Rural Road Project in Prosperidad, Agusan del Sur in Mindanao Philippines. To arrive at a spatial and social distribution of the benefits of the project, use was made of the actual conducted cost-benefit analysis study of the project. Travel time savings as a measure of accessibility across spatial locations was the main parameter used to disaggregate the benefits across *puroks* and across income groups. In combination with the information of the spatial distribution of different road users and their socio-economic characteristics (derived from existing household surveys), the research was able to disaggregate the benefits spatially and among social groups. The distributed benefits from the project were further analyzed using equity measures and indicators to gain more insights on the effect of the project.

The road improvement project shows that the central areas in San Lorenzo gained most of the total benefits. However, across socio-economic groups the poor and the ultra-poor are expected to gain more than the better-off which is a positive sign for the project. The project could also contribute to alleviating the poverty situation in the area as shown by the high poverty impact ratio and an overall positive poverty reducing impact. The road improvement project is also expected to reduce inequality across income groups and across *puroks* but not within each income group. Some other direct benefits not included in the original cost-benefit analysis were also analyzed in terms of their relative contribution to the various social groups. Savings for vehicle operating costs for vehicle owners and savings in hauling of forestry products seem to be captured mainly by the poor and the ultra-poor. However, for the benefits on school attendance due to the road improvement project, the better-off are expected to gain.

The integration of distribution and equity analysis in the appraisal of rural road project could provide more information for decision-makers which could enhance the quality of decision. The decision-makers are more interested on how the project is benefitting the target groups specifically the poor, women and the indigenous peoples. The planners and project implementers as well, could potentially benefit from the new information to further aid them in formulating more appropriate development strategies for the community.

While the approach showed strong potential to provide the needed information regarding how the benefits of the road can be distributed across *puroks* and across social groups, there are several remaining issues that need to be further investigated. Among these issues are related to the other benefits not included in the cost-benefit analysis like the savings in hauling cost for hauling of forestry products and savings in vehicle operating costs for vehicle owners as well as the other benefits related to health, employment and attendance to schools which were not dealt with strongly due to time and data limitations. Despite some of these drawbacks, the research could provide significant contribution in further development of spatial-based approaches for the appraisal of rural road projects.

Keywords: rural road, appraisal, distribution analysis, income groups, spatial equity

ACKNOWLEDGEMENT

I would like to thank the people who are behind the accomplishment of this thesis. Most particularly, I want to thank the Lord for giving me the strength and courage to complete this piece of work. I would like also to express my deepest gratitude to my supervisors Drs. Emile Dopheide and Dr. Johannes Flacke, my external reviewer, Leo de Jong and our Committee Char, Prof.Dr. Anne van der Veen, for without them, this academic undertaking would have not been made possible.

Thank you also to Monika and the rest of UPM Professors and staff who have assisted us throughout the completion of the course. Special mention to Laura who have been very supportive to our batch.

Thank you to my Filipino angels... Coleen, Geliah, Paula and Sonia for helping me in many ways. Alam nyo nya yun (you know what it is) and also to John C. for the night outs together. To Manang A of course for the very helpful advices and to Richard my Nikon travelling buddy!!! Also to Sir Pit and Nolet for one of the memorable travel in Belgium!

Thank you to ITC RunForFun especially to Wan and Simon, I will not forget the almost 18 months of running together in winter, spring summer and fall... and of course how could I forget the "Betavieren" experience being chosen as the last runner of the leg? What a lasting memory indeed!

Thank you to the Faculty Council colleagues from the students, Susheel, Tanmoy, Robert and Mitava and to the Faculty and Staff: Wan, Sjef, Barrend, Petra and Tom. I learned a lot from this experience.

Also, to the Student Association Board (SAB) and the Student Affairs Office. It's so nice working with you!

I would like also to express my deepest gratitude to the Filipino-Dutch community here in Netherlands who always opened their doors whenever I need comfort. Thank you for making me feel HOME away from home! First, to the Help Filipino Children (HFC) in Roermond – Guus and Ate Dianne, Ate Mildred and family, Ate Lineth and family, Ate Lizzie and family, Nanay Sally and family; and to Stichting Filipino in Overrijsel – Kuya Tom and Ate Elvie, Kuya Allan and family, Ate Nerry and family, Jane and family, Tante Lou and family and to all the rest whom I have failed to mention... Thank you so much.

To the Corbillons (Don, Ruth and James) in Milan Italy, Tita Malou, Kuya Dennis, Dawson and the Bongalontas in Torino Italy, thank you so much for the warm accommodation and for offering me the best Christmas away from home.

Thank you to my dear brothers: Kwak, Tang, Daniel, Susheel, Wang and Mostafa – my best buddies and to my sisters – Nuria, Chao and Phuong. I could not survived ITC without you guys! I will never, ever forget you.

To my fellow UPMs, thank you guys for the great camaraderie. Despite the cultural differences we managed to stick together through thick and thin. Thank you for the respect and confidence you offered me for the short time I took over as your class representative. All these memories will remain in my heart FOREVER.

To all my ITC friends and classmates, I could not mention all your names here because the space is not enough... Thank you, thank you, and thank you. We made it!

I would like to thank also the MRDP 2 staff headed by Director Lalay Ramos and Deputy Director Arnel de Mesa. Thank you to Kuya Mario, Boyet, Mam Sheila, Leila, Chix and to all others who assisted me in getting the needed documents for the accomplishment of this thesis.

To Caraga Region headed by Director Edna Mabeza for providing me the needed logistics for my data gathering and visit to the study areas. Also to MRDP RPCO staff headed by Tatay Eli Tila particularly the RI group headed by Kuya Rene and all others who provided me all the data that I need. Daghang salamat!

I would like also to thank my DA family especially PDS headed by Director Zenaida Villegas. Thank you for the great support.

My special thanks also to World Bank especially Ms. Carolina Figueroa-Geron and Sir Joey Virtucio, NEDA Central and Regional office and other agencies, the Provincial government of Agusan del Sur and the municipalities of Prosperidad, Esperanza and Bunawan, whom I have visited during my data gathering. Also, to all the barangay officials in all the areas visited. Thank you for support.

To Kuya Abel Wagas and family... no words can express my heartfelt gratitude to all of you. I would have not accomplished this work if not for your generosity and guidance. You are the best!!!

To my F4 + 1 friends... Igan Tonton, Edsch, Randy and Brix... Thank you mga pare!

To all my family, friends and relatives especially to the Atons, the Darios, the Superables and the Picazzos, for taking care of my family while I am away. To Uncle Mat, Tita Lol, Ate Mae and Kuya Junjun from US, the Verzons in Japan, the Homos, the Barcarses, the Carayugans, the Melegritos, the Guillermos and the Dirains in the Philippines for always cheering me up and providing moral support through the social network. Thank you.

And to all those whom I have failed to mention... Thank you and Mabuhay. God bless us all!!!

I would like to dedicate this piece of work to
my dearest ***Leonora****,* ***Alvin Carlo*** *and* ***Aeronne Paul***
who have been my source of strength and inspiration...
Mahal na mahal ko kayo!!!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

LIST OF ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
BCR	Benefit Cost Ratio
BDP	Barangay Development Plan
BFAR	Bureau of Fisheries and Aquatic Resources
CBA	Cost Benefit Analysis
CBMS	Community-based Monitoring Survey
CEA	Cost Effectiveness Analysis
CGE	Computable General Equilibrium
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DPWH	Department of Public Works and Highways
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
FEA	Financial and Economic Analysis
FGD	Focus Group Discussion
FMR	Farm-to-Market Road
FPIC	Free and Prior Informed Consent
FS	Feasibility Study
GIS	Geographic Information System
GPS	Geographic Positioning System
HDM4	Highway Development Model, Version 4
HH	Household
ICC	Investment Coordination Committee
IE	Impact Evaluation
IP	Indigenous Peoples
IRR	Internal Rate of Return
ITC	Faculty of Geo-information Science and Earth Observation or International Training Center
km	Kilometer
LGU	Local Government Unit
LOI	Letter of Intent
LUTI	Land Use Transport Interaction
MCA	Multi-criteria Analysis
MDG	Millennium Development Goals
MRDP	Mindanao Rural Development Project
MRDP 2	Mindanao Rural Development Project-Phase 2
NCIP	National Commission on Indigenous People
NEDA	National Economic and Development Authority
NEI	National Economic Institute

NPV	Net Present Value
NSCB	National Statistical Coordination Board
O&M	Operation and Maintenance
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
pcu	Passenger-car Unit
PhP	Philippine Peso
PSO	Project Support Office
RAFC	Regional Agriculture and Fishery Council
RED	Roads Economic Decision
RFU	Regional Field Unit
RIA / ZOI	Road Influence Area / Zone of Influence
ROW	Right of Way
RPAB	Regional Project Advisory Board
RPCO / SPCO	Regional Project Support Office / Sub-Project Coordination Office
SI	Social Index
SPSS	Statistical Package for the Social Sciences
TEE	Transport Economic Efficiency
TRN	Transportation Research Notes
vpd	Vehicle per Day

1. INTRODUCTION

1.1. Background

Poverty alleviation continues to be the main thrust of the Philippines due to its commitment to the Millennium Development Goals (MDG) as a member state of the United Nations (UN). Hence, investments in rural development are still the over-arching objective of international financial institutions particularly the World Bank and Asian Development Bank (ADB). This is also driven by the fact that in the Philippines, one-third of the total population and almost one-half of the rural population are living below the poverty line (World Bank, 2005d).

According to World Bank (2005d), one of the main challenges in the Philippines is the provision of basic infrastructure such as rural roads. Lebo and Schelling (2001) noted that effective transport is a complementary input to every aspect of activity in the rural area and is an essential element for poverty reduction. These rural roads provide basic access, a necessary condition for alleviating poverty (World Bank, 2005c). Roads facilitate access to markets, to off-farm employment, and to social services like education and health (World Bank, (2005d); Donnges, Españo, & Palarca, (2006). Similarly, the World Bank (2005c) revealed that rural access gives rise to benefits like lower transport costs to existing traffic due to smoother and sometimes shorter routes; savings in time due to faster travel; economic development benefits resulting in generated (new) traffic; and social benefits due to improved access to hospitals, schools, etc.

In the Philippines, the island group of Mindanao was specifically targeted by the Philippine government as one of the priority areas for the provision of rural roads. This is because it has the comparative advantage in agricultural production but development is heavily hampered by the limited access to efficient product markets and poor infrastructure (World Bank, 2005d). Hence, development efforts by the national government agencies particularly the Department of Agriculture was geared towards improving access to markets through the provision of rural roads, bridges, etc. Most of the rural roads[1] provided are tertiary roads which are considered basic access roads or low volume roads having less than 200 motor vehicles per day of travel (World Bank, 2005c).

In the appraisal of these rural road projects, traditional methods such as financial and economic analysis (FEA) or cost-benefit analysis (CBA) still remain to be the main tool to justify these investments. This is because CBA has a good theoretical foundation and, as claimed by Pearce et al. (2006), majority of economists tend to favour CBA because it is more rational, individual preferences are counted and the optimal scale of the policy in question are determined. Annema et al. (2007) however argue that CBA tends to ignore equity in the distribution of benefits. Moreover, Van de Walle (2002) criticized that the traditional appraisal did not distinguish the different income or socio-economic groups. But Pearce et al. (2006) maintained that a properly executed CBA does not ignore these equity issues.

This thesis will develop an approach on how the distribution of economic and other benefits can be captured in the appraisal of rural development projects, particularly in rural road projects. This approach will be tested to a specific rural road project in Agusan del Sur in Mindanao under the second phase of the Mindanao Rural Development Project-Phase 2 (MRDP2) to examine how the benefits were distributed across the targeted areas and beneficiaries.

1.2. Justification

The framework for the evaluation of transport projects are in Transport Research Notes#5 or TRN-5 (World Bank, 2005b). Economic evaluation or CBA is the main tool used for the appraisal of the said projects, where the difference between the value of the benefits and the costs are measured in monetary

[1] According to Lebo & Schelling (2001) rural roads are part of the Rural Transport Infrastructure (RTI) which also include tracks, paths, and footbridges.

terms. Another main concern in the economic evaluation of transport projects is whether the project is socially desirable. Although critics say that CBA does not relate to distributive concerns or poverty alleviation or ignores equity (Annema, et al., 2007), the framework as included in TRN-5 shows that distributional analysis can be accommodated within the context of CBA. Moreover, Pearce et al. (2006) together with the Organization for Economic Cooperation and Development (OECD) developed a framework on how the distributional implications of projects can be accommodated within cost-benefit appraisals. Their framework recognizes that efficiency in the allocation of resources should not be the only basis to distinguish if projects or policies are desirable but also consider the social desirability of the distribution of benefits and costs. Adding to this is the fact that knowledge on the impact of rural roads and the heterogeneity of these impacts to the targeted beneficiaries continues to be limited (Van de Walle, 2009). Hence, the challenges in the evaluation of the impacts of rural roads still remain.

Distributional analysis is defined by Asian Development Bank or ADB (1997) as the analysis of the distribution of the benefits and costs in order to identify and measure the magnitude of the gains and losses during the appraisal of projects. It is a crucial in determining how a proposed project will affect different stakeholders or beneficiaries (Gajewski, Luppino, Ihara, & Luppino, 2004). Moreover, distributional analysis, according to Gajewski et al. (2004) is very flexible because stakeholders may be defined and examined through various attributes, such as income status, social (including economic and political) roles, gender, and geospatial characteristics. It is also a particularly useful tool for policymakers because it allows them to '(1) assess whether the distribution of project net benefits corresponds with the stated objectives of the project; (2) Evaluate whether success or failure of the project is independent from traditional measures such as the internal rate of return; and, (3) Examine the likely impact of policy changes on the distribution of project economic impacts' (Gajewski, et al., 2004).

The rationale behind the conduct of distributional analysis is to determine how the investments in rural roads are affecting poverty (World Bank, 2005a). This is because the impact of the road project may have positive or negative effect on poverty. While the challenge to fund more rural road projects persists, resources are limited which points out the need to further improve the appraisal process. This can be done in order to increase the accuracy of the appraisal process in determining the target areas. This is also to ensure that resources are directed towards the areas as well as the communities who it need the most.

Complementing distributional analysis is the determination whether equity is being achieved in rural road projects. Equity according to Jones (2009) revolves around life chances and access to opportunities and services. Hence, measures on how to assess equity are part of this research. More and more relevant policies related to equity have been formulated. In the Philippines for example, Republic Act No. 9710 or the Magna Carta for Women has been enacted in 2009 to protect discrimination of access to various opportunities against women (Arellano Law Foundation, 2000); the Republic Act 8371 or the Indigenous Peoples Rights Act (IPRA) of 1997 (NCIP, 1997) to recognize, promote and protect the rights of Indigenous Cultural Communities/ Indigenous Peoples (ICCs/IPs)[2]; and the UN Millennium Declaration[3] in September 2000 where the Philippines is one of the signatory and committed to the main aim of eliminating extreme poverty worldwide.

Equity considerations have also inched their way into every project preparation particularly those funded by international financial institutions. One major approach in ensuring that equity is addressed in most rural development projects (e.g., poverty reduction programs) is by targeting the poor areas. The poor areas are normally measured in terms of poverty incidence or percentage share of poor people below the

[2] 'This refers to a group of people or homogenous societies identified by self-ascription and ascription by others, who have continuously lived as organized community on communally bounded and defined territory, and who have, under claims of ownership since time immemorial, occupied, possessed and utilized such territories, sharing common bonds of language, customs, traditions and other distinctive cultural traits, or who have, through resistance to political, social and cultural inroads of colonization, non-indigenous religions and cultures, became historically differentiated from the majority of Filipinos' (IPRA Law, Chapter 2, Section 3h, p.3)

[3] Also known as the MDG (1990-2015).

poverty line. However, more concrete proof or evidence is necessary in order to show that the benefits of the project are fairly distributed among its beneficiaries.

Prioritizing the poorest, however, does not always mean that equity is being achieved (Van de Walle, 2002). This is because certain rural development projects have redistributive effects that could be different across target areas. While most rural road projects that are ODA-funded target the poor and vulnerable or disadvantaged groups, the impact of these projects cannot be confined within these target groups—there will always be some impact on non-targeted groups as well. In this regard, the boundaries on the impact of these development projects are not well-defined. In contrast, political boundaries do exist. Therefore, according to Talen and Anselin (1998), it is inappropriate to exclude spatial externalities from the analysis if the service provision of the public good is not limited. Normally, targeting or planning of projects for ODA is based on geographical boundaries. However, these geographical boundaries have certain degrees of natural and socio-economic differences including factors and characteristics that may influence the distribution of these impacts. Maro (1990) considers these natural and socioeconomic differences and factors in space as crucial elements in any development planning processes. It then becomes essential to assess whether these impacts are really felt in the main target area as well as by the targeted beneficiaries, and how these different natural and socio-economic factors interplay in the distribution of these impacts.

On the other hand, the World Bank Development Report (2006) concluded that poverty reduction is stronger in more equal societies. Equity consideration in the evaluation of rural development projects, particularly for rural roads, therefore has a considerable degree of importance. First, in terms of policy choice, which implies that policy-makers have varying views on what equity stands for. The challenge of development according to the report is to institute policies that allow and encourage "unbalanced" economic growth but ensures that the development outcomes are balanced across geographic locations (World Bank, 2009). The second importance is that equity can build up support to prevent conflict (World Bank, 2010) while the third importance lies in the possible redistribution of compensation. Policy-makers need to become more sensitive and proactive to society's distributional objectives in developing redistributive mechanisms (Pearce et al., (2006). Therefore, integrating the equity analysis in the evaluation of rural development projects is vital in achieving the country's project development objectives.

Other practical implications of distributional and equity analysis is that, it provides some basis for planners in evaluating the contribution of different approaches and strategies in the achievement of equity in the context of rural road projects. This may provide a basis for the adjustment of the strategies or approaches in future project developments.

In summary the main rationale for incorporating distribution and equity analysis into the appraisal of transport projects and rural road projects in particular are:

- Determine how the investments in rural roads impact on poverty
- Assess how the benefits are distributed vis-a-vis the project objectives
- Evaluate the likelihood of success and failure of a particular policy or project as an add-on to the traditional CBA method; and,
- Can provide a clearer view of how specific policies and programs can have an impact on the economic benefits of the project

1.3. Research Problem

The existing approaches for the appraisal of rural development projects, particularly for rural roads, have some limitations in terms of analyzing the distributional effects and equity of these projects across social groupings and across geographic/spatial units. The existing appraisal used the CBA-based method which only shows the overall benefits aggregated at the project level. Although the guidelines show that distributional analysis should be conducted for rural development projects, the framework on how to approach it is still lacking. Please note earlier that due to limited resources, priorities are given to poverty stricken areas. The distributional and equity analysis can aid in more accurate targeting of the project areas during the appraisal process.

1.4. Research Objectives

1.4.1. Main Objective

The main objective of this research is to develop an approach on how the analysis of the distribution and equity effect can be integrated into the existing appraisal of rural road projects. The approach will be tested to a specific rural road project in the Philippines under the Mindanao Rural Development Project Phase 2 (MRDP 2) funded by the World Bank.

1.4.2. Sub Objectives

- Analyze the existing appraisal process of rural road projects in terms of how distributional and equity analysis is considered
- Review the existing concepts, methods and tools that can be applied in the distributional and equity analysis of the benefits of rural roads
- Develop and apply the approach to assess the effect of the rural road project in improving the situation of the area and of the beneficiaries
- Identify the advantages and the limitations of applying the approach in the appraisal of rural road projects

1.5. Research Questions

The research questions for each sub-objective are as follows:

Sub-Objective 1. Analyze the existing appraisal process of rural road projects in terms of how distributional and equity analysis is considered

a. To what extent is distributional and equity analysis considered in the existing appraisal process of rural roads?

Sub-Objective 2. Review the existing concepts, methods and tools that can be applied in the distributional and equity analysis of benefits of rural roads

a. What are the existing methods and approaches for distributional and equity analysis in the appraisal of rural road projects?
b. How can these methods be integrated or incorporated into the existing framework of appraisal of rural road projects?

Sub-Objective 3. Develop and apply the approach to assess the effect of the rural road project in improving the situation of the area and of the beneficiaries

a. How are the benefits of the rural road improvement project distributed across the target areas? Across social groups?
b. Is equity improved due to the road improvement project?

Sub-Objective 4. Identify the advantages and the limitations of applying the approach on distributional and equity analysis in the appraisal of rural road projects

a. What are the advantages of the approach?
b. What are its limitations?

1.6. Conceptual Framework

Impact evaluation (IE), according to the World Bank Independent Evaluation Group (2009), estimates the magnitude and distribution of changes in outcome and impact indicators among different segments of the target population. It is also used to assess whether these changes can be attributed to the interventions being evaluated. The World Bank recognizes that there are many evaluation methodologies that were originally developed to assess the impacts of precisely defined interventions. However, the most important challenge is how to adapt these methodologies to evaluate the multi-component, multi-donor sector- and country-level support packages that are becoming the central focus of development assistance.

Van Pelt (1993) discusses the three main phases of project appraisal: Decision-making framework; Impact Assessment; and Evaluation. According to Van Pelt (1993), the applicability of appraisal methods is strongly dependent on the measurement scales for impacts: quantitative and qualitative. Figure 1.1 shows the different measurement scales.

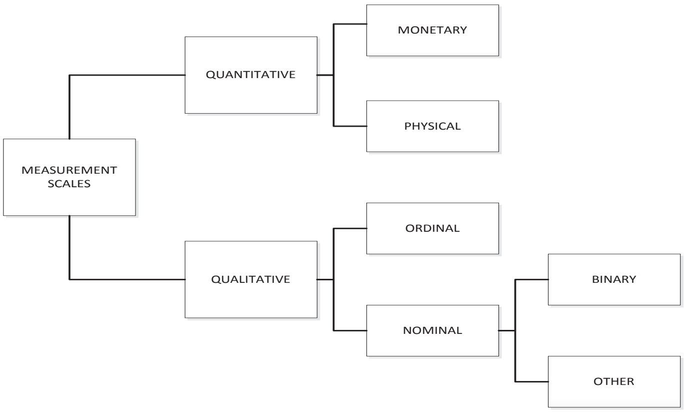

Figure 1.1 Van Pelt's (1993) measurement scales for impact assessment

Khanna (2009) on the other hand, developed a framework (Figure 1.2) for the distributional and equity analysis (with focus on disaggregating the benefits spatially) for evaluating the impact of transportation projects. The framework shows how the different benefits in the transportation project will be distributed among different population subgroups at the household unit by income level including the distribution across spatial units in order to assess the social and spatial equity of the project.

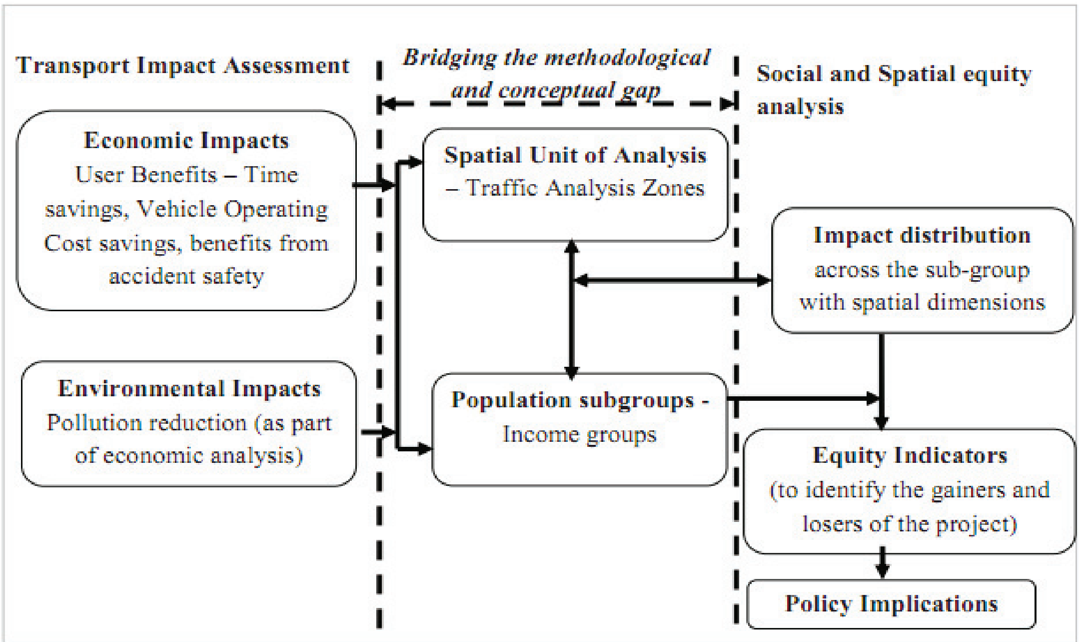

Figure 1.2 Khana's (2009) conceptual framework for assessing the distributional and equity analysis of transportation projects

Rule 4 of the ODA Act of 1996 also stated that the processing of projects proposed to be financed by ODA loans or combination of loans and grants shall be in accordance with the Investment Coordination Committee's (ICC) Guidelines and Procedures as well as Project Evaluation Guidelines and Procedures (NEDA, 1996). The guidelines and procedures outline how each ODA-funded project will be evaluated. The revised guidelines (as of March 2005) recognized that aside from financial and economic analysis, social desirability should also be given more attention. The aim of social analysis is to determine the responsiveness of the proposed program or project to national objectives of poverty alleviation, employment generation, and income redistribution. In this guideline, spatial distribution was also explicitly mentioned as part of the evaluation. The concepts of distribution and equity considerations are present in the guidelines but the framework and approaches for implementation are insufficient.

Building on the framework developed by van Pelt (1993) and Khanna (2009), a revised framework on how distributional and equity analysis can be assessed and integrated into the appraisal of rural development projects (i.e., rural roads) is shown in Figure 1.3. This framework shows how the benefits of the rural road projects could be distributed across social groups (who enjoys the benefits?) and across geographic locations (where are the benefits falling?). The approach is also based on the guidelines developed in the evaluation of project proposals for different ODA projects.

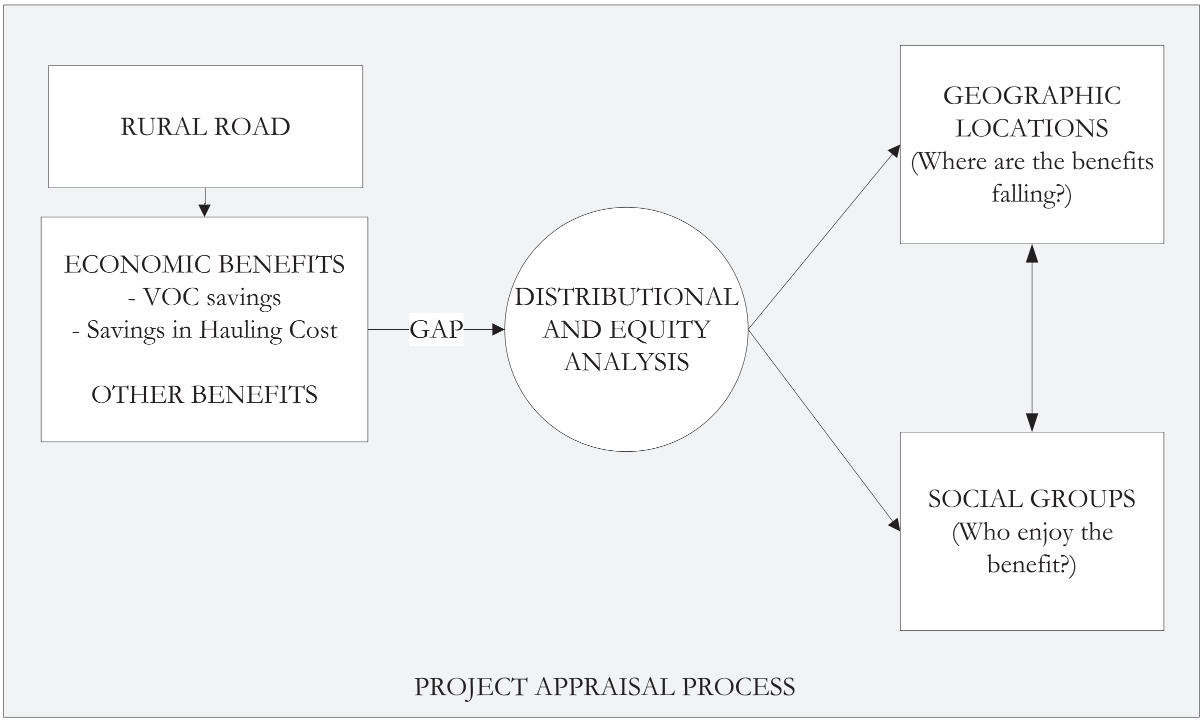

Figure 1.3 Conceptual framework for integrating distributional and equity analysis into the appraisal of rural road projects

1.7. Thesis Outline

This section shows the final thesis structure which is composed of 8 chapters. The contents of each chapter are described below.

Chapter 1: Introduction
This chapter gives an overview of the research. The background and justification, research problems, objectives, sub-objectives, and the conceptual framework are discussed here.

Chapter 2: Literature Review
This chapter focuses on literature related to the methods of distributional analysis as applied to the assessment of impacts of rural development projects. Literature on equity and spatial equity measures are also discussed.

Chapter 3: Research Methodology
This chapter contains the steps involved in conducting the research and how the approaches to distributional and equity were developed.

Chapter 4: The Existing Appraisal Process for Rural Roads
This section provides an overview of the MRDP Phase 2 including a short technical description as well as an analysis of the existing situation, among others.

Chapter 5: Development of the Approach
This chapter explains the step-by-step process on how the distributional and equity analysis was conducted.

Chapter 6: Application of the Approach: the Case of MRDP 2: Los Arcos-San Lorenzo FMR, Prosperidad, Agusan del Sur
This chapter contains the application of the approach and the results with regard to how road improvement affected the distribution of benefits, i.e., which areas benefited and who gained and who lost.

Chapter 7: Discussion
This chapter provides synthesis of the results in Chapter 6 in relation to the review of literature in Chapter 2.

Chapter 8: Conclusion and Recommendation
This chapter draws conclusions of the entire research along with relevant recommendations.

2. LITERATURE REVIEW

This literature review focused on the extent to which the distributional and equity of the benefits were considered in the appraisal of rural road projects. Particularly, the review was centred on the methods and approaches used in the distributional and equity analysis of the benefits of transport projects, particularly rural roads. An overview of the present situation of distributional analysis and several state-of-the art methods in the appraisal of rural road projects are also included.

The road as a public good can be accessed by anyone regardless of his/her societal status. As discussed earlier, several methods were developed and tested particularly by the World Bank and the ADB. The role of this research was to further develop an approach that could be applied to any rural road project appraisal. The main idea was to combine several methods as well as develop and improve some of the parameters in order to come up with a more specific approach for rural roads.

2.1. Economic Evaluation and Appraisal of Transport Projects

World Bank (2005b) sets the framework for the economic evaluation of transport projects. Chapter 11 of the Handbook on Economic Analysis of Investment Operations (World Bank, 1998) also provides a detailed approach on the economic evaluation of transport projects. Economic evaluation in the transport sector involves the assessment of net worth or net value of projects, which is the difference between the benefits and costs as both measured in monetary terms. The aim of economic evaluation is to determine whether the impact of a particular policy or intervention is socially desirable or not. In addition, economic valuation aims to identify which social groups are benefitting and if a pattern of who gains and who losses exists.

The framework also identified CBA as the main tool for economic evaluation of transport projects. According to the framework, CBA is a good measure because it is timely and cost-effective in relation to the resources at stake. CBA provides evidence on project impacts on the whole as well as individual agents or social groups. It also supports the decision against the key tests of 'social value for money, financial sustainability, and practicability' (World Bank, 2005b).

2.1.1. Appraisal of Rural Transport Infrastructure Projects

The design and appraisal of rural transport infrastructure (RTI) according Lebo and Schelling (2001) involves three key areas: '(1) participatory approaches, i.e. consultation to local government and communities; (2) preparation of community or local transport plan, i.e. survey on the existing obstacles of the local transport networks like road, tracks, paths and footbridges; and (3) selection which consist of combined screening and ranking procedures to reduce the number of alternatives'. The selection process involves targeting of disadvantaged communities based on poverty incidence or eliminating low priority links. Three methods and their recommended applications in the ranking of rural transport projects are used (Lebo & Schelling, 2001):

1. Multi-criteria analysis (MCA) is recommended for projects with a few, relevant and pre-determined cost criteria. This method is participatory but often leads to non-transparent results.

2. Cost-effectiveness analysis (CEA) is appropriate for RTI with less than 50 motorized four-wheeled vehicles per day. In CEA, priority index is defined for each link based on the ratio of the total life-cycle cost and the total population served.

3. Cost-benefit analysis (CBA) is recommended for traffic levels for 50-200 vpd. In transport, this method uses appropriate computer-assisted models like enhanced CBA and Roads Economic Model (RED) while Highway Development Model, Version 4 (HDM-4) for road above 200 vpd.

In the appraisal of rural development projects particularly in the Philippines, the CBA is still the most commonly applied technique.

2.1.2. The CBA-based Methods and Approaches for the Appraisal of Rural Transport Projects

The transport CBA is based on a partial equilibrium (i.e. all users are in perfect competition) and concentrated on the 'primary' impacts of incurred by transport users, operators and government. CBA is calculated based on the following (World Bank, 2005b):

Overall Economic Impact	=	Change in transport user benefits (consumer surplus)	+	Change in system operating costs and revenues (producer Surplus and Government Impacts)	+	Change in costs of externalities (environmental costs, accidents, etc.)	-	Investment costs (including mitigation measures)

2.1.2.1. Characteristics of Rural Road Appraisal

Appraisal of rural road projects as in other transport projects uses the consumer surplus approach. The consumer surplus approach or the change in transport user benefits is the excess of consumers' willingness to pay (WTP) over the cost of a trip or the change in the cost of travel because of improvement in the transport conditions (World Bank, 2005b). The consumer surplus approach according World Bank (2005c) is well established and applied in road investment models like the (HDM4). However, HDM4 is more reliable to higher volume traffic roads (greater than 200 vpd). Hence, it may not be suitable for application to low volume rural roads. This is because, as indicated in TRN-21, appraisal of rural roads (i.e. low volume rural roads) requires a slightly different consideration from other transport projects because of the following characteristics: '(1) The development of the road has a high potential to influence economic development through supply side effects e.g., improved accessibility may lead to changes from subsistence crops to cash crops - or to improvements in health and education leading to more productive work days per year and a better skilled workforce; (2) The majority of the road users will travel using a slow mode i.e., traffic will consist of pedestrians and non-motorised traffic (NMT); (3) Foot traffic (pedestrians and animals), NMTs, and motorised vehicles tend to intermingle in the traffic stream; and, (4) there will generally be periods of disrupted passability during a year' (World Bank, 2005c).

In this regard, a modified and customized approach was developed i.e., the Roads Economic Decision (RED) model specifically for lower traffic and unpaved roads (below 200 vpd). The RED model[4] simplifies the process thereby reducing the input requirements to match with the characteristics of rural roads (Archondo-Callao, 2004). The main difference of the RED with HDM models according to Archondo-Callao (2004) is that, RED considers a constant level of service during the analysis period while the HDM models is more dynamic where roughness of a given road vary over time (deteriorate).

2.1.2.2. Value of Time Savings

TRN-5 indicates that price alone is not an appropriate measure of either the cost of travel or consumers' willingness to pay (WTP) but in terms of the generalized cost (World Bank, 2005b). The generalized cost also includes other components like travel time spent by the individual, access times to public transport, discomfort, perceived safety risk and other elements (World Bank, 2005b). The generalized travel cost entails the cost of travelling from a particular origin and destination through a particular mode. Hence, it varies by type of mode. In practice, the generalized cost is limited to the following impacts: '(1) Time costs (Time in minutes * Value of Time in $/minute); (2) user charges (e.g. fares/tolls); and, (3)operating costs for private vehicles (VOCs), Non-Motorised Traffic (NMT) and pedestrians' (World Bank, 2005b).

[4] The World Bank developed special software called RED to compute for the VOC difference.

Time savings as a component of the generalized costs varies across individuals and dependent on the purpose of the trip. Valuation of time savings is indicated in TRN-15 (World Bank, 2005f). While the World Bank recognizes that time savings are one of the major benefits and very important in the appraisal of transport investments, it was often omitted in transport appraisal because of lack of data particularly in developing countries. Adding to this is the complexity of valuing the time savings particularly in rural areas of developing countries are the following characteristics: '(1) Productive economic activities include task associated with subsistence as well as cash economy; (2) a single trip may be made to fulfil several productive tasks; and (3) many trips are made for a mixture of productive social purposes(World Bank, 2005b).

2.1.2.3. VOC Savings

The estimation of VOC savings are another measure for the direct economic benefits of transport project. As discussed earlier, value of time savings is not included in most appraisals of projects because of lack of data. The VOC savings was used instead. TRN-14 discussed the key issues and the components and sources of operating costs by mode (World Bank, 2005e). Software and models (i.e. HDM-4 and RED) were developed by World Bank to compute for the VOC. The components of the VOC include: 'Fuel, and lubricant consumption, tire wear, **crew time, passenger time**, depreciation and other overhead costs' (Archondo-Callao & Faiz, 1994). The crew time is the number of hours spent in travelling measured in terms of crew cost/hour/km while passenger time is the number of passenger-hours spent in travelling or passenger delay cost measured in passenger time cost/hour/km.

2.2. Social Impact in the Appraisal of Transport

According to Serageldin and Store (1994) as cited in Van Wee (2011) the World Bank introduced the three dimensions economic, environment and equity/social in the 1990s. However, since its introduction, very little attention had been done to effectively incorporate the social dimension into the appraisal process. A lot of attention has gone and still is going into the economic (using CBA) and environment (using EIAs) dimension. Even in Netherlands, equity/social impact is often under-exposed during the appraisal of transport projects even if its importance is very high (Geurs, Boon, & van Wee, 2009).

The main issue however, is that, it is quite difficult to distinguish among the three dimensions in the appraisal of projects because often they are overlapping. This is because social impacts have very broad definition i.e. all impacts to people should be considered. According to Geurs, Boon and Van Wee (2009) economic and social often overlaps, hence, they defined further how these social impacts could be categorized based on human needs (specific for transport projects). The categories mentioned include: '(1)presence of infrastructure; (2) presence of (parked) vehicles; (3) presence of transport facilities; (4)movement of vehicles (traffic); and (5) travel'. In their final conclusion, however, categorization of these impacts is not that most important (Geurs, et al., 2009). The most important is, these social impacts should be included and identified during the appraisal and to avoid double counting. Further steps were then recommended by Geurs, et al. (2009) to identify which indicators are the most important and find methods and ways on how to assess these indicators.

2.3. Accesibility Concepts and Measures in Transport

Van de Walle (2009) noted that one cannot obtain utility directly from the road but indirectly through access to opportunities. Hence, the extent of impacts is dependent on interactions with investments, other social and physical infrastructures, and the geographical community and household characteristics (World Bank, 2005a). Moreover, Donnges et al. (2006) emphasize that the key role of the road is to provide access. Access is only improved if road investments result in positive changes in transport.

Basic access is rated high priority by the poor and very poor (Hettige, 2006). Time and energy saved are very valuable for these groups in order for them to interact with other households within and outside the community. The time saved also offers them to do other activities like engaging in more productive activities like putting-up business, schooling (for children), etc.

2.3.1. Characteristics of Rural Transport

Lebo and Schelling (2001) concluded that interventions in rural transport is seen as an integral part of rural development to counter poverty. It is also seen as a basic input to achieve success in rural livelihood strategies. Hence, efforts should be focused on designing an efficient focusing on the access needs of the community. There are three complementing elements described in Lebo and Schelling (2001) for rural accessibility: '(a) means of transport, (b) location and quality of facilities, and (c) transport infrastructure'. The transport infrastructure described in Lebo & Schelling (2001)as RTI consist of the roads, footpaths and bridges. RTI network is the lowest level of the physical transport chain connecting that connects the rural population to their farms, local markets, and social services, such as schools and health centers. RTI with the minimum level of service is also referred to as basic access usually below 50 vehicles per day (Lebo & Schelling, 2001). Basic access (to rural roads) is commonly viewed as a basic human right (World Bank, 2005c). Therefore, basic access plays a very vital role in the improvement of the economic and social-well being of the community.

2.3.2. Measures of Accessibility in Transport

The most important aspect of accessibility are travel cost, destination, and travel choice (Handy & Niemeier, 1997). This means that accessibility is determined by the spatial distribution of potential destination and ease of access including the quantity, quality, and type of activities. Travelling from one place to another entails cost. This is in terms of time, distance, and monetary cost. These costs were measured during the appraisal of different transport infrastructure investments particularly rural roads and included the CBA as determinant of the economic viability of the project.

Litman (2011b) defined three types of measuring transport, namely: traffic-based measurements, mobility-based measurements, and accessibility-based measurements.

Traffic-based measurements are used to evaluate the movement of motor vehicle (e.g. vehicle trips, traffic speed and roadway level of service). This measure is focused on automobile travel and transportation users such as the passengers and drivers and give little consideration to non-motorize vehicle and users.

Mobility-based measurements are employed to evaluate person and freight movement (e.g. person-miles, door-to-door traffic times and ton-miles. The assumption is that any increase in travel mileage and speed benefits the society. This measure considers mainly the motorized modes and users (both private and public transport) but give little consideration to non-motorized modes and users.

Accessibility-based measurements are utilized to evaluate the ability of people and businesses to reach desired goods, services and activities (e.g. person-trips and generalized travel costs). Hence, this approach involves both motorist and non-motorist.

Litman (2011b) concluded that among the three types, accessibility-based measures are the most appropriate approach to use as it is normally the ultimate goal of transport. Accessibility-based measurements are measured in terms of person trips and generalized travel costs which include time, money, discomfort and risk. Litman (2011a) also mentioned that accessibility is affected by various factors which makes it relatively difficult to measure. These factors include, suitability of locations, the quality and cost of travel options, etc.

2.4. Methods and Approaches for Distributional Analysis of Benefits

The methods and approaches on how to distribute benefits are continuously evolving. From simple methods like social CBA and ADB's approach to distributional analysis to more complex methods like the TEE table, spatial analysis, market analysis, and final impacts. These methods for distributional analysis of benefits were developed and improved throughout the years by agencies like the World Bank and ADB. These methods and some of their applications were discussed in the next sub-chapters.

2.4.1. Social CBA and ADB Distributional Analysis Approach

Social CBA involves adjusting of economic costs and benefits for equity objectives. Cost and benefit flows are adjusted in accordance with policy-makers' value judgements on desirable patterns of income (re)distribution (Division of Macro Sector Policies, 1996). Social CBA although extensively described in various literatures was not used in practice because of theoretical complexity and often associated with severe data problems and the use of weights is often biased towards the policy-makers' income distribution preferences (van Pelt, 1993). Almost a similar approach by the ADB as indicated in their Guidelines of Economic Analysis of Projects (1997) is the distribution of net benefits among beneficiary groups according to their gender and income level.

The ADB (1997) also formulated in their Guidelines some relevant key questions for the distributional analysis of projects:

1. 'Has a distribution analysis been undertaken for the project?
2. 'Have levels of income been projected both without the project and with the project?'
3. 'Has the effect of different levels of charges for goods and services been assessed for operators, customers and government? Has the distribution of costs, especially on the poor, been identified?
4. Has the distribution of benefits, especially to the poor, been identified?'
5. 'What proportion of net benefits will go to poor people?'
6. 'Is the distribution of costs and benefits analyzed by gender?'
7. 'Is there a substantial foreign involvement in investment and operation?'
8. 'Has the proportion of incomes and revenues going to foreign investors, lenders and workers been identified?'

2.4.2. Transport Economic Efficiency (TEE) Table

The TEE Table is the most straightforward approach which entails distribution of benefits across user groups (2005a). The World Bank (2005a) explicitly indicates in their framework (*TRN 5: Framework (Section 4)* that reporting of cost benefit analysis should always include a TEE table. It also sets out the step-by-step guide in the construction of the TEE table. The approach requires that the net project benefits for the economy (economic net present value, or the NPV) be allocated to different groups affected by the project. The mechanism suggested by the ADB (1997) can be expressed in the following way:

$$NPVecon = NPVfin + (NPVecon – NPV fin)$$

where

NPVecon	=	refer to the net present value of economic flows
NPVfin	=	refer to the net present value of financial flows

Net benefits of the project comprise the financial flows including incomings (e.g., revenues, loans, grants, etc.), outgoings (e.g., principal repayment of capital, interest payments, construction and operations, maintenance costs, etc.), and the flows created by divergences between economic and financial prices. The distribution analysis requires the identification of winners and losers from financial transactions as well as the winners and losers from the divergences between economic and financial values. Step 5 for developing a TEE distributional analysis sets out that the distribution of benefits can be categorized in the following (World Bank, 2005a):

1. For general cases – disaggregation is among project entities, workers of the project, consumer of the project outputs, input suppliers, lenders of the project, and the government (representing the rest of the economy);
2. For poverty – by the income levels of the beneficiaries;
3. For gender or ethnic groups – by gender or ethnicity beneficiaries;
4. For spatial subdivisions – by spatial subdivisions; and
5. For international or sub-regional project – by participating countries.

The TEE approach was applied in a project in Tajikistan to look at how the benefits (VOC and time savings) were distributed across four classes of passenger vehicles and three classes of freight vehicles (Gajewski, et al., 2004). The approach, however, only looked at the aggregated distribution of the benefits across these user groups but did not take into consideration the distribution across geographic locations.

2.4.3. Spatial Analysis

One form of spatial analysis assumes that improved transport will be used by people located along routes and along areas through which the routes pass through (World Bank, 2005a). GIS data, zonal population, socio-economic characteristics and measures of zonal accessibility change should be available to make the approach feasible. The main disadvantages are whether the users represent the income of the zonal population, effect of fare policies on the poor, possible displacement of landless poor of the property development in the area. An example of this approach is the work of Barone and Rebelo (2003) which evaluated the impact of the Sao Paulo Metro Line 4 for the Sao Paolo Metropolitan Region in Sao Paolo, Brazil.

Another form of spatial analysis is the display of the users' benefits (arising from operating costs and time savings) by zone for different options along with the per capita income figures, benefits per capita, and benefits per head per capita income (Table 2.1). This method is often suitable in an urban context and in a model-based appraisal. It also requires intensive data.

Table 2.1 Suggested matrix for displaying distribution of benefits

Zone	Zone Population	Average per capita Zonal Income	Total User's Benefits	Benefits per head	Benefits per head per capita Income
N_1	P_1	I_1	B_1	B_1/P_1	$B_1/(P_1{*}\ I_1)$
N_2	P_2	I_2	B_2	B_2/P_2	$B_2/(P_2{*}\ I_2)$
...					
N_n	P_n	I_n	B_n	B_n/P_n	$B_n/(P_n{*}\ I_n)$

Source: TRN-26 of World Bank (2005a)

2.4.4. Market Analysis

Market analysis requires a detailed economic impact type investigation of the study area (World Bank, 2005a). The increases in profits of the beneficiaries of the transport project are not a guarantee that those who travelled or transport their products via the scheme benefited. This method complements with the TEE and with spatial analysis through the conduct of detailed surveys to determine the proportion of benefits that will be passed onto the poor and the proportion of benefits that would be retained by freight operators. This approach was also applied in the Tajikistan project (Gajewski, et al., 2004).

2.4.5. Forecasting Final Impacts

The World Bank (2005a) describes this approach as the most complex. It can be conducted in two approaches: the micro approach and the top-down forecasting approach. The micro approach looks at how the incremental benefits of improved health, education, and agriculture are estimated. This approach needs to be supported with detailed market research e.g., TRN 21: Low Volume Rural Roads (World Bank, 2005c) as applied in a case study dealing with a rural access project in Bhutan. The top-down forecasting makes use of the Land Use Transport Interaction (LUTI) model or the Computable General Equilibrium (CGE) model. The model gives a full representation of the different markets (product, labour, and land) and models the interaction of these markets with transport. However, according to World Bank (2005a), the technique was not fully developed because it requires detailed market research which was too expensive and time consuming and may not be afforded for the appraisal of rural road projects because of limited resources.

2.5. Equity Concepts in Transport Projects

There have been several concepts and definitions of equity in various literatures. In general, equity as defined by Litman (2011a) refers to the fairness in which impacts (benefits and costs) are distributed. The other relevant concepts is seen in the World Bank Development Report (World Bank, 2006) defining equity in two basic principles: equal opportunity and avoidance of absolute deprivation while Jones (2009) expanded this concept to cover the three strong areas of convergence i.e. equal life chances principle; equal concern for people's needs, and meritocracy.

2.5.1. Social Equity

Social equity according to Litman and Brenman (2011) refers to the equitable distribution of impacts (benefits, disadvantages, and costs). According to Litman (2011a), there are three major types of transportation equity: (a) horizontal equity; (b) vertical equity with regard to income and social class; and (c) social equity with regard to mobility, need, and ability.

Horizontal equity refers to the fair distribution of impacts between individuals and groups with equal ability and need. This means that no one should be favoured. Individuals and groups should be treated the same as well as should receive equal shares of resources and bear equal costs.

Vertical equity with regard to income and social class, often called social or environmental justice, refers to equal distribution of impacts between individuals and groups that differ in abilities and needs. This is either by income or social class. Equitable transport policies and projects favour economically and socially disadvantaged groups.

Vertical equity with regard to mobility need and ability differs with item (b) in terms of focus. Item (b) deals with income and social class while item (c) is concerned with people having disability or special constraints.

2.5.2. Geographic/Spatial Equity

Another form of equity is geographic or spatial equity. Geographic or spatial equity as defined by different authors refers to the geographical location of an individual, group, or region affected by a particular project. Thomopoulos et al. (2009) and Stohr and Todtling (1977) defined it as the reduction of disparities of living levels. Talen and Anselin (1998) refer to it as the comparison of the locational distribution of facilities or services to the locational distribution of different socioeconomic groups. Maro (1990) implies the identification of the criteria of "fairness" in the allocation and location of development resources and activities and basic social services. In this regard, spatial equity will mean that aside from geographical considerations, social equity and fairness is also being considered. Theoretically, according to Tsou et al. (2005) spatial equity is an extended form of social equity.

2.6. Measures of Equity

Equity is measured in terms of inequity and inequality. The concept of inequity and inequality coincides as some types of inequality are in fact inequity such as unequal life chances, political inclusion, unequal education coverage, and health inequalities (Jones, 2009). An ideal measure of economic wellbeing for assessing inequality will capture an individual's long-term economic status in terms of his/her current income or consumption as compiled from household survey data (World Bank, 2006). Income or wealth according to Jones (2009) is crucial to understanding equity.

Based on the relationships of equity and inequality discussed above, various measures to quantify inequality can be used to assess equity during the appraisal of projects. These measures were detailed in the following sub-chapters.

2.6.1. Poverty Impact Measures

One of the main considerations of the rural road projects funded under ODA is to help alleviate poverty. The World Bank sets out several measures to study the impact of poverty (see Table 2.2). These kinds of measures aim to evaluate how much proportion of the net gains of the project is accruing to the poor. The most used indicator is the poverty impact ratio (PIR) which has been applied in the evaluation of various rural road projects e.g., Gajewski (2004). The PIR is defined as the sum of all the net benefits going to the poor divided by the total economic benefits which is given by:

$$\text{PIR} = \frac{\text{Benefits to the Poor}}{\text{Total Economic Benefits}}$$

According to the World Bank (2005a), the project has a positive poverty reducing impact if the PIR is greater than the proportion of the population below the poverty.

Table 2.2 Measures of poverty impacts

Method	Description	Suitability
Poverty Impact Ratio (PIR)	A simple ratio that informs whether the project will improve, maintain, or worsen the income gap	Straightforward method utilizing CBA appropriate for a typical transport project
'Coefficients of Income Distribution (CID)'	The CID is computed using 3 alternative indicators: a. CID = Number of low income persons / Total number beneficiaries b. CID = Value of net benefits to low income persons/Economic NPV c. CID = Value of net benefits to low income persons/Economic NPV (net government income)	-do-
'Progressivity' and 'Regressivity'	Detailed analysis on the financial implications of a project. It pays particular concern to the financial impacts of a project on different income groups of society	For analysis of change in policy; requires detailed income distributions
'Method of Rapid Assessment Gains by the Poor in a Workfare Program'	A method that reflects the income generated by the poor from providing labour to an infrastructure project as well the benefit they would receive from the project (once opened)	Applicable for maintenance or construction projects to assess the workfare programmes; dependent on data, resource and time constraints

Source: World Bank (2005a)

2.6.2. Gini-Coefficient of Inequality and Lorenz Curve

Gini coefficient is the most widely used measure which is based on the Lorenz curve (Haughton & Kandkher, 2009). Lorenz curves shows cumulative percentage of households (from poor to rich) on the horizontal axis and the cumulative percentage of expenditure (or income) on the vertical axis (Figure 2.1).

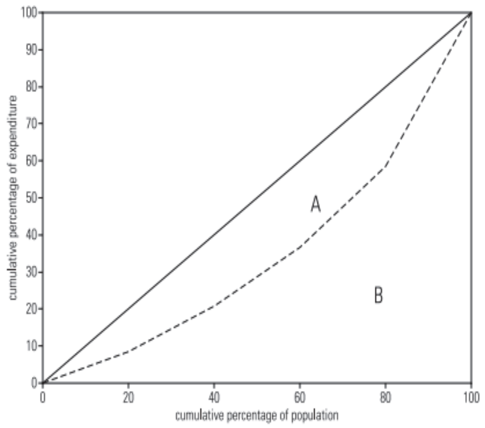

Figure 2.1 Illustration of Lorenz Curve
Source: Haughton and Kandkher (2009)

The Gini coefficient varies between 0, which reflects complete equality, and 1, which indicates complete inequality (one person has all the income or consumption, all others have none). Graphically, the Gini coefficient can be easily represented by the area between the Lorenz curve and the line of equality.

It is sometimes argued that one of the disadvantages of the Gini coefficient is that it is not additive across groups i.e., the total Gini of a society is not equal to the sum of the Ginis for its sub-groups (Haughton & Kandkher, 2009).

The Gini coefficient was computed based on the following formula (Haughton & Kandkher, 2009): Let x_i be a point on the x-axis, and y_i a point on the y-axis. Then:

(1.1) $$Gini = 1 - \sum_{i=1}^{N} (x_i - x_{i-1})(y_i + y_{i-1}).$$

Gini index can also be calculated using the covariance between income levels and the cumulative distribution of income (Bellu, 2006b) given by:

$$G = Cov(y, F(y))\frac{2}{\bar{y}}$$

where *Cov* is the covariance between income levels *y* and the cumulative distribution of the same income *F*(*y*) and $\bar{y}$ is average income. Among the many calculations for Gini indices, covariance was the easiest to manipulate (World Bank, 2011b).

2.6.3. Theil's Index of Inequality

Another form of inequality measure is the Theil's index which is a measure of disorder or deviations from perfect equality(Bellu, 2006a). The Theil's index is less commonly used than the Gini coefficient, but has the advantage of being additive across different subgroups or regions in the country (Haughton & Kandkher, 2009). The other disadvantage according to Bellu (2006a) is that Theil's index cannot be defined when there are zero incomes.

2.6.4. Comparison of Gini and Theil's Index

Both Gini and Theil's index presented can be computed using statistical software packages but can also be computed manually. The Food and Agriculture Organization (FAO) through the Easypol provides the step-by-step process of computing the Gini (Bellu, 2006b) and the Theil's Index (Bellu, 2006a). The Gini coefficient is not entirely satisfactory, thus, Haughton and Kandkher (2009) provide a comparison with six (6) criteria to determine whether a method is a good measure of inequality (Table 2.3). The Theil's method scores a little higher than Gini coefficient in terms of decomposability but overall they are both good measures of inequality.

Table 2.3 Comparison matrix for Gini and Theil's Index

Criteria	Description	Satisfied by	
		Gini	***Theil's***
1. Mean independence	If all incomes were doubled, the measure would not change.	Yes	Yes
2. Population size independence	If the population were to change, the measure of inequality should not change, all else equal.	Yes	Yes
3. Symmetry	If any two people swap incomes, there should be no change in the measure of inequality	Yes	Yes
4. 'Pigou-Dalton Transfer sensitivity'	Under this criterion, the transfer of income from rich to poor reduces measured inequality	Yes	Yes
5. Decomposability	Inequality may be broken down by population groups or income sources or in other dimensions. The Gini index is not easily decomposable or additive across groups. That is, the total Gini of society is not equal to the sum of the Gini coefficients of its subgroups	Not easily	Yes
6. Statistical testability	One should be able to test for the significance of changes in the index over time. This is less of a problem than it used to be because confidence intervals can typically be generated using bootstrap techniques.	Yes	Yes

Source: Haughton & Kandkher (2009)

Despite this strength of both of these indices, according to World Bank (2011a) both the Gini and Theil's have the tendency to vary the distribution regardless if the change occurs from the poor or rich income groups. Hence, these might not be applicable when the society is more concerned only on the share of the poor.

2.6.5. Coefficient of Variation

In most statistical books, the coefficient of variation (CV) is used to know the consistency or uniformity in the values of the data or distribution of the data. The distribution with a smaller CV is more consistent. The coefficient of variation is computed by dividing the standard deviation from its mean with value ranging from zero to 1 or can be expressed in percentages. The CV is expressed as follows:

$$CV = \frac{\sigma}{\mu}$$

Where CV is the coefficient of variation, σ is the standard deviation for all locations and μ is the mean for all locations. The CV was used by Khanna (2009) to measure the horizontal social equity and the geographic equity.

2.6.6. Standard scores or Z-scores

The z-score was used by Khanna (2009) to measure geographic equity since the CV cannot be decomposed across spatial units. The z-score was computed for both the average income per HH which represents the *without* project scenario and the average benefits per HH for the *with* project scenario. The difference between the z-scores was used to identify the varying intensity of gains for each spatial location.

The z-score is a normalized value that has a mean of 0 and standard deviation of 1 which value ranges from -1.96 to +1.96 in order to compare two different datasets with different means and standard deviations (Field, 2009). A z-score is calculated using the following formula:

$$z_i = \frac{X_i - \mu}{\sigma}$$

where z_i is the z-score for *i*th location, X_i is the value of the *i*th location, μ is the population mean for all locations, and σ is the standard deviation. A classification of gainers and losers developed by Khanna (Table 2.4).

Table 2.4 Classification of gainers and losers from the BRTS project

Gainers (+Δz) i.e. $z_b > z_i$	**Losers (-Δz) i.e. $z_b < z_i$**
1) When $z_b > 0$ and $z_i > 0$ (+ to +)	1) When $z_b > 0$ and $z_i > 0$ (+ to +)
2) When $z_b > 0$ and $z_i < 0$ (- to +)	2) When $z_b > 0$ and $z_i < 0$ (+ to -)
3) When $z_b < 0$ and $z_i < 0$ (- to -)	3) When $z_b < 0$ and $z_i < 0$ (- to -)

where: z_b is the z-score for average benefits per HH and z_i is the z-score for average income per HH
Source: Khanna (2009) p. 70

2.7. Summary of the Method for Distributional and Equity Analysis

2.7.1. Distributional Analysis

Table 2.5 provides the summary of description, and advantages and disadvantages of the different methods of distributional analysis. The review found out that most of the methods were dependent on the type and quality of data available. Some methods require intensive and complex data while others may require simple data and is available and can be easily acquired. The current researches also show the possibility of combining several methods and tools in order to come up with a specific approach for distributional as well as equity analysis.

Table 2.5 Summary description, advantages and disadvantages of the different methods of distributional analysis

Method	Description	Advantages	Disadvantages
Social CBA	Both measured in intratemporal equity (e.g. assign weights to different income from richer or poorer groups or areas and intertemporal equity (savings is valued higher than income)	Largely described in various literatures	The use of quantitative weights is biased towards the policy-makers' income distribution preferences
Transport Economic Efficiency (TEE) Table	Presentation of cost-benefit analysis by impact group (e.g., users, operators, government)	Requires no more information than is required for the economic appraisal itself	Does not look into the disaggregation across spatial units
Spatial Analysis	Analysis of the TEE benefits at a spatial level, i. e. which population areas benefit from the improvement and what are the population characteristics of those areas	Presents the disaggregated benefits across spatial units	Requires additional information other than the economic appraisal itself; requires intensive data
Market Analysis	Supports TEE and/or spatial analysis; analysis of competitiveness and structure of different market segments (e.g., land market, freight sector) with the objective of considering the propensity of the TEE benefits to be retained by the travellers	Support other approaches like TEE, spatial analysis and Forecasting Final Impacts	Requires detailed investigation/survey of the economic impact
Forecasting Final Impacts	Detailed multi-sectoral model that allows the tracing of transport benefits to the final impacts (e.g., changes in wages, prices, land rents)	Evaluation of economic impacts is both at the micro- and macro- approach	Complex and requires extensive surveys; the approach is not yet fully developed

Source: Summarized by the author based on World Bank (2005a)

2.7.2. Equity Analysis

The approaches and methods that were already developed are flexible and can be accommodated within the context of rural road equity assessment both in theory and in practice as exemplified by the works of Khanna (2009), and Gajewski, et al. (2004). Moreover, Litman (2011a) noted that there was no standard or single measure of equity. Equity evaluation is dependent on the type of equity, categories of people, and how impacts are considered and measured. In addition, van Wee (2011) pointed out that equity could be explicitly included in ex ante evaluations (appraisal) using measures. Table 2.6 presents the summary of the measures of equity. On the other hand, Van Wee and Geurs (2011) suggested that certain norms should be included considering that equity is a complex issue and could be subject to various interpretations.

Table 2.6 Summary of the measures of equity

EQUITY FORMS	MEASURES	REMARKS
1. Vertical Equity with respect to income groups	• Gini index and Lorenz curve • Theil's index	Considering the decomposability of Gini index amongst groups, the Theil's index was used. However, the Gini and the Theil's index could not be comparable.
2. Horizontal equity	• CV • Theil's Index	The CV measures equity across sub-groups (income classification) which the Theil's index failed to measure.
3. Geographic equity	• CV • z-score	The CV cannot be further decomposed across spatial units, hence, z-scores were used to measure equity across spatial locations.

Source: Summarized by author based on Khanna (2009)

2.8. Distribution, Equity and Accessibility: Some Relevance and Issues

While Litman (2011b) concluded that accessibility-based measures are the most appropriate approach and one of the ultimate goal of transport, according to Van Wee and Geurs (2011) accessibility-based measures is not commonly used in CBA-based *ex-ante* evaluation except for the monetary benefits expressed in value of time savings. Moreover, only few researches have been conducted specifically on distribution of accessibility changes across income class and regions (locations) which this research is aiming.

On the other hand, recent study by Van Wee and Geurs (2011) concluded that distribution and equity were poorly addressed in CBA-based appraisal of transport projects. They however recognize that inclusion of equity into the process, adds more value to the existing utilitarian-based perspective (i.e. CBA-based appraisal). According to these authors, in dealing with distribution and equity, one must not only need to consider money as there are other factors that should be considered like environmental pressure, travel time and accessibility.

2.9. Summary

This chapter describes the existing methods of transport project appraisal particularly rural roads. It also describes the different concepts and methods for accessibility, distributional and equity analysis which serves as guide in the development of an approach towards integrating these methods and approaches into the appraisal of rural road projects. The approach was developed in the context of combining these methods and concepts described in this chapter and match this with the unique characteristics of appraisal for rural roads. The detailed approach was described in Chapter 5.

3. RESEARCH METHODOLOGY

Figure 3.1 shows the step-by-step process in achieving the objectives and research questions set out in this research. This includes an overview of the existing appraisal process and description of the case under study in Chapter 4 focusing on how distribution and equity is being considered and can be integrated into the appraisal of rural road projects. It also include a review of the concepts and state-of-art approaches for distributional and equity analysis which is described in Chapter 2. This lead to the development of a specific approach of how to integrate distributional and equity analysis into the appraisal of rural roads in Chapter 5. The approach was tested in Chapter 6 to a specific rural road project funded by World Bank in Mindanao to identify the advantages and limitations of the approach.

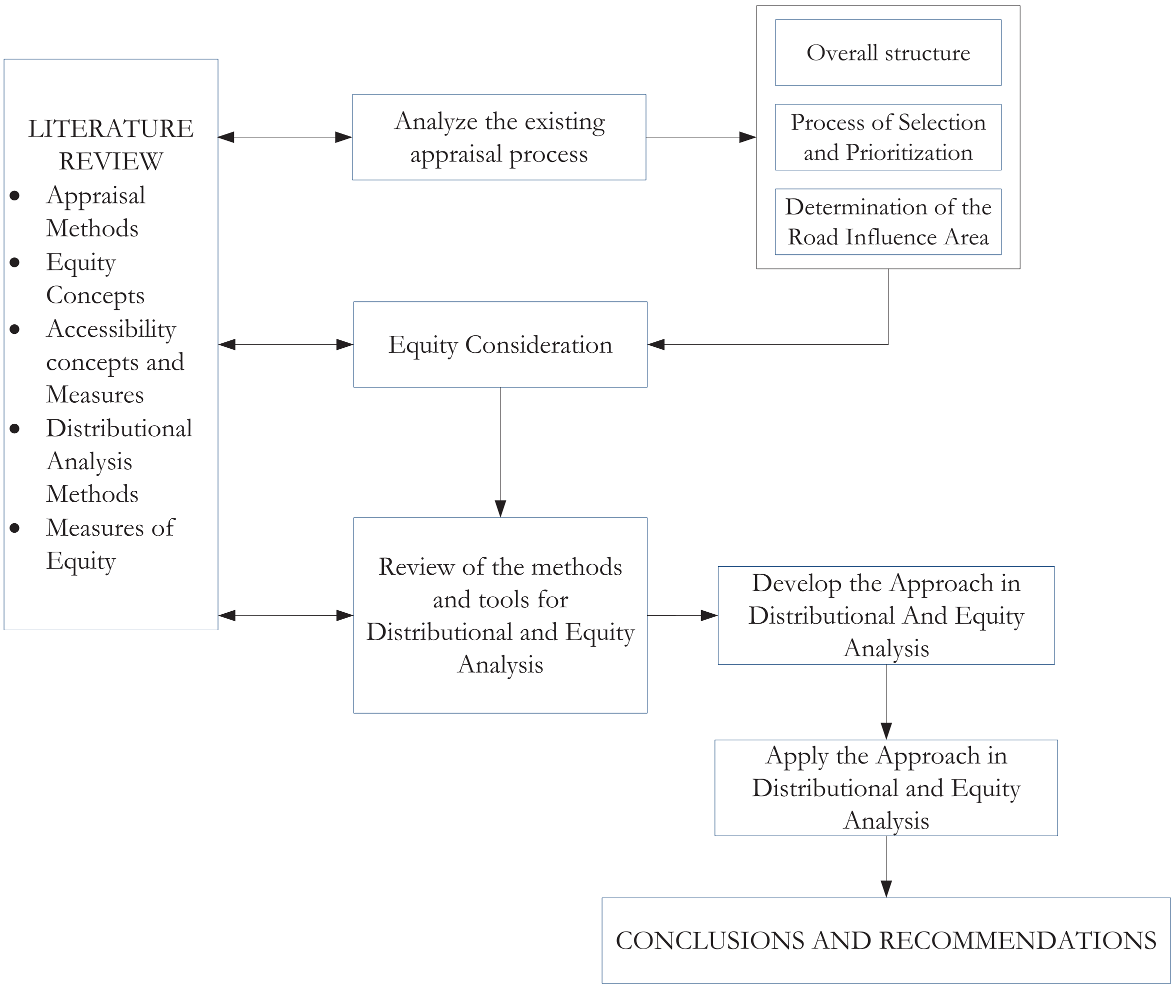

Figure 3.1.Research Methodology

3.1. Research Methodology

This section provides the information on how the case study was selected as well as how the approach described in Chapter 4 was developed.

3.1.1. Selection of the Case Study

In the selection of the case study, a meeting was convened with the Rural Infrastructure group of the MRDP 2 Regional Project Coordination Office (RPCO) in order to choose the areas to be visited. Priority was given to the project sites with the following: (1) Already completed and turned over road projects so that initial impacts could be captured;)(2) areas with high incidence of poverty; and, (3) roads with at least 4km road length so that more areas (*puroks*) were covered.

In addition, accessibility and security of the project sites to be visited were also considered. Out of the total 10 completed projects in Agusan del Sur, two projects were initially identified based on the above criteria. These are: (1) Rehabilitation of **5.15 km of Los Arcos-San Lorenzo FMR,** Prosperidad, Agusan del Sur; and (2) Rehabilitation of **4.04km Lateral G – New Visayas FMR**, Libertad Bunawan Agusan del Sur.

However, during the field visit, we decided to visit two more sites in Esperanza which are close to each other and near to the areas visited. The additional two rural road projects visited were the following: (1)Rehabilitation of **1.5341km Bentahon-Mahagkot FMR,** Esperanza, Agusan del Sur; (2) Rehabilitation of **2.0 km Cubo-Poblacion FMR,** Esperanza, Agusan del Sur

During the analysis, it was finally decided to focus only on one rural road project (**5.15 km of Los Arcos-San Lorenzo road)** due to time limitations and lack of spatial data (i.e., road network and *purok* boundaries) including community-based monitoring survey (CBMS)[5] data at the household (HH) level.

3.1.2. Development of the Approach for Distributional and Equity Analysis

In the development of the approach, a literature review was done, focusing on the approaches conducted by the ADB and the World Bank. The literature review was further complemented with interviews with key stakeholders. Questions regarding how the existing appraisal was conducted and how distributional and equity analysis could be further integrated into the appraisal process were addressed. Review of relevant documents like the MRDP RI Operations Manual (2011) was also done. Discussions were also conducted with the municipal staff to identify the preparation process and validate some of the parameters in the original CBA including identification of the social groupings. Likewise, discussion with the technical staff (project appraisal team from the Sub-PCO) was also conducted to have deeper insight on the assumptions and parameters included in the computation of the economic benefits and how these roads were being evaluated. Finally, a focus group discussion (FGD) was conducted for the target beneficiaries composed mainly of barangay[6] officials including some household heads to further validate some of the parameters and determine the actual impact of the road projects. Most of the assumptions came from the FGD including secondary data gathered from different sources (see list in the next section).

3.2. Data Collection and Fieldwork

The data, data quality and limitation as well as the process of data collection and processing was described in this section.

3.2.1. Data, Data Collection and Processing

The data collected were composed of primary and secondary data. Primary data collected came mainly from interviews with the key stakeholders: World Bank, DA, NEDA Central Office, NEDA Regional Office, MRDP PCO, MRDP SPCO and the key members of the RPAB in Caraga, namely: the NCIP,

[5] The CBMS is an organized process of data collection and processing at the local level and of integration of data in local planning, program implementation and impact-monitoring. It has several: (a) LGU-based while promoting community participation; (b) taps existing LGU personnel and community volunteers as monitors; (c) has a core set of 14 indicators; (d) involves complete enumeration of all households; and (e) establish databanks at all geopolitical levels (CBMS Network Coordinating Team, 2002).

[6] is similar to village, district or ward and it is the smallest administrative division in the Philippines. Municipalities and cities are composed of barangays and further subdivided into smaller areas called *purok* or *sitio* or zones.

Provincial representative of Agusan del Sur and the RPAB Chairman (represented by the head of the SPCO). The guiding interview questions for these stakeholders are included in Appendix 3. The questionnaire captures the current situation of the appraisal process and how equity is being considered in the appraisal of rural roads. FGDs were also conducted with key beneficiaries composed mainly of barangay officials, including some members of their households. Another set of guiding questions was developed in order to determine and identify the impacts as well as some of the parameters to be used in the development of the approach (Appendix 4).

GPS coordinates of each rural road were taken and downloaded to Google earth and were shown during the focus group discussion to further validate the road influence areas and the population served. The Google earth image was not a high resolution image but it helped (to some extent) during the validation of the location of the built-up areas because the bodies of water are visible and the extent of the build-up areas can be identified.

Several secondary data and document from various sources were collected but only the following were used: (1) MRDP RI Operations Manual (2011) detailing the process of evaluation and approval; (2) Selected feasibility studies (of completed projects); (3) Community-based monitoring system (CBMS) data for 2009 (Household level) by *purok* for all barangays covered by the road projects in MS Excel format. Income, poverty, and other indicators were included (source: Provincial Statistics Office); CBMS Municipal level summary – in MS PowerPoint format (tables and graphs); Maps (Shape files: barangay boundary, existing land use, river and road network provided by the provincial office, municipal boundaries (in jpeg format); Barangay and *purok* boundaries (scanned maps) and GPS data of all rural road projects and barangay centers.

All data were checked for consistency and quality. The processing of spatial data was done through GIS. Statistical analysis tools like Microsoft Excel and SPSS were used in the analysis of all the statistical data collected.

3.2.2. Data Quality

The maps and other geographic data collected were obtained from different sources, thereby affecting the quality and consistency of data. For instance, the slight variations in the area boundaries of the *purok* maps were reconciled by georeferencing and digitizing the said paper maps.

3.2.3. Data Limitation

During the FGD, the Google earth image shown during the discussion was not a high resolution image (see Figure 3.2b). This resulted to some difficulty in the identification of the built-up areas (location of households) and farms within the road influence area. The ideal google image resolution is Figure 3.2a where the farm areas, including the built-up areas can be easily recognized.

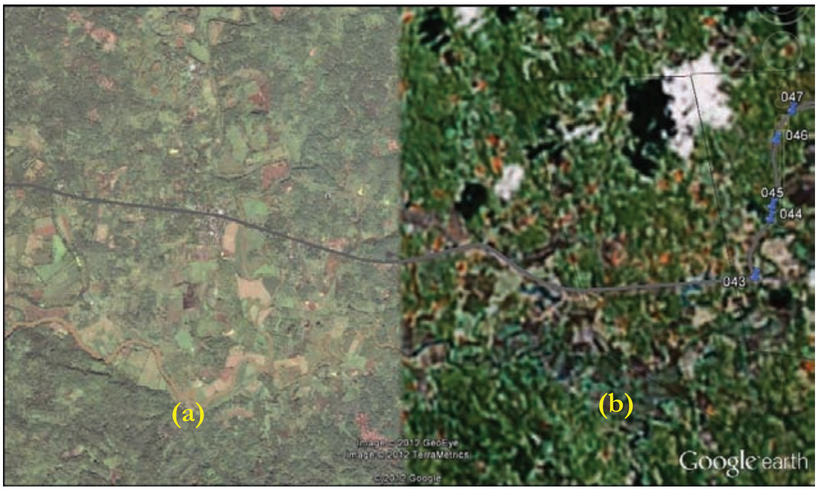

Figure 3.2 A comparison of a google earth image of Prosperidad (a) higher resolution image (b) lower resolution image
Source: Google earth

Maps were released after the actual site visit pending approval from the chief executive. They were still reconciling all the maps due to boundary conflicts with Compostela Valley which was a newly created province from the other Region (Region 11). Therefore validation was not properly conducted. Hence, the location of the built-up areas may have some slight accuracy problems.

3.3. Summary

This section set out the methods on how to go about the research. The case study selection was done with the RI group of the MRDP Sub-PCO through a set of criteria. Out of the 10 completed projects, two project sites were initially identified and visited but two additional sites were included during the fieldwork. In the end, only one project site were included due to lack of time and data particularly on spatial information and CBMS data. In developing the approach, a literature review was conducted. It was further complemented by the FGDs with beneficiaries and discussion with MRDP and municipal staff including interviews with key stakeholders as well as review of relevant documents. Primary and secondary data were also collected from various sources using an interview guide questions. All the data collected were checked for quality and consistency.

The approach of the actual development and integration of the distributional analysis within the appraisal process is further elaborated and discussed in chapter 5.

4. THE EXISTING APPRAISAL PROCESS FOR RURAL ROADS

The case project selected came from the Mindanao Rural Development Project-Phase2 (MRDP 2), a poverty alleviation project covering 225 municipalities in the Mindanao Region. MRDP 2 project started its implementation in 2007[7] and aims to further improve rural incomes and achieve food security through the provision of agri-fisheries infrastructure, livelihood enterprises and environmental and biodiversity conservation projects. Rural roads or FMRs constitutes around 74% of the total rural infrastructure allocations which is one of the main components of the program. The other rural infrastructure projects include the provision of communal irrigation systems (CIS) and potable water supply (PWS) and other agriculture and post-harvest facilities.

Due to time and budget constraints, the study only focused on one province in the Caraga Region, namely Agusan del Sur. Agusan del Sur was chosen because it continues to be the province with the highest incidence of poverty (51.2%) in the whole country (National Statistical Coordination Board, 2009). Agusan del Sur ranks as the fourth largest province in the Philippines with approximate area of 8,965.50 sq.km (ADS, 2010). As of 2007, Agusan del Sur has a total population 609,444 people. It is inhabited by different ethnic groups like Higaonon, Mamanwas, Talandig, Banwaon, Manobo and migrants from Visayas regions (Cebuanos). Agusan del Sur is often visited by typhoon which somewhat contributed to the poverty situation in the area. The province has 13 municipalities and one city (Bayugan). The project case area is situated in the municipality of Prosperidad where the seat of the Provincial government was also located. Prosperidad is a second class municipality with a total land area of 592.79 sq.km.(source: NSO, Agusan del Sur).

4.1. Analysis of the Existing Appraisal Process

This section provides an overview of how the existing appraisal process of the MRDP2 project was being conducted. The overall structure as well as the selection and prioritization process was described including how the road influence area was being considered. Te review of the RI Operations Manual and interview with the key stakeholders like the World Bank, NCIP, Provincial Government, NEDA, and DA and MRDP were conducted to determine the strength and weaknesses of the existing appraisal process and how equity is being considered.

4.1.1. Overall Structure

The overall implementation structure of Mindanao Rural Development Project Phase 2 (MRDP 2) from national to regional, provincial and down to the municipal level is seen in Appendix 1. In the case of the MRDP 2, the appraisal and approval of proposed subprojects below US$300,000 or PhP 15M (most rural road projects are within this category) at the regional level is being conducted by the Regional Project Coordination Board through the Regional Proejct Advisory Board. The RPAB was composed of the Regional Executive Director of the Department of Agriculture as Chair and the following as members, namely: representative from each covered Province within the region, Department of Environment and Natural Resources (DENR) Regional Executive Director, Regional Director of Bureau of Fisheries and Aquatic Resource (BFAR) and National Commission of Indigenous People (NCIP) Regional Director, and Regional Agriculture and Fishery Council (RAFC) Chair.

The subproject development process has several phases. These are detailed in Table 4.1.

[7] Full implementation commence only in 2009.

Table 4.1 The subproject development phases and responsible entities

Phase	Particulars	Responsible Entity
1	Subproject identification	LGU/Beneficiary-community
2	Validation	DA-RFU & PSO
3	Feasibility study	LGU
4	Appraisal	DA-RFU & PSO
5	Detailed engineering (field survey, design, drawings, specifications, program of work)	LGU
6	Review, evaluation and approval	DA-RFU & PSO
7	Implementation	LGU
8	Operation and Maintenance (O&M)	LGU/Beneficiary-community

(Source: MRDP RI Operations Manual (2011)

4.1.2. The Process of Selection and Prioritization

This research delves into the first four phases of project development. A two-stage appraisal process is being employed. The first stage is characterized by screening for the eligible subprojects wherein municipalities are invited by the RPCO to submit a letter of intent (LOI) which must then be validated by the RPCO whether it complies with the following criteria (MRDP RI Operations Manual (2011), pp. 29-30): '(1) must link to an existing all-weather road; (2) must be a vital link to existing or potential key production areas of target municipalities; (3) roads must have sufficient traffic; (4) proposed barangay/farm-to-market roads shall have a minimum of 20 vehicles per day (vpd), where pedestrians and other transport vehicles may be converted to equivalent pcu; (5) unit costs shall not exceed PhP 2,500,000/km for the rehabilitation of barangay/farm-to-market roads, and PhP 3,500,000/km for new barangay/farm-to-market roads. LGUs with lower road unit costs may be granted longer lengths of proposed road works; and including lined canal and cross-drainage; (6) if necessary, proposed roads must not be currently covered by other local or foreign funding sources; (7) must be included in the barangay development plan; (8)right-of-way (ROW) is not a problem. ROW cost shall not be included under loan funding; (9) in the case of new road openings, necessary clearances approved by the DENR must be secured; (10) the location of new road openings shall be such that the cutting of big trees will be avoided or if this cannot be avoided, any such cutting of big trees shall be in conformity and in accordance to rules, regulations, and policies of DENR-FMB; and, (11) where new road openings encroach on areas with IPs/lands with Ancestral Domain Claims, the free and prior informed consent (FPIC) of the IPs must be obtained through the NCIP.'

In addition, the selection criteria for the identification of FMRs were based on the following principles MRDP RI Operations Manual (2011): '(1) the proposed subproject shall be selected through community consensus based on informed decision-making done after taking various technical options related to poor access; (2) the community's choice shall be based mainly on expected benefits, e.g., expected reduction in transport costs, potential increase in production and economic activities and entry of basic services; (3) the barangay and the community understand its roles and responsibilities, such as providing equity counterpart contribution in cash or in kind and funds for operation and maintenance.'

Accordingly, based on the interview with the municipal staff, selection of study area was based on the following: resolution from the barangay captain; has not been a recipient of any rural development program from any funding institution or has not availed any similar projects from the government; high potential for agricultural development e.g. high potential agricultural areas; barangays with high number of inhabitants (so that more people will benefit from the project); and high incidence of poverty.

The second stage process is linked with the preparation of a Feasibility Study (2009) and appraisal of the same by the RPAB. The general criteria include the following (MRDP2, 2011): '(1) proposed subprojects shall generate an economic internal rate of return of at least 15% as reflected in the original CBA; (2) financial capability of LGU to provide the required equity contribution in cash and in kind; technical capability of LGU to prepare the detailed engineering design, drawings and program of work; and, (2) technical capability of LGU to manage the implementation of a given number of sub-projects simultaneously in a given year.'

Based on the interview with various stakeholders, the existing appraisal process shows a semblance of equity by targeting the poorest areas from the regional, provincial, municipal, and subproject level. However, the stakeholders also recognize that the existing appraisal process could be further improved. The strength of the existing process is that, it ensures that the project submitted has an impact on the beneficiaries through the CBA. However, the focus of the approach is more on efficiency but not on equity. Also, the existing appraisal process, specifically the original CBA, only shows the aggregate impacts or net benefits from the road but do not show how these benefits are distributed across the target groups and across spatial units. The other weakness identified is on data collection either because of lack of human resources or financial resources to conduct survey therefore most of the assumptions were taken through FGD. The strength of the analysis is dependent on the type and reliability of data collected. Household income and other socio-economic data in most cases are lacking.

Consideration of equity is most important from the perspective of the provincial government while at the side of the DA is more on efficiency but it has been a policy that majority of the projects should be directed towards improving the poverty situation. Accordingly, the province endorses the projects where there are more poor households that are being served. The approach to further distribute the net economic benefits and assess whether equity is achieved is a welcome improvement for the existing appraisal process. This can provide additional information which could further aid in the evaluation of rural development projects particularly for rural roads. However, the stakeholders particularly the NEDA cautioned that additional information could lead to more data collection. Hence, more resources are needed which is often a problem in the adoption of some methods and approaches in most appraisal process.

The main priority concern as mentioned during the interview with key stakeholders was to determine how the road improvement project helps in improving the poverty situation in the area. Hence, information on poverty incidence in each of the target area was used during the selection and prioritization. The World Bank as included in their policy also mentioned that at least 30% of the beneficiaries should belong to the disadvantaged groups (i.e. women and IPs). The NCIP also wants to ensure that welfare of the IPs should be protected. On the other hand, social aspects are being dealt with based on inclusion of Social safeguards which is mainly for the compensation of the displaced persons (DP) due to the road project and encroachments on ICC/IP areas and lands with Ancestral Domain that requires free and prior informed consent (FPIC) obtained through the NCIP (MRDP2, 2011). The environmental safeguards as described in particular, the Environment Management Plan (EMP) shall be prepared and included in the feasibility study before implementation.

4.1.3. Identification of Road Influence Area and Population Served

The road influence areas identified in the Feasibility Study (2009) were the two barangays, San Lorenzo and Los Arcos with an estimated road influence area of 6,176 ha and a total population of 3,852 or 747 households. However, during the validation of the actual road influence areas, all the eight (8) *puroks* in San Lorenzo were using the road while only two *puroks* (*Purok* 8 and *Purok* 9) in Los Arcos were close to the rehabilitated road project.

4.2. Description of the Rural Road: The Case of Los Arcos-San Lorenzo FMR

4.2.1. Location and Description

The road project covers two barangays of Los Arcos and San Lorenzo in Prosperidad, Agusan del Sur. This involves rehabilitation of existing 5.15 kilometers of barangay roads (Figure 4.1). San Lorenzo is geographically located between 125^{0}56’30” to 126^{0}00’30”N (latitude) and 8^{0}38’45” to 8^{0}39’00”E (longitude), while Los Arcos is geographically located between 125^{0}57’30” to 125^{0}60’00” N (latitude) and 8^{0}39’00” to 8^{0}38’00” E (longitude) (Municipality of Prosperidad, 2009).

4.2.2. Land Area Land Use and Administrative Units

The total land area for San Lorenzo is 3,166 ha. covering eight (8) *puroks* while Los Arcos has a total land area of 3,010 ha. and nine (9) *puroks* (Municipality of Prosperidad, 2009). In terms of land use, the areas covered are predominantly timberland, agriculture and built-up areas.

During the discussion, only *Puroks* 8 and 9 in Los Arcos were covered by the road project. Hence, there were 10 *puroks* covered in total. Figure 4.1 shows the location of the study area and Figure 4.2 shows a map of the study area with the different administrative units covered including the built-up area centroids and *purok* centroids (representation of the location of the farms).

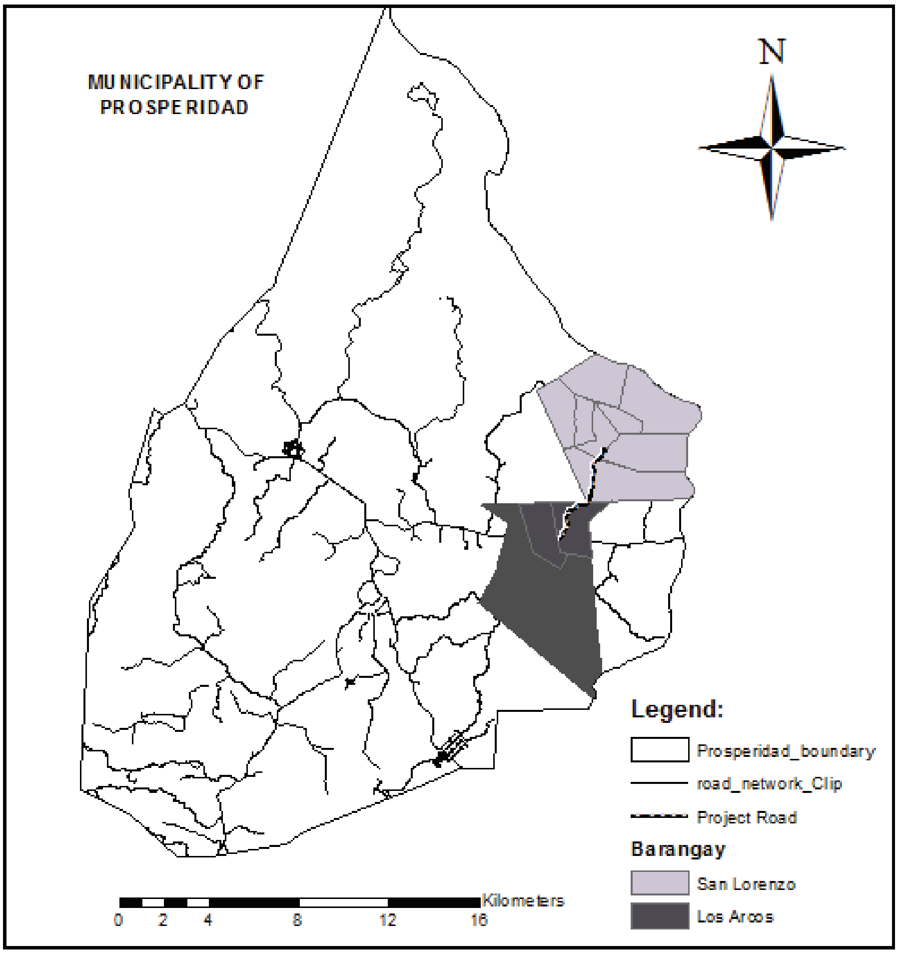

Figure 4.1 The municipal map of Prosperidad showing the location of the study area
Source: Municipal Agriculture Office

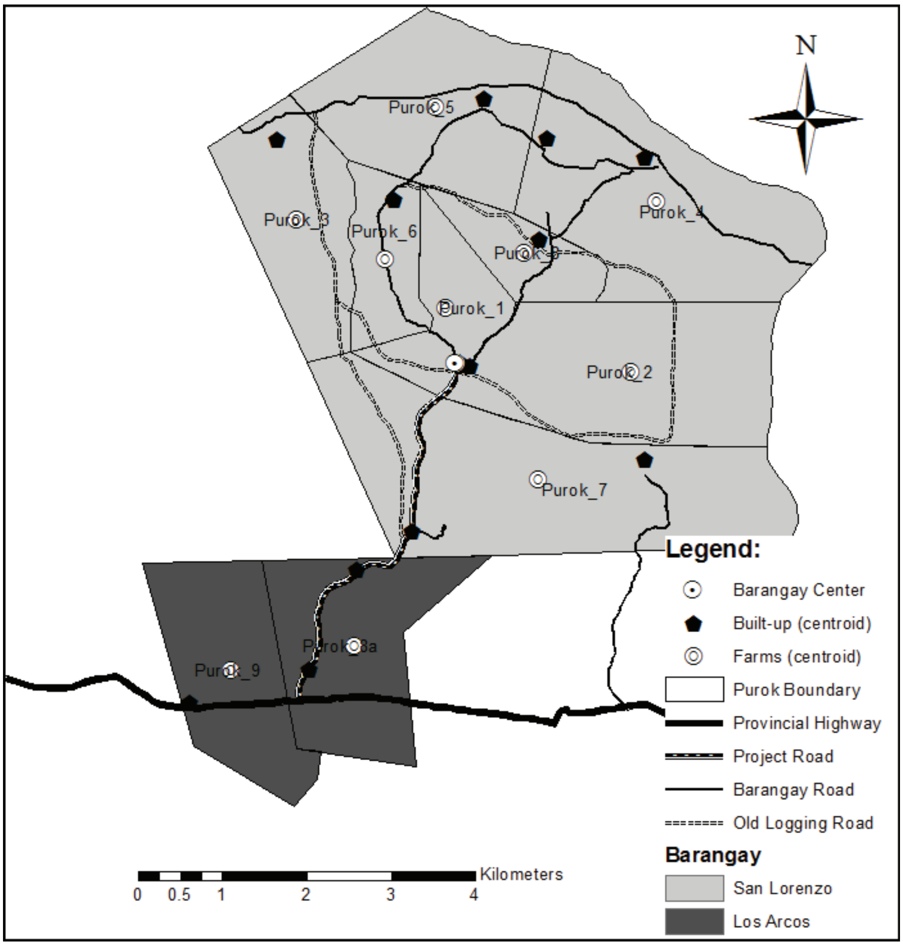

Figure 4.2 A map of the study area

(Main source of data: Agusan del Sur provincial office and Prosperidad municipal planning office)

4.2.3. Economic Activities and Sources of Income

Household income of residents mainly come from farming and non-farm activities like wholesale and retail, market vending, small business (e.g., sari-sari stores). Others were engaged in farm labor and forestry (Municipality of Prosperidad, 2009). For those who were engaged in farming, predominant crops grown are corn, banana, rootcrops, and vegetables.

4.2.4. Sociodemographic Characteristics

This section provides an analysis of the existing situation in terms of the characteristics of the population and social group, income and poverty situation and characteristics of road users in the study area. Spatial distribution analyses of these characteristics were also carried out.

4.2.4.1. Population and Population Density

The total population in the project area was 1,767. The population ranges from 75 to 416 across *puroks*. The most populated are in *Puro*k 1 (416 people) and 8 (347 people). In terms of population density, *Purok* 1 was the most densely populated with 227 people/sq.km. (Figure 4.3). This was where the barangay centers, elementary schools and majority of the businesses and sari-sari stores were located.

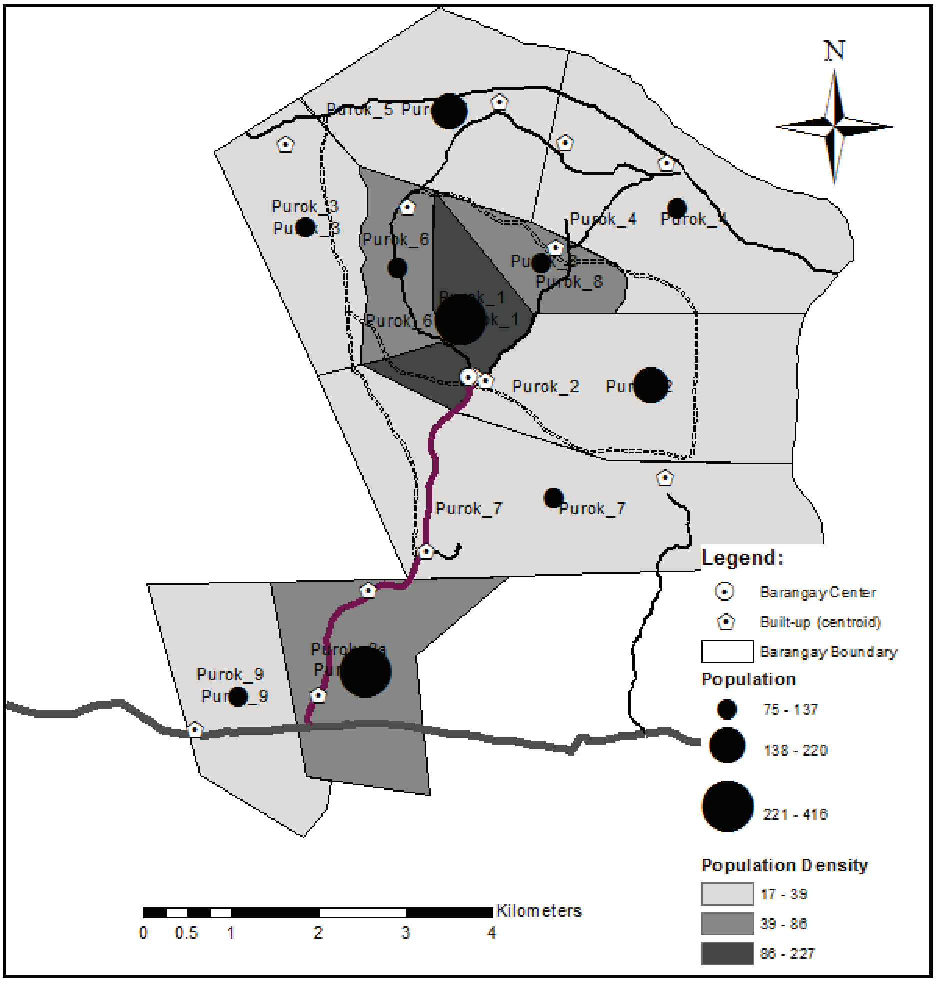

Figure 4.3 Map showing the population density (in people/km^2) across *puroks*

4.2.4.2. Social Groupings

During the discussion with key stakeholders three main social groupings were identified: income status, gender and ethnic groups. Income was classified during the discussion with key stakeholders into: ultra-poor (per capita income < PhP9,000); poor (per capita income <PhP15,000); and better-off (per capita income > PhP 15,000).

Table 4.2 shows the distribution of the social groups (income status, gender and ethnic group) by barangay. The better-off households constituted around 40% while poor and ultra-poor constituted about 33% and 27%, respectively. In terms of gender, the male population was 2% higher (51%) than the female population (49%). The ethnic group constituted around 20% of the whole households in the target area. The ethnic groups were mixed tribes. Majority of the households in both barangays derived their sources from farming while the other sources of income included tree farming and off-farm sources like sari-sari store, wholesale and retail, and manufacturing activities (Municipality of Prosperidad, 2009).

Table 4.2 Distribution of households per income class, gender and ethnic group across *puroks*

BARANGAY	INCOME CLASS (%)			GENDER (%)		ETHNIC (%)	
	Ultra-poor	*Poor*	*Better-off*	*Male*	*Female*	*Indigenous Peoples*	*Non-IP*
Los Arcos	**11**	**27**	**62**	**50**	**50**	**13**	**87**
Purok 8a	11	21	68	50	50	16	84
Purok 9	11	46	43	52	48	5	95

BARANGAY	INCOME CLASS (%)			GENDER (%)		ETHNIC (%)	
	Ultra-poor	*Poor*	*Better-off*	*Male*	*Female*	*Indigenous Peoples*	*Non-IP*
San Lorenzo	**33**	**35**	**31**	**52**	**48**	**23**	**77**
Purok 1	31	44	25	51	49	33	67
Purok 2	32	27	41	50	50	27	73
Purok 3	43	29	29	43	57	8	92
Purok 4	32	28	40	58	43	13	88
Purok 5	24	36	39	56	44	3	97
Purok 6	29	43	29	56	44	8	92
Purok 7	52	24	24	50	50	47	53
Purok 8	40	33	27	52	48	2	98
TOTAL	**27**	**33**	**40**	**51**	**49**	**20**	**80**

Source: CBMS data

Appendix 2 shows the distribution of HH by income class across *puroks*. The highest number of ultra-poor households are located in *Puroks* 3, 7 and 8 (Appendix 2a). The Poor households on the other hand are highest in *Puroks* 1, 6 and 9 (Appendix 2b) while the Better-off households are located in *Purok* 8a (Appendix 2c).

4.2.4.3. Distribution by Poverty Incidence and Income

The 2009 CBMS data showed that poverty incidence (people living below the poverty line) ranged from a low of 32% to a high rate of 76% while income ranged from PhP49T to PhP109T per household per year. In terms of distribution, the *puroks* that were located along the South to Northwest side of San Lorenzo exhibited a very high incidence of poverty and low income (Figure 4.4). As such, majority of these poor areas were located along or near the proposed project. It is also interesting to note that *Purok* 1, being the center of commercial activities was among the lowest income areas.

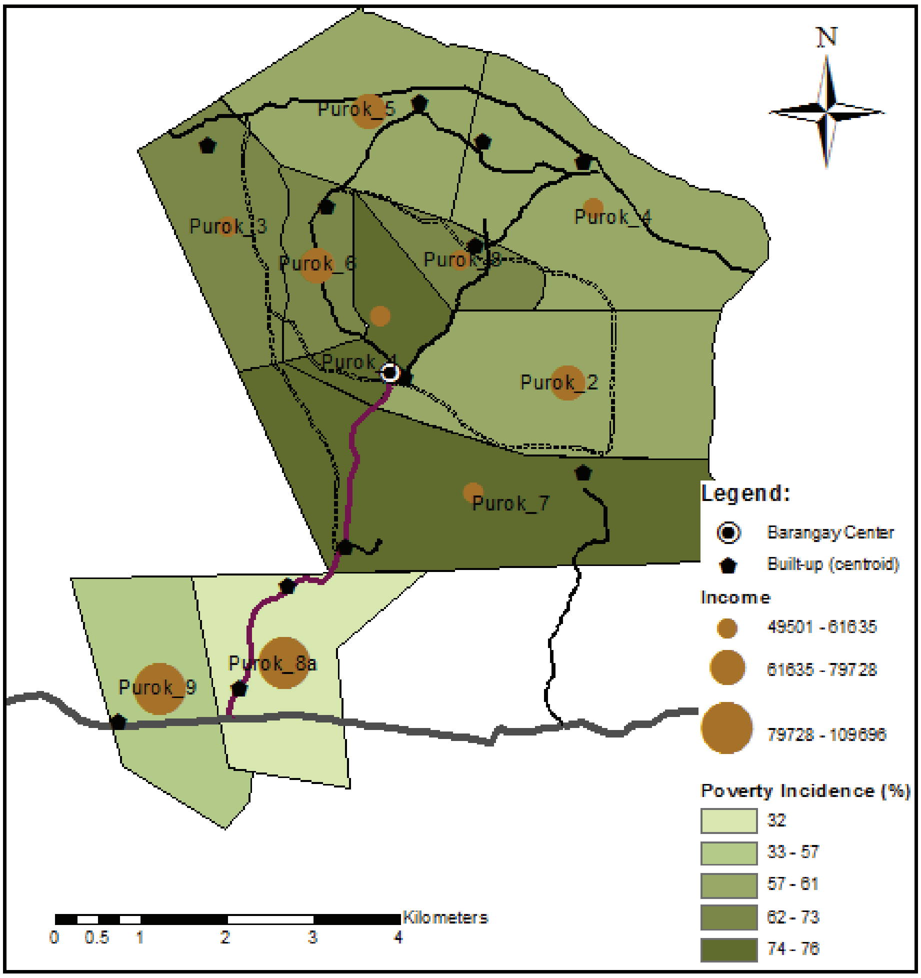

Figure 4.4 Spatial distribution of HH by poverty incidence and income across *puroks*

4.2.4.4. Distribution Road Users or Stakeholder

The identification of stakeholder or road users group was critical in the distributional and equity analysis. Figure 4.5 shows the distribution of stakeholder or road users by income class. Overall and across income classification, the farmer's group dominated the area followed by the business groups and the 13-16 years old group attending high school. The other road users were the transport operators and wholesalers/retailers' groups.

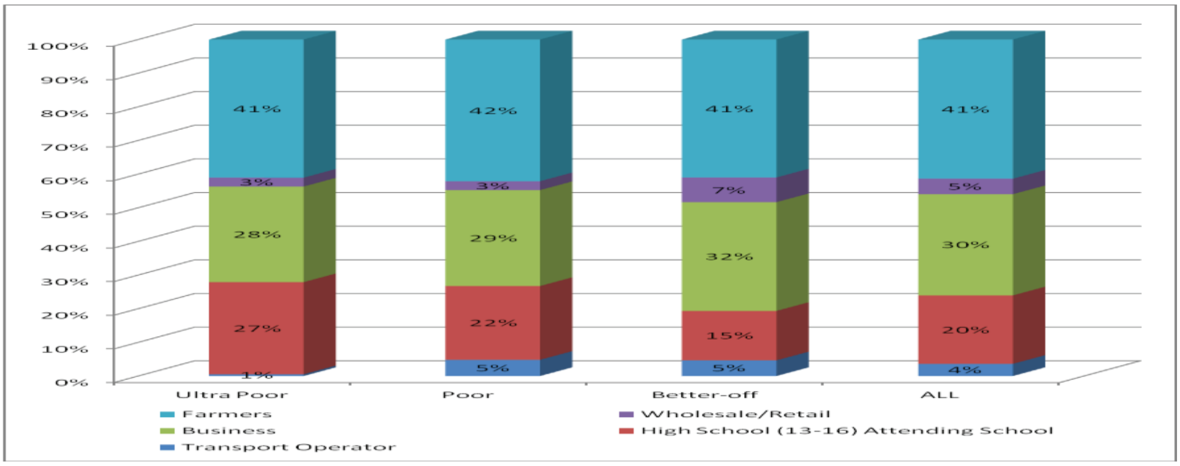

Figure 4.5 Distribution of HH by stakeholder or road users
(Source: CBMS data)

4.2.5. Characteristics of the Road Project under Study

The road project (before the project implementation) was in very bad condition and was not passable all year (only around 40% each year). This prompted most of the people to resort to non-motorized means through use of animal drawn carts for hauling their products and walking. The road improvement project is expected to provide an all year round undisrupted flow of traffic in order to increase economic opportunities and increase access to market. This in turn could provide some direct benefits like the reduction in travel time, reduced freight cost of farm products and decrease in transportation fares through a provision of all year round passable gravel road. The road surface condition was transformed from very bad to good (gravel). The MRDP 2 project follows a standard VOC measured in PhP per kilometer by type of vehicle and by road surface condition (Table 4.3). These standards were used in the computation of VOC difference. The road project's major modes of transportation were *habal-habal* and *jeepney* which were used to haul farm products to the market. The traffic volume was relatively low with an average volume of 12 trips per day. The average loading capacity for *habal-habal* was 5 people while the *jeepney* was 20 people.

Table 4.3 VOC by type of vehicle and by type of road surface condition (PhP/km)

Surface Condition	Vehicle Type					
	Car/Van	Jeepney	Motorcycle (habal-habal)	Tricycle	Bus	Truck
PAVED						
Good	7.81	6.48	1.03	8.05	10.44	13.18
Very bad	12.67	11.20	4.37	2.70	20.87	26.25
GRAVEL						
Good	9.01	7.59	1.09	2.88	13.16	16.61
Very bad	15.38	14.93	2.15	8.40	28.01	34.99

Source: (Municipality of Prosperidad, 2009)

4.2.6. The Impact of the Rehabilitated Road Project

The project based on the original CBA showed an economic internal rate of return (EIRR) of 19.66% and benefits to cost ratio of 2.06 at a discount rate of 15%. Only the direct benefits (which are quantifiable) were included in the original CBA. The direct benefits identified were savings in hauling cost and VOC savings and some indirect benefits included increase in school attendance and improvement in health services, among others.

4.2.6.1. Direct Economic Benefits

The economic benefits include the savings in hauling costs and the VOC savings. Savings in hauling costs was based on the reduced cost of transporting agricultural products to the market. This was because of the shift from manual hauling of products (animal-driven) to motorized transport. This had greatly reduced the time spent in bringing the products to the market, resulting in the reduction in transport cost. Generally, this direct benefit is accrued to the farmers. As discussed earlier, the savings in hauling cost is computed based on the savings from using the manual hauling to motorized transport. The assumptions from the original CBA are detailed in Table 4.4.

Table 4.4 Summary computation of savings in hauling costs *(Municipality of Prosperidad, 2009)*

Parameters		Amount/Unit
Current hauling costs from barangay center to provincial road via carabao/manual hauling (PhP)	**A**	100.00
Current transport cost via motorized transport from barangay to Poblacion (PhP)	**B**	60.00
Total distance in Distance (in kilometers)	**C**	25.00
Cost per kilometre (PhP/km)	**D** = B/C	2.40
Total road length (rehabilitated road in kilometres)	**E**	5.15
Estimated average transport cost in new roads (PhP)	**F** = D * E	12.36
Average savings in hauling costs per unit of produce (PhP)	**G**	**87.64**
Average savings per kilometre (PhP/km)	**H**	**17.01**

The estimation of the average savings in hauling cost per produce was based on the current transport cost from barangay center to the provincial road (main highway) minus the estimated average transport cost in new roads. The estimated average transport cost was computed by multiplying the cost per kilometre with the total length of the rehabilitated road. The Annual savings in hauling costs per crop per year was computed using this average savings based on the total volume of products hauled to the market. The total average savings computed was PhP87.84 or PhP17.01/kilometer. The decrease in transportation costs which lead to the savings in hauling costs is the value of time saved due to decrease in travel time of these products. Therefore this was the main parameter used in the distribution of the benefits. The higher the travel time saved because of the road improvement, the higher the benefit or weights accrued to these households.

The average savings in annual cost was the same for all types of crops. The major crops marketed were vegetables, root crops, corn, and banana. An aggregated annual total savings in hauling costs were computed at PhP1.055M. The road is estimated to last for 10 years assuming that the road is properly maintained. In most cases, according to the MRDP-PSO, roads will last only for 6-7 years because of lack of maintenance. The total net benefits were PhP 5.297M discounted at a 15% rate.

The other direct benefit derived from the road as discussed in the original CBA is the VOC savings which is computed based on the following parameters in Table 4.5. The VOC computed is the incremental savings derived due to the improvement of the road. There were two kinds of public transport services available: *habal-habal*[8] (single motorcycle) and *jeepneys*[9].

Table 4.5 Summary computation of VOC savings for Year 1

Parameters		*Jeepney*	*Habal-habal*
VOC Difference per mode in PhP/km (see standard values in Table 4.3)	**A**	7.346	1.055
Average Annual Daily Traffic (AADT) per year	**B**	8.00	**80.00**
Number of Vehicles	**C**	2.00	8.00
Road Length (km)	**D**	5.15	5.15
No. Of days in operation/year	**E**	300.00	300.00
Total VOC savings (PhP/year)	**F=** A*B*C*D	**181,593.12**	**130,398.00**
Total VOC Savings (PhP/km/year)	**G** = F/D	**35,260.80**	**25,320.00**
Traffic Growth Rate (%)[10]	H	**4.86**	**4.06**

Source: (Municipality of Prosperidad, 2009)

In the Philippines, poor quality of the roads or road surface resulted in high vehicle operating costs and thus affecting travel speed and time (World Bank, (2005d). Vehicle operating cost is a function of the average vehicle speed, and the resources used which include fuel and oil used, passenger time, etc. As per computation, the total VOC savings for *jeepney* per annum in Year 1 was PhP 181,593 or PhP 35,260 per kilometer/year. For *habal-habal*, the total VOC savings per year was PhP 130,398 or PhP 25,320 per kilometre/year. Starting from Year 2, the projected savings will increase by the projected number of vehicles based on the traffic growth rate (TGR).

Similar to the case of the savings in hauling costs, the cost savings per kilometer was mainly due to the savings in travel time, hence this was the main parameter considered in the distributional analysis across

[8] A single motorcycle-propelled vehicle for hire with extended seats that normally carries 1-4 passengers specifically designed for poor road networks (Guillen & Ishida, 2003).

[9] *Jeepneys* are one of the most common modes of transportation in the Philippines and with cultural significance that can accommodate around 20-30 passengers. The first *jeepney* came from a refashioned US army truck surplus by extending the backward frame with two long bench installed on each side so that passengers are often seated face to face with their knees almost touching one another's (source: WikiPilipinas - www.wikipilipinas.org)

[10] Computed based on the Income growth rate, Income elasticity and the Compounded population growth rate. The income growth is set at 2.0 while income elasticity is computed based on the standard set by World Bank e.g for Jeepneys is 1.5 while motorcycles are 1.1. The compounded population growth rate used was 1.0186.

puroks and across social groups. The total computed net benefits for VOC savings was **PhP 1.832M** discounted at 15% for 10 years.

4.2.6.2. Other Benefits

As noted earlier, according to Van de Walle (2009) and the World Bank (2005a), utility from the road cannot be obtained directly but through indirect access to opportunities which are dependent on the interactions with investments, other social and physical infrastructures, and the geographical community and household characteristics.

The indirect benefits from the road project were not included in the original CBA but were revealed during the FGD. The rehabilitation of the road gave opening to several indirect impacts such as: (1) improved in health services due to the entry of health workers in the area; (2) increased schooling rate because of the good road condition; (3) lower cost for farm inputs due to lower transport cost; (4) increase in cropping intensity and hectarage which lead to an increase in hired labor requirements and increase in hired labor rates; and (5) increase in employment or livelihood opportunities (i.e., increase in the number of *sari-sari* stores and opportunities for hired labor). The road rehabilitation also opened up more market for agricultural development which could provide an increase in financial inflows. There was also an increase in the Internal Revenue Allotment of the barangay from PhP 800,000 to PhP 1M after the road was constructed. This additional resource (i.e., increase in IRA) has the potential to further improve the development of the area.

4.3. The Need for an Improved Approach

The existing appraisal process is limited to showing only the aggregated benefits of the rural road improvement project and do not include how the benefits are distributed across locations and socio-economic groups. On the other hand, equity can be achieved by prioritizing the poorest areas and the areas with high number of disadvantaged groups (e.g. IPs) but Van de Walle (2002) noted that this is not always true considering that the redistributive effects are not the same across targeted areas.

The review of the concepts methods and tools in Chapter 2 indicates that distributional and equity can be accommodated within the context of CBA-based appraisal of transport projects. However, approach on distributional and equity analysis specific for CBA-based appraisal of rural roads have not been clearly defined particularly in terms of distribution across income and geographic locations. Another issue mentioned in sub-chapter 2.7.1 where the use of the different methods and tools is dependent on the availability of data and information. Aside from this, Van Wee & Geurs (2011) noted that limited researches have been conducted on accessibility particularly on the distribution of accessibility changes across income class and regions (geographic locations). Hence, the development of new approach specific for rural roads was carried out in Chapter 5 to cover the special characteristics of the road and the demand for further research in this field.

4.4. Summary

This chapter presented the current status of the appraisal of projects specifically for rural road in the Philippines. The appraisal involves two-stage appraisal process. The first stage involves screening of the eligible subprojects through a set of eligibility criteria. The second stage is the final appraisal and approval process which involves the preparation of the feasibility study. CBA or FEA was the main decision criteria for the project's approval where IRR should be greater than 15%. In terms of equity consideration, the stakeholders indicated that the project had a semblance of equity since it considered the areas with high incidence of poverty or poor areas as the main priority during the selection process.

It also provides a brief background of the case project that would be analyzed based on the approach developed in Chapter 5. The road improvement project covered 10 *puroks* with a total population of 1,767. *Purok* 1 (being the center of commercial activities) was the most densely populated with 227 people/sq.km. and also one among the lowest income areas. Poverty incidence ranged from a low of 32%

to a high of 76% with the highest exhibited along the South to Northwest side of San Lorenzo. The income per household per year ranges from PhP49T to PhP109T.

The direct economic benefits of the road improvement project was measured in terms of the savings in hauling cost and VOC savings which was included in the original CBA. Savings in hauling cost was measured by the average savings incurred from manual transport of the agricultural produce to motorized transport. The total average savings in hauling cost per unit of produce was computed at PhP 87.64 or PhP17.01 per kilometer. In terms of VOC savings, The incremental savings due to the road improvement was computed by taking into account various parameters like: 1) VOC Difference per mode; Average Annual Daily Traffic (AADT) per year; TGR; Road length; and number of days in operation for both the two types of transport: *habal-habal* and *jeepney*. The incremental savings computed for *jeepney* per year was PhP181,593 or PhP 35,260 per kilometer/year and for *habal-habal*, PhP130,398 or PhP 25,320 per kilometre/year. The savings was mainly due to the lower transport cost due to the time saved from travelling from the farm and household location to the highway.

Some indirect benefits of the road were also mentioned during the FGD which include (1) improved in health services; (2) increased schooling rate; (3) lower cost for farm inputs; (4) increase in cropping intensity and hectarage; and (5) increase in employment or livelihood opportunities.

5. DEVELOPING THE APPROACH TO DISTRIBUTIONAL AND EQUITY ANALYSIS

The review of related the concepts and methods and on the results of the discussions with key stakeholders and beneficiaries as well as the data and information generated during the field work, a detailed approach was developed. Figure 5.1 shows the framework for the distribution and equity analysis.

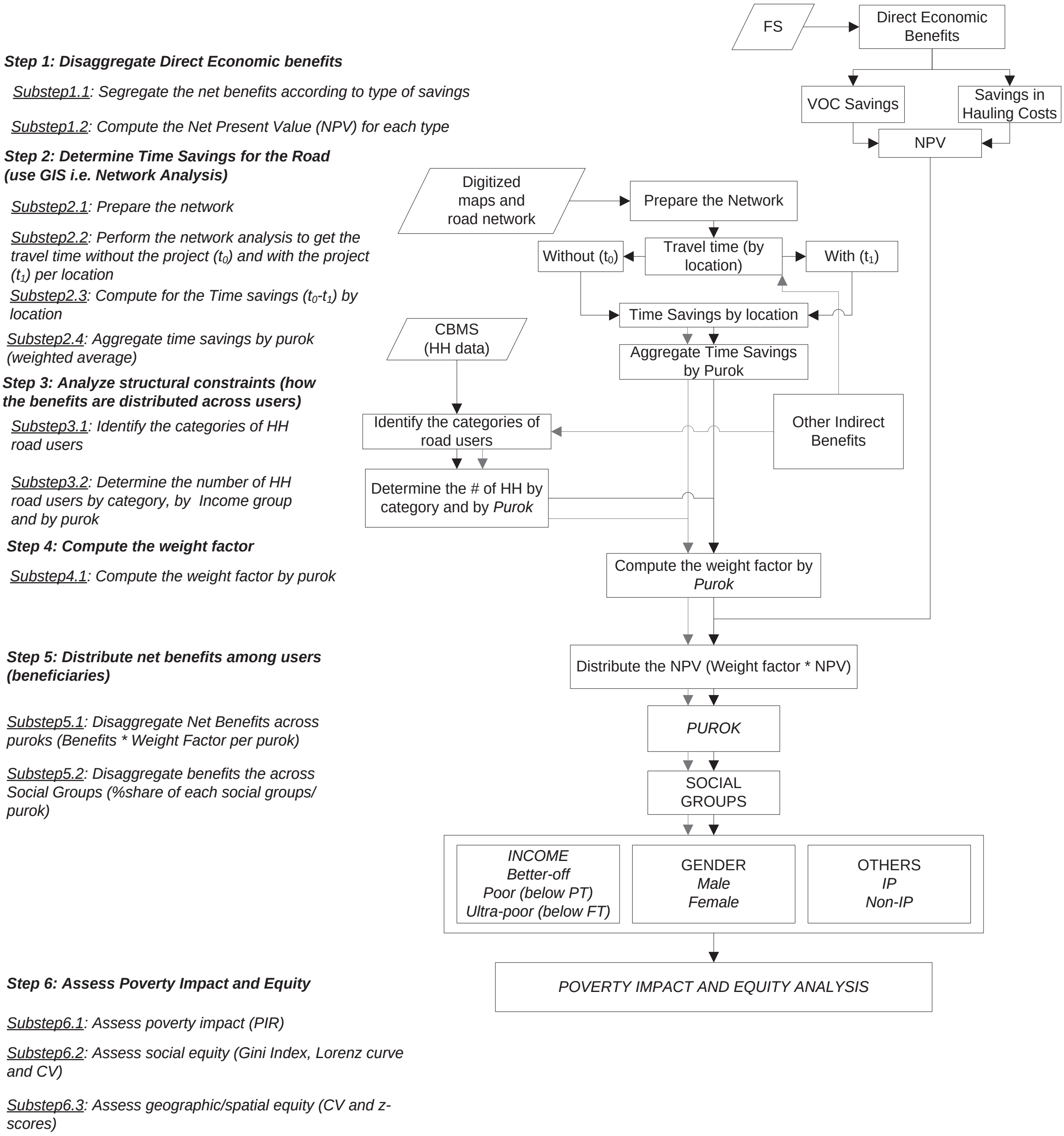

Figure 5.1 The approach for the distributional and equity analysis of the benefits of rural roads
(Source: Author's construct)

Table 5.1 shows the detailed steps on how the distributional analysis was conducted. Steps 1-6 which were discussed in Section 5.2 constitute the steps used for distributional analysis while Step 7 presents the details for assessing the equity. The key innovation in the approach was the use of the net travel time saved and the number of road users and their characteristics across spatial units (location of household users and location of farms across *puroks*) computed and analyzed using spatial-based approach. This is in order to come up with a weight factor to distribute the net benefits of the road improvement project across *puroks* and social groups (i.e. income).

Table 5.1 Steps in the distributional and equity analysis of the benefits of rural road project

Steps	Sub-steps	Data and Sources
1. Disaggregate the net economic benefits of the rural road project	1.1 Segregate the benefits into: • Savings in Hauling Costs • Vehicle Operating Costs 1.2 Compute for the NPV for each type of benefit	Financial and Economic Analysis (FEA) / Cost Benefit Analysis (CBA) of the Feasibility Study (2009)
2. Determine the Time Savings (use GIS i.e., Network Analysis)	2.1 Prepare the data and establish the network • Prepare and identify all spatial information necessary for the network analysis • Create the network (travel time assumptions per road network from *with* and *without* the road) • Establish the travel time for each of the road network from *with* and *without* situation • Define the origin and destination (OD) cost matrix	Spatial data (digitized maps of the area by *purok* and built-up areas and road networks)
	2.2 Perform the network analysis to get the travel time without the project (t_0) and with the project (t_1) per location	
	2.3 Compute for the time savings (t_1-t_0) by location	Results from 2.2
	2.4 Aggregate time savings by *purok* (weighted average per *purok*)	Results from 2.3
3. Analyze structural constraints (Who are the road users and how are the benefits distributed across these road users?)	3.1 Identify the categories of HH road users • For Savings in Hauling: Farmers • For VOC savings: with vehicles (private) and transport operator. The share of transport operator were distributed further to the passengers i.e. farmers, with business, HS children and those engaged in wholesale and retail	Use CBMS data and FGD Assumptions from literature: For VOC, 50% of the share of transport operator will be distributed to the passengers equally (Gajewski, et al., 2004)
	3.2 Determine the number of HH road users by category and by social group per *purok*	Use CBMS HH data to identify the number of each users by social group per *purok*
4. Compute for the weight factor	4.1 Compute weight factor	Results from 2.5 and 3.2
5. Distribute net benefits among users (beneficiaries)	5.1 Distribute the NPV per type (NPV * weight factor)	Results from 1.2 and 4.1
	5.2 Disaggregate NPV (net benefits) at the *purok* level	Results from 5.1
	5.3 Disaggregate NPV (net benefits) across social groups (e.g. income)	Results from 5.1
	5.4 Prepare distributional table, figures and maps	Results from 5.2 and 5.3
6. Assess poverty impact and equity	6.1 Assess poverty impact • PIR	Computed from the results of 5.2 and 5.3
	6.2 Assess social equity • Gini Coefficient	Computed from the results of 5.2 and 5.3

Steps	Sub-steps	Data and Sources
	• CV	
	6.3 Assess geographic equity • Coefficient of variation • Z-scores	Computed from the results of 5.2 and 5.3

5.1. Distributional Analysis

This section discussed the steps in disaggregating the direct net economic benefits of the project as well as the ways on how to distribute the other relative benefits that was not captured in the original CBA and some indirect benefits mentioned during the FGD.

5.1.1. Direct Net Economic Benefits

The following were the steps undertaken in the diaggregation of the net economic benefit:

Step 1 Disaggregate Net Economic Benefits

Benefits in terms of hauling costs will be accrued to the farmers while VOC will be accrued to all targeted households within the road influence area. The target groups identified are: (1) vehicle owners (private), (2) transport operators, and (3) users of passenger transport. The users of passenger transport considered only the heavy road users which were identified during the FGD. These are farmers, HH with business, school children (13-16 years old or high school students), and those households who are involved in wholesale/retail. Only the economic benefits were included in the analysis.

Step 2 Determine the Time Savings

Step 2.1 Preparing the Network

The detailed steps for the network analysis are: (a) digitize maps and road networks; (b) identify travel speeds per road type for *without* and *with* the road situation; (c) identify other parameters for the network analysis; and (d) define the origin and destination (OD) cost matrix.

The travel speed per road network was identified through the FGD. Table 5.2 shows the average travel and hauling speed per type of road network. The data however is limited to the existing barangay roads and the old logging roads and failed to include the whole network which included foot paths across barangays.

Table 5.2 Assumptions of travel and hauling speed per road network (without and with the road)

Road Type	Hauling Speed (Savings in Hauling)		Travel Speed (VOC savings)	
	Without (t_0) (in km/hr)	With (t_1) (in km/hr)	Without (t_0) (in km/hr)	With (t_1) (in km/hr)
Old logging road	2.0	2.0	4.0	4.0
Barangay road	2.0	2.0	5.0	5.0
Project road[11]	7.38	20.6	9.35	20.6
Highway	60.0	60.0	60.0	60.0

Source: FGD

[11] The average speed is estimated based on the weighted average of manual and motorized on the without situation. For both the hauling speed and travel speed, 60% are done manually (carabao and walking) while 40% are motorized. The original CBA (2009) assumed that all the NMTs will be shifting to motorize. Though, it was mentioned during the FGD, that there was a slight increase in travel speed of the motorized vehicle due to improved road condition. The new travel time is estimated at around 10-15 minutes from a previous 15-20 minutes. In this analysis, the modest assumption was used i.e. 20 minutes average travel time for "without" and 15 minutes travel time (with the road).

Step 2.2 Perform the Network Analysis

After setting up the network, travel time *without* and travel time *with* the road were computed. The travel time includes the length of time spent from travelling from a specific geographic location to the provincial highway. In the estimation of time saved due to road improvement, the first step is to identify the location of farms or farmers which were already set up during the preparation of the network. In the case study, the centroids[12] of the *purok* were used to represent the location for each of the farms while for passengers, the centroids of the built-up areas were used. The *purok* centroids were set as the origin for the hauling of farm products due to lack of detailed data on the land cover and land use.

Step 2.3 Compute the Time Savings

The time savings is computed by subtracting the time savings obtained from *with* (t_1) and *without* (t_0) the project.

Step 2.4 Aggregate Time Savings

Since the CBMS data at the household level was disaggregated only at the *purok* level, time savings was also aggregated at the *purok* level. This is done by taking weighted average time savings i.e. taking the weights of the area of the built-up per *purok*. This was done only for the savings in VOC case since some of the *puroks* have two built-up areas.

Step 3 Analyze structural constraints

The analysis of structural constraints was part of the steps in Gajewsky, et.al. (2004) to assess the structure and performance of the transport market in Tajikistan. The analysis of structural constraints can provide a deeper insights of how the share of the benefits are distributed. The analysis, however, involves pilot surveys with drivers, passengers and farmers to determine how much savings from the use of the road are passed on from the vehicle owners to users and how much benefit the poor and the extremely poor are benefitting from the project.

In the absence of a detailed survey, the FGD and literature review were used. During the FGD, the users of the road were identified. In the study conducted by Gajewski et al. (2004), the distribution of benefits from transport operator to passenger is 50:50. The FGD was supplemented further by the CBMS data which contain the actual number of road users per category per *purok* and across social groups. For savings in hauling costs, the farmers were the main users of the road. However, the households involved in hauling of forestry products were not accounted hence, this was included in the distribution analysis. For VOC savings, the main users of the road were the transport users including those with businesses, farmers, students attending schools (high school students or those aged 13-16 years old were considered since there was also an elementary school within the barangay), and those involved in wholesale and retail. The traffic projection in the original CBA (2009) accounted for passenger transport only. Since there was no data available on the distribution of the benefits in VOC savings across road users, secondary information was used. Further, the CBMS data showed that there were households that owned private vehicles (not used for passenger transport) which were not included in the original CBA.

[12] Land cover map (scanned copy) were provided but it presents only the general land cover classification specifically for San Lorenzo e.g. for agricultural areas: permanent crops (fruit trees, coconut, etc.), cash crops (corn, vegetables, rootcrops) and mixed crops (combination of cash crops and permanent crops). Hence, it was decided that the *purok* centroids were used instead which is one of the major limitation of the approach.

Step 4 Compute the Weight Factor

Time savings is one of the crucial elements in the distribution of benefits. On the other hand, the number of households and road users per geographic location also affect the distribution. Thus, in computing for the weight factor the general formula was used taking into consideration the time saved per location and the number of households per location (Source: Author's construct):

$$WF_i = \frac{TS_i * HH_i}{\sum_{i=1}^{n} TS_i * HH_i}$$

Where:
- WF_i = weight factor in *i*th *purok*
- TS_i = Time saved in *i*th *purok*
- HH_i = Number of Households in *i*th *purok*

The weight factor was computed for each benefit: savings in hauling cost and VOC savings. The formula implies that the higher the time saved and the higher the number of road users per location, the higher the share of benefits. Exceptions were made for transport operator since they are the providers of transport, hence the time savings used should be equal across these users. The time saved in *Purok* 1 was used to represent one way travel from barangay center to the main highway.

Step 5 Distribute Net Benefits among Users

Using the values computed in Step 4.1 and 4.2, the net benefits were distributed across social groups by multiplying net benefits (from savings in hauling cost and VOC savings) with weight factor for each *purok* and the actual percentage per social group. The social groups can be categorized by income, gender, and ethnic group. The groupings for income group were: ultra-poor, poor, and better-off. The data for HH by social group and by *purok* were derived from the 2009 CBMS data. In the absence of a detailed survey for the frequency of use of transport by income class, the results of the study conducted by Hettige (2006) were used (Table 5.3). Please note that in Step 3, only those heavy users of the road were considered. In this case, those that travel often were used to better account the differences across income groups. However, this was not applicable for the transport of farm and other products since regardless of your income status, the product must need to be brought to the market in order to get income from these products. Hence, the distribution was assumed to be equal across income groups.

Table 5.3 Frequency of use of transport services by income groups

Frequency of Use	**Very Poor***	**Poor**	**Better-off**
Yes, often	50	68	76
Use transport only occasionally	46	30	21
No, never	3	2	3

** Note that very poor is also the same with ultra-poor*
Source: Hettige (2006), p.26

To disaggregate the benefits across road users of the passenger transport by social group (e.g. income) the %share by income group by *purok* were computed taking into account the frequency of travel across income groups using the following formula:

$$\%share_{ij} = \frac{FT_i * NRUBIG_{ij}}{\sum_{i=1}^{n} FT_i * NRUBIG_{ij}}$$

Where:
- $\%share_{ij}$ = % share in *i*th income group and *j*th *purok*
- FT_i = Frequency of travel/use of transport in *i*th income group
- $NRUBIG_{ij}$ = Number of users in *i*th income group and *j*th *purok*

Distributional tables, figures, and maps were prepared and analysed therein. The distributional analysis was undertaken by comparing the percentage of distribution of road users per category with the percentage of benefits due to the road improvement.

5.1.2. Ways to Estimate Other Benefits

The first step is to identify the indirect benefits. After the identification of the benefits, the same process in Step 2 was used to compute for net time savings through the network analysis. In Step 3, the number of households and category of household users for a particular indirect benefit was determined (e.g., number of vehicle owners, number of users engaged in forestry, number of high school children ages 13-16 years old not attending school). Step 4 and Step 5 are the same with the direct benefits.

5.2. Poverty Impact and Equity Analysis

In assessing the distributional impact on poverty and equity of benefits, one of the main considerations that emerged during the interview with the key stakeholders was the effect of the road on poverty alleviation. Several tools have been developed to measure poverty impact and equity. The detailed description of Step 6 is discussed in the following sub-chapters.

5.2.1. Poverty Impact Ratio

The Poverty Impact Ratio (PIR) is the most common indicator for measuring poverty impact. The overall PIR and PIR across *puroks* were computed. The PIRs computed were compared to the proportion of the population below the poverty line to determine whether equity is achieved. The project is said to have a positive poverty reducing impact if the PIR is greater than the proportion of the population below the poverty (World Bank, 2005a).

5.2.2. Assessing Distributional Equity of Benefits

The social and geographic equity were assessed using different methods. The social horizontal equity was measured in terms of Gini coefficient and the Lorenz curve, social vertical equity in terms of CV and geographic inequity in terms of CV and z-scores. Maps showing these several computed indices were also prepared and analyzed.

5.3. Summary

The approach developed was built on the methods and concepts adopted and tested in various researches as described in the literature review. The main component of the approach was the use of the net travel time saved and the number of household users and their characteristics across spatial units (*puroks*). A weight factor to distribute the net benefits of the road improvement project was computed. The weight factor determines how the benefits are distributed across the different locations of the farms and household road users. The approach to analyze the distribution of the benefits and equity analysis of the rural road project in Agusan del Sur were presented in this chapter including a detailed step by step process on how to execute the approach.

6. APPLICATION OF THE APPROACH: THE CASE OF LOS ARCOS-SAN LORENZO RURAL ROAD PROJECT

This section discusses how the direct and some other benefits were distributed across *puroks* (spatially) and across socio-economic groups (socially) and if equity is being achieved across these groups and locations. The approaches designed in Chapter 5 were applied for a particular rural road project: the Los Arcos-San Lorenzo Rural Road Project in Prosperidad, Agusan del Sur in Mindanao, Philippines.

Rural roads have their direct and indirect effects. While the main purpose of this study is to design ways on how to assess the distribution of direct economic benefits from the road improvement, it can also give insight on the distribution of some benefits not captured in the original CBA and some indirect benefits (as discussed in Section 4.2.6.2). The direct benefits include the savings in hauling cost and VOC savings. These form part of the original CBA.

The net benefits were derived from the FEA or CBA of the approved Feasibility Study (2009) of the Los Arcos-San Lorenzo rural road project. Only the benefits taken from the savings in hauling costs and vehicle operating costs were included since the costs were provided through a loan and through the counterpart of the municipality (the contribution of the barangay for the maintenance was not very significant since maintenance cost was covered by the Municipality[13]).

6.1. Distributional Analysis

This section contains the analysis of the distribution of the benefits derived from the original CBA (i.e. savings in hauling cost and VOC savings) across *puroks* and across income groups using the approach described in Chapter 5. While the main consideration was on the direct benefits, this chapter also includes ways on how the to distribute the other benefits not captured in the original CBA like savings in hauling costs for forestry products, savings in VOC for vehicle owners and some indirect benefits like attendance to schools, health and employment.

6.1.1. Distribution of Net Time Savings

As discussed in Chapter 5, the approach used the net time saved from the *without* and *with* situation as a proxy to further disaggregate the benefits from the savings in hauling costs and VOC savings of the road users across *puroks*. The network analysis was used to capture the difference in the travel time spent from travelling from the location of the farms (represented by the *purok* centroids) and household (represented by the built-up centroids) as the origin to the main highway as the destination. The origin-destination cost matrix was particularly used.

Maps showing the spatial distribution of the net time saved from the road improvement project were shown in Figure 6.1 (farm locations or *purok* centroids) and Figure 6.2 (for the household location or built-up centroids). The central most part of San Lorenzo gained the highest in terms of net time saved from travelling from the center to the main highway (Figure 6.1). This was expected considering that rural road project aims to provide basic access, hence most rural road projects are connected via the barangay center. The lowest time saved (aside from the areas in Los Arcos) was located at the south to southwestern side of San Lorenzo. These are the areas that were least connected to the road network specifically for one community in *Purok* 7 where they are using different network. *Purok* 3 was also connected via the old logging road with very bad condition. Please note that the only effect of the project

[13] This was part of the counterpart funds or commitment from the Municipality which also forms part of the second stage selection criteria indicated in Section 4.2.1.

in *Purok* 9 was in terms of those who are providing passenger transport. Hence, the value of time is only computed for the passenger transport which in this case, only a single value of travel time saved for all the transport operators were assigned. The net value from *Purok* 1 was used because it is the take-off point of all the passenger vehicles.

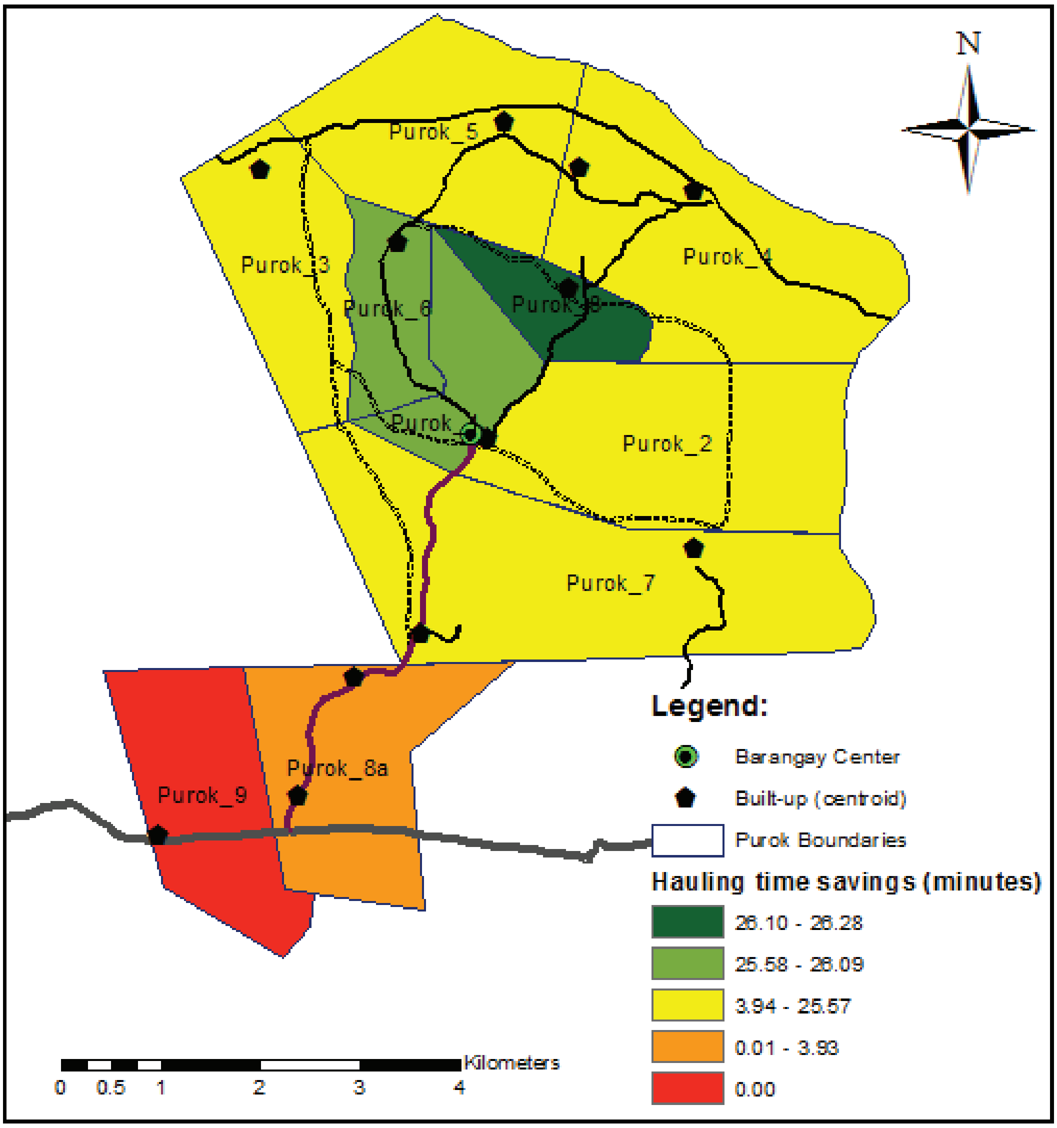

Figure 6.1 Spatial distribution of net time saved (in minutes) from the farm locations (*purok* centroids) to the main highway across *puroks*

Figure 6.2 also showed that the central most portion of San Lorenzo gained the highest net time savings in terms of travelling from the origin (household locations or built-up centroids) to the main highway. These are *Puroks* 1, 2 and 8 in San Lorenzo while the least net time savings was in Purok 8a and 9 in Los Arcos which were located near the highway.

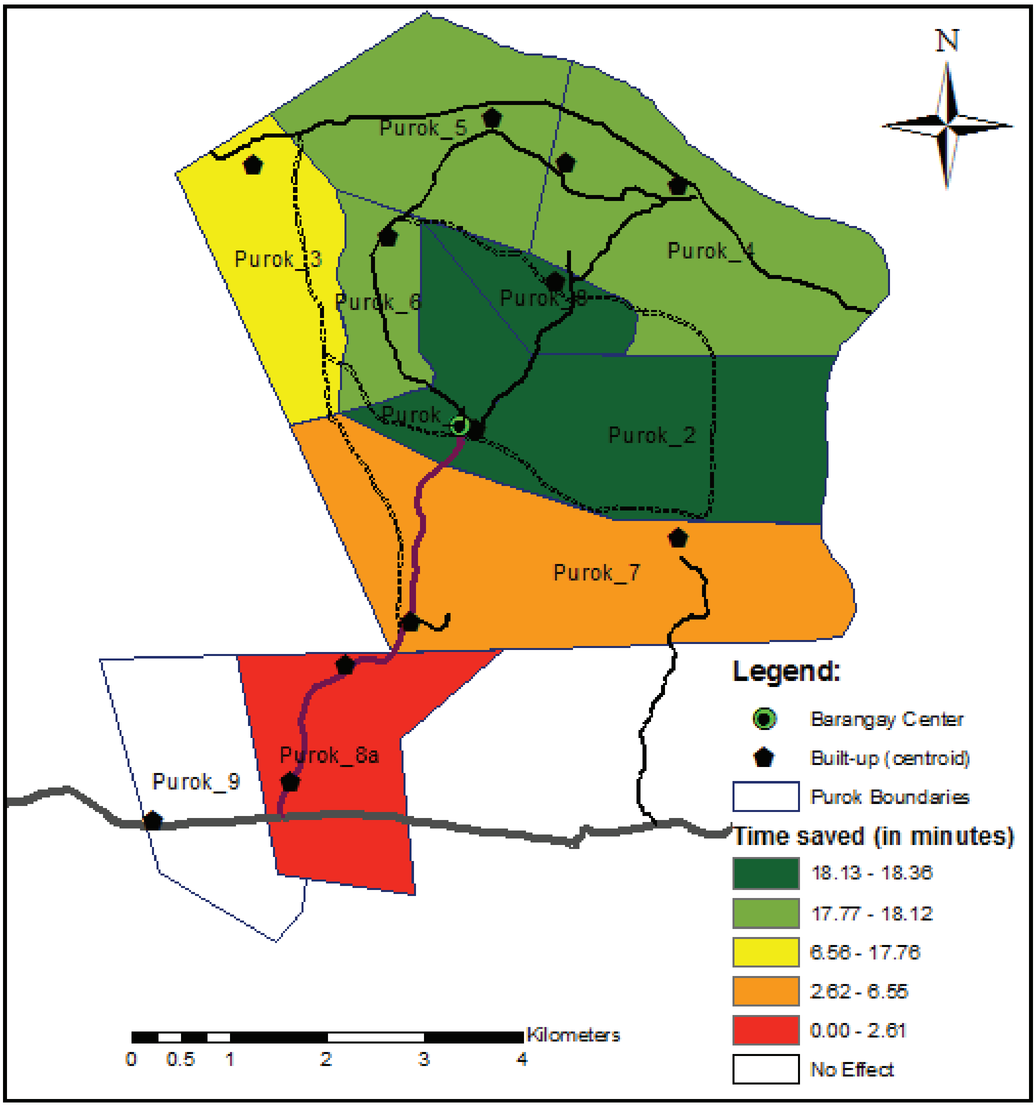

Figure 6.2 Spatial distribution of net time saved (in minutes) from household locations (built-up centroids) to the main highway across *puroks*

6.1.2. Distribution of Benefits across *Puroks*

The distribution of the total benefits across *puroks* as well as the savings in hauling costs was described here. Maps showing the spatial distribution of benefits were used to further visualize the distribution of these benefits.

6.1.2.1. Distribution of Benefits across *Puroks* by Savings in Hauling Costs

In terms of savings in hauling costs[14], *Purok* 1 in San Lorenzo gained the highest benefits worth PhP1.44M while the least benefits were gained by *Purok* 8a in Los Arcos with PhP 183T (Table 6.1). As discussed earlier, the road has no or little effect in *Purok* 9. A spatial distribution of the disaggregated absolute benefits from savings in hauling cost was shown in Figure 6.3. The map revealed that the central side of San Lorenzo (*Puroks* 1 and 2) could gain most of the benefits while the western side could receive

[14] calculated per *purok* as the product of the overall savings in hauling costs and the weight factor, calculated as the formula specified in Chapter 5.1, step 4 and 5.

relatively less (*Puroks* 3, 6 and 8). The effect of the road improvement for those barangays close to the highway (e.g. *Purok* 8a and 9 in Los Arcos) were very low or no effect at all.

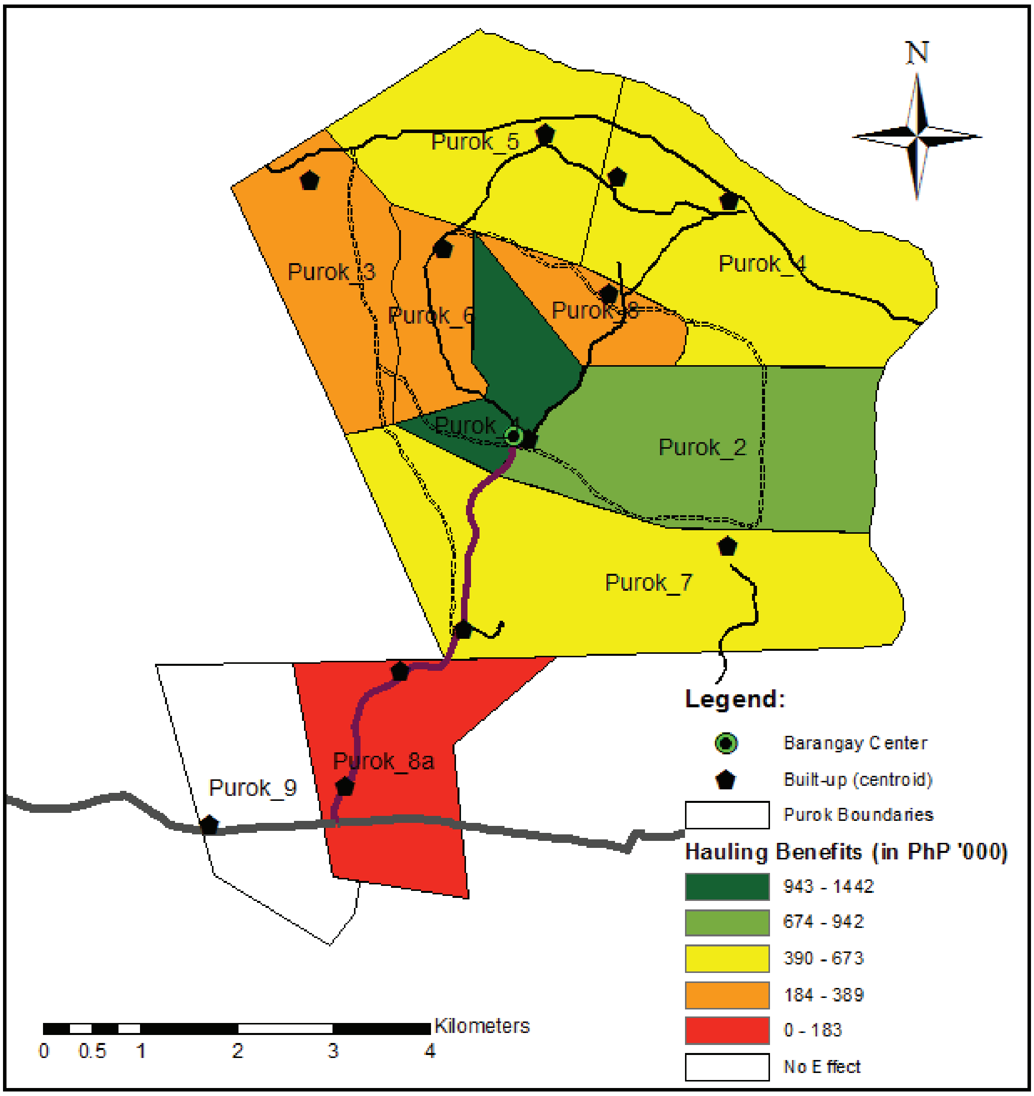

Figure 6.3 Spatial distribution of benefits from savings in hauling costs across *puroks* (in PhP '000)

Source: Author's construct

6.1.2.2. Distribution of Benefits across *Puroks* by VOC Savings

Benefits from the VOC savings were also computed. *Purok* 1 in San Lorenzo and *Purok* 8a in Los Arcos gained the highest benefits with PhP569T PhP 357T, respectively, while the least benefits could be gained by *Purok* 9 in Los Arcos with only PhP35T (Table 6.1). Please note that *Purok* 8a was one of the major providers of transport for the road project, hence the highest in terms of savings in VOC.

Figure 6.4 showed the spatial distribution of benefits from VOC savings disaggregated across *puroks*. The main benefits from hauling costs shows that the central most part of San Lorenzo as well as in *Purok* 8a in Los Arcos were gaining. These are the areas within or close to the barangay center and the central commercial area. While the areas gaining the least were the northwestern side of San Lorenzo. These were among the areas that were least connected to the road network.

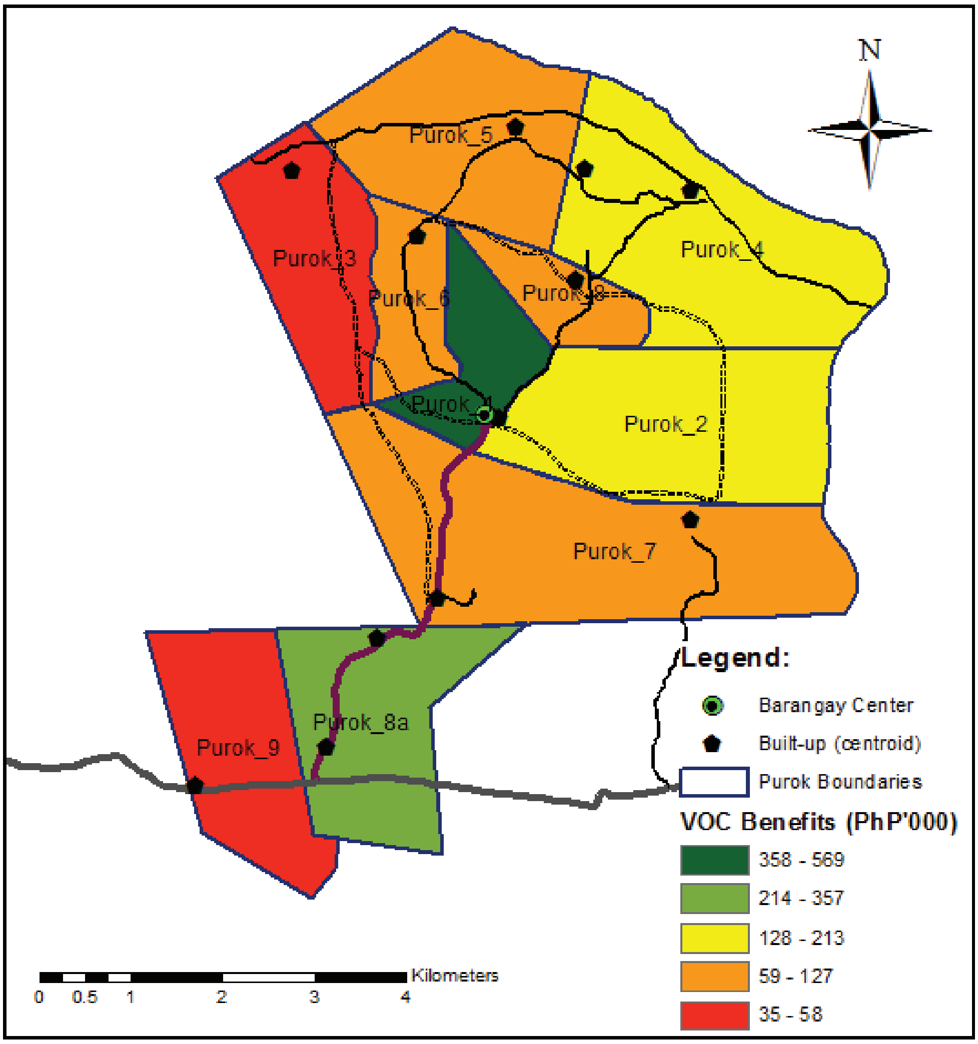

Figure 6.4 Spatial distribution of benefits from VOC savings across *puroks* (in PhP '000)
Source: Author's construct

6.1.2.3. Total Benefits (Savings in Hauling Cost and VOC savings)

The total benefits were computed by taking the arithmetic sum of the benefits from savings in hauling costs and VOC savings. Table 6.1 showed the distribution of these benefits across *puroks*. *Purok* 1 and 2 gained most of the benefits with PhP 2.01M and PhP 1.16M, respectively, while the least were gained by *Purok* 9 in Los Arcos.

Table 6.1 Distribution of total benefits by category across *puroks*

Purok	CATEGORY OF BENEFITS (IN PhP '000)		
	Savings in Hauling Costs	VOC Savings	ALL
8a	183	357	**539**
9	-	35	**35**
1	1,442	569	**2,010**
2	942	213	**1,155**
3	314	58	**372**
4	538	159	**697**
5	673	119	**792**
6	389	93	**482**

Purok	CATEGORY OF BENEFITS (IN PhP '000)		
	Savings in Hauling Costs	VOC Savings	ALL
7	471	102	**573**
8	346	127	**472**
ALL	**5,297**	1,833	**7,129**

Source: Author's construct

Figure 6.5 showed the spatial distribution of the total economic benefits and by type of savings across *puroks*. While *Puroks* 1 and 2 are gaining, the main concern was for the areas along the northwestern side of San Lorenzo particularly *Puroks* 3 and 6 since these were identified earlier as the most impoverished *puroks* but gaining the least benefit from the project particularly savings in VOC, which means that people are travelling less in this area because of poor connection. This could be potential site that require special attention in future development strategies. For savings in hauling costs, *Purok* 1 and 2 in San Lorenzo gained most of the benefits. In terms of VOC savings, *Purok* 8a in Los Arcos and *Purok* 1 in San Lorenzo gained the most benefits because this is where most of the transport operators are located based on the FGD.

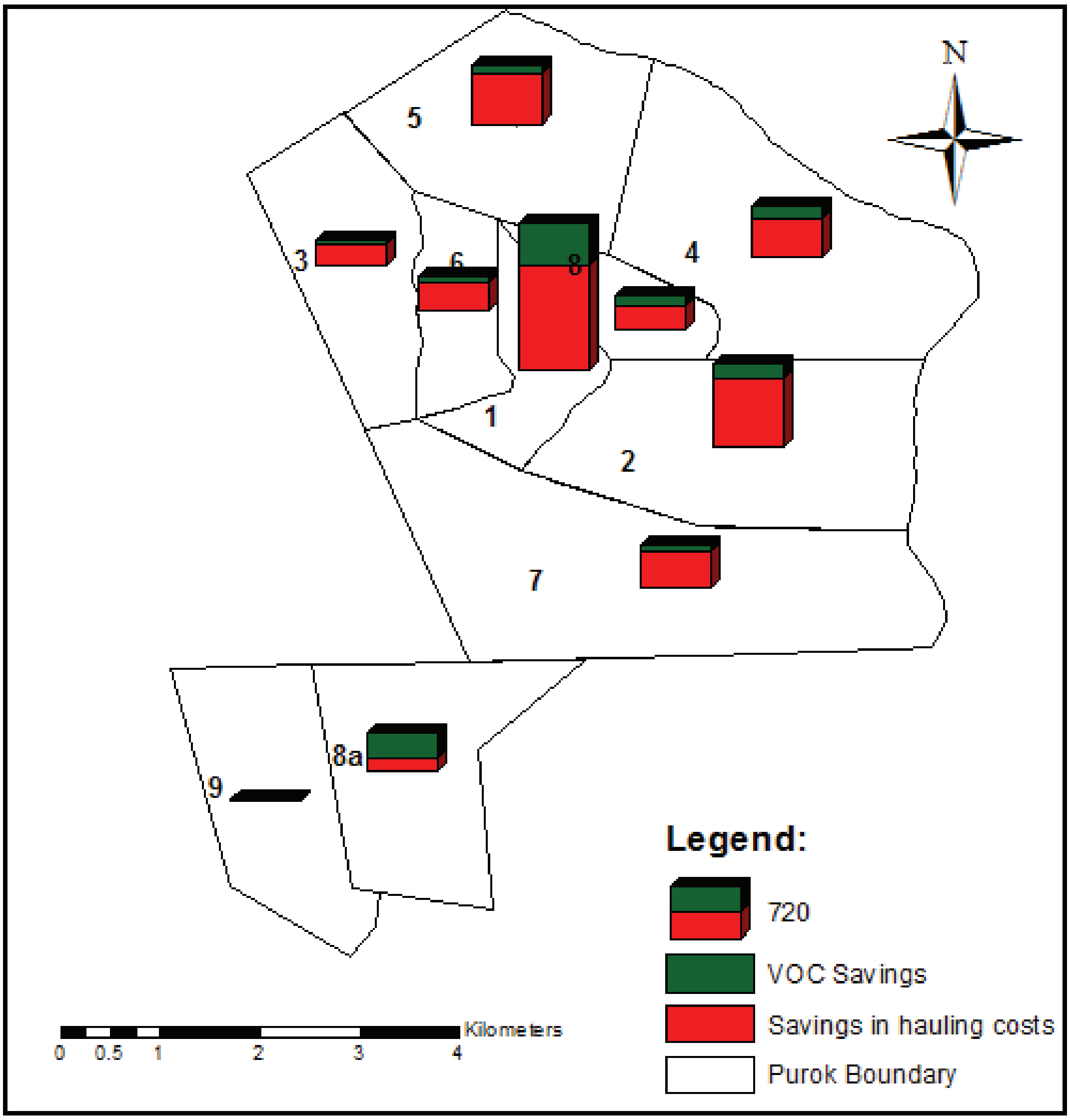

Figure 6.5 Spatial distribution of total benefits by type of savings across *puroks* (in PhP '000)
Source: Author's construct

In terms of spatial distribution of the benefits per household, while the central most parts was the highest in terms of absolute total net benefits, Figure 6.6 showed in contrast since these areas have the lowest benefits per HH. This was mainly due to the high number of inhabitants sharing the benefits. Obviously, *Purok* 8a and 9 in Los Arcos was the lowest because these areas were closest to the highway where the net effect of the road in terms of the net time savings was very low. The highest benefit per household was in *Purok* 8 and 6 of San Lorenzo with PhP13,027 and PhP12,245 while the lowest was in *Purok* 8a and 9 in Los Arcos with PhP 2,932 and PhP 691, respectively.

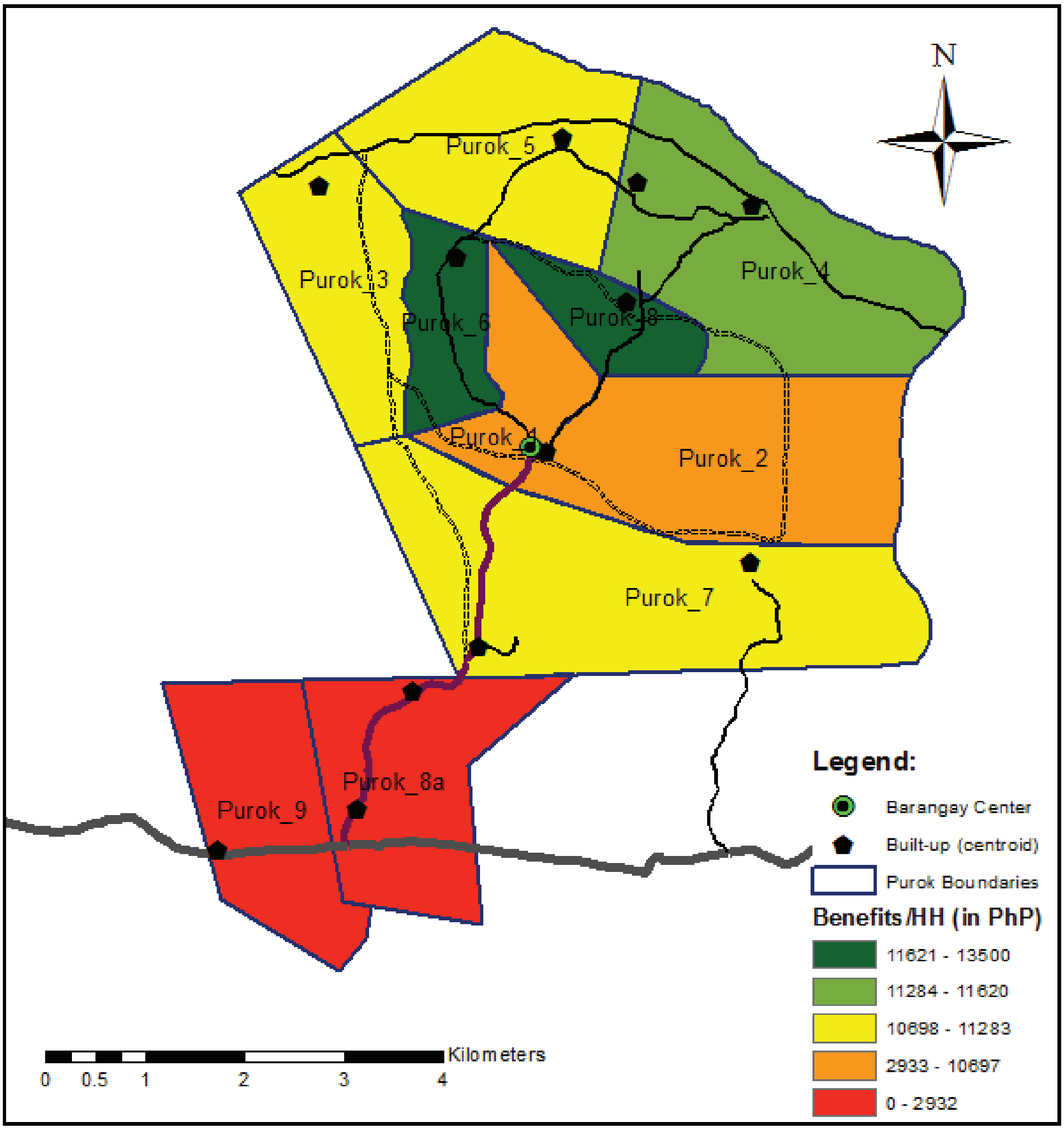

Figure 6.6 Spatial distribution of total benefits per household across *puroks* (in PhP)
Source: Author's construct

6.1.3. Distribution of Benefits across Income Groups

After disaggregating the benefits across *puroks*, the benefits were further disaggregated across income groups as well. The income groups were the ultra poor, poor and the better-off. The savings in hauling costs were distributed by multiplying the total savings in hauling benefits from each *purok* to the percentage of the actual number of farmers (road users) per income group. The VOC savings on the other hand, was the product of the total benefits in VOC savings and the % share per income group per *purok* computed using the formula in Step 5.

6.1.3.1. Savings in Hauling Costs

The distribution of benefits from savings in hauling cost is presented in Table 6.2. Consistently, among all the groups, *Purok* 1 gained the highest while *Purok* 9 was not gaining or the road do have effect at all. The poor group in *Purok* 1 gained the highest with PhP 595T followed by better off with PhP 481T and the Ultra-poor with PhP 366T. The percentage distribution of benefits across income groups also showed almost an equal proportion with the better-off just gaining slightly with 36% or PhP1.93M and, followed by the poor (33% or PhP1.76M) and the ultra-poor with 30% or 1.60M.

Table 6.2 Distribution of benefits from savings in hauling costs across income groups and across *puroks*

Purok	INCOME GROUPS (in PhP '000)			
	Ultra Poor	Poor	Better-off	ALL
8a	21	38	124	183
9	-	-	-	-
1	366	595	481	1,442
2	292	247	404	942
3	135	90	90	314
4	179	135	224	538
5	135	247	292	673
6	114	183	92	389
7	224	112	135	471
8	138	115	92	346
ALL	**1,604**	**1,761**	**1,932**	**5,297**

Source: Author's construct

The benefits from the hauling costs savings of transporting agricultural products seem to be favoring the ultra-poor and the poor compared to the better-off who are losing (Figure 6.7). The reason being the *puroks* are predominantly farming communities and majority belong to the poor and ultra-poor.

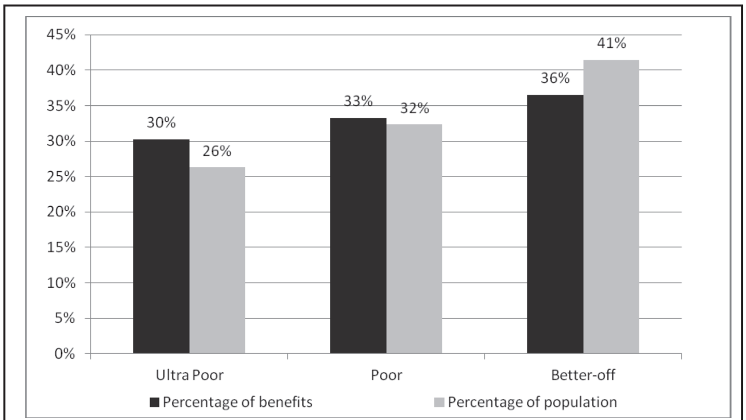

Figure 6.7 Comparison of the distribution of benefits and percentage population of all farmers from savings in hauling costs across income groups
Source: Author's construct

6.1.3.2. VOC Savings

The distribution of absolute benefits from the VOC saving as shown in Table 6.3 showed that the better-off gained the highest benefits with PhP 920T while the poor gained the lowest with PhP 229T. Among the ultra-poor, the benefit ranges from PhP 0T to 65T, while the poor ranges from PhP16T to 266T and the better-off from PhP16T to 276T.

Table 6.3 Distribution of Benefits from VOC savings across income groups and across *puroks*

Purok	INCOME GROUPS (in PhP '000)			
	Ultra Poor	Poor	Better-off	ALL
8a	3	78	276	**357**
9	-	-	35	**35**
1	65	266	238	**569**
2	39	52	122	**213**

Purok	INCOME GROUPS (in PhP '000)			
3	21	16	22	**58**
4	25	89	45	**159**
5	22	44	53	**119**
6	16	61	16	**93**
7	15	45	42	**102**
8	55	55	17	**127**
ALL	**261**	**705**	**867**	**1,833**

Source: Author's construct

Figure 6.8 shows the distribution of benefits in terms of VOC savings. The better-off and the poor were gaining more from the VOC savings while the ultra-poor gained the least. The main reason why the poor were also gaining may be because majority of the available transport are *habal-habal* (single motorcycles) which are popular (particularly in Mindanao) for being a cheaper means of transport. Also investments and maintenance costs are relatively cheap and can be afforded by the poor.

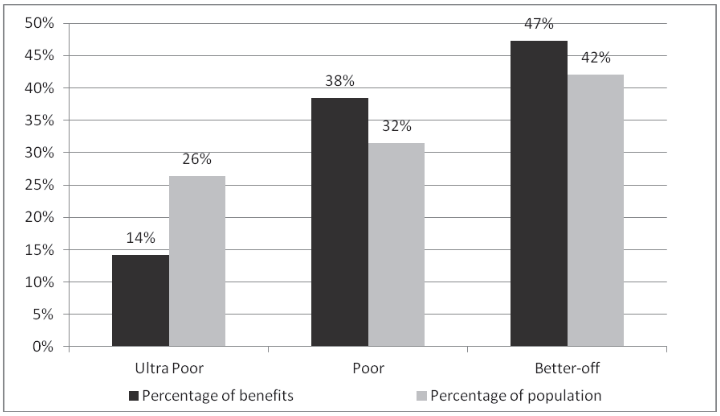

Figure 6.8 Comparison of the distribution of benefits and percentage population of all passengers from VOC savings across income groups

6.1.3.3. Total Economic Benefits (Savings in Hauling Cost and VOC savings)

The total economic benefits were derived from the arithmetic sum of the savings in hauling cost of transporting agricultural products and VOC savings derived from the passenger transport (transport operators and road users) disaggregated by income groups. The better-off households and the poor have almost equal gains in the total benefit with PhP2.85M and PhP2.44M, respectively, while the ultra-poor gained the lowest with PhP 1.83M (Table 6.4).

Table 6.4 Distribution of total benefits across income groups and across *puroks*

Purok	INCOME GROUPS (in PhP '000)			
	Ultra Poor	Poor	Better-off	ALL
8a	23	116	400	**539**
9	-	-	35	**35**
1	431	861	719	**2,010**
2	331	299	526	**1,155**
3	156	105	111	**372**
4	204	223	270	**697**
5	156	291	345	**792**
6	130	244	108	**482**
7	239	157	177	**573**
8	193	170	109	**472**
ALL	**1,864**	**2,465**	**2,799**	**7,129**

Source: Author's construct

Overall, the poor could gain more from the project as shown in Figure 6.9 compared to the better-off and ultra-poor by comparing the distribution of benefits with the percentage of population of all road users. In terms of the absolute distribution of benefits however, the better-off gained the highest with 39%, while poor had 35% and the ultra-poor with 26%.

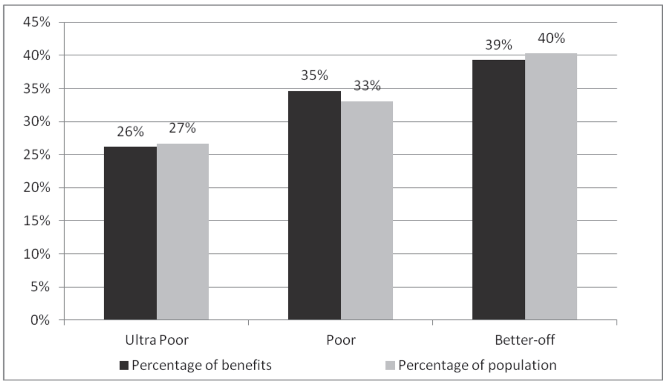

Figure 6.9 Comparison of the distribution of total economic benefits and percentage population of all road users across income groups
Source: Author's construct

In Figure 6.10, the distribution of the total economic benefits showed that the savings in hauling costs constituted at least around 74% from all the income groups as compared with 26% for VOC savings. The area was predominantly agricultural in nature, hence, the major type of savings were incurred in the transportation of agricultural products. The poor are gaining the most of the benefits in VOC savings (32%) while the ultra poor mostly gaining from the savings in hauling costs (79%).

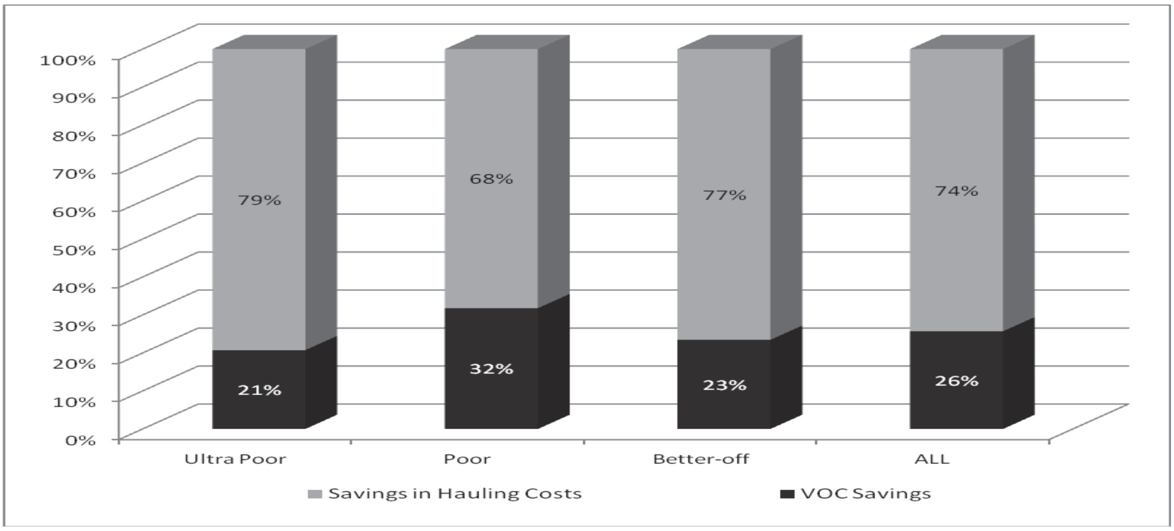

Figure 6.10 Distribution of total net economic benefits due to road improvement
Source: Author's construct

Across *puroks*, Figure 6.11 showed the spatial distribution of total benefits by income group and across *puroks*. Majority of the *puroks* in San Lorenzo showed that the poor and ultra poor are gaining most of the benefits compared to the proportion going to the better-off while in *Purok* 8a and 9 in Los Arcos showed the opposite. Please note earlier that *Purok* 8a and 9 in Los Arcos are predominantly the highest in terms of per household income as shown in Figure 4.4.

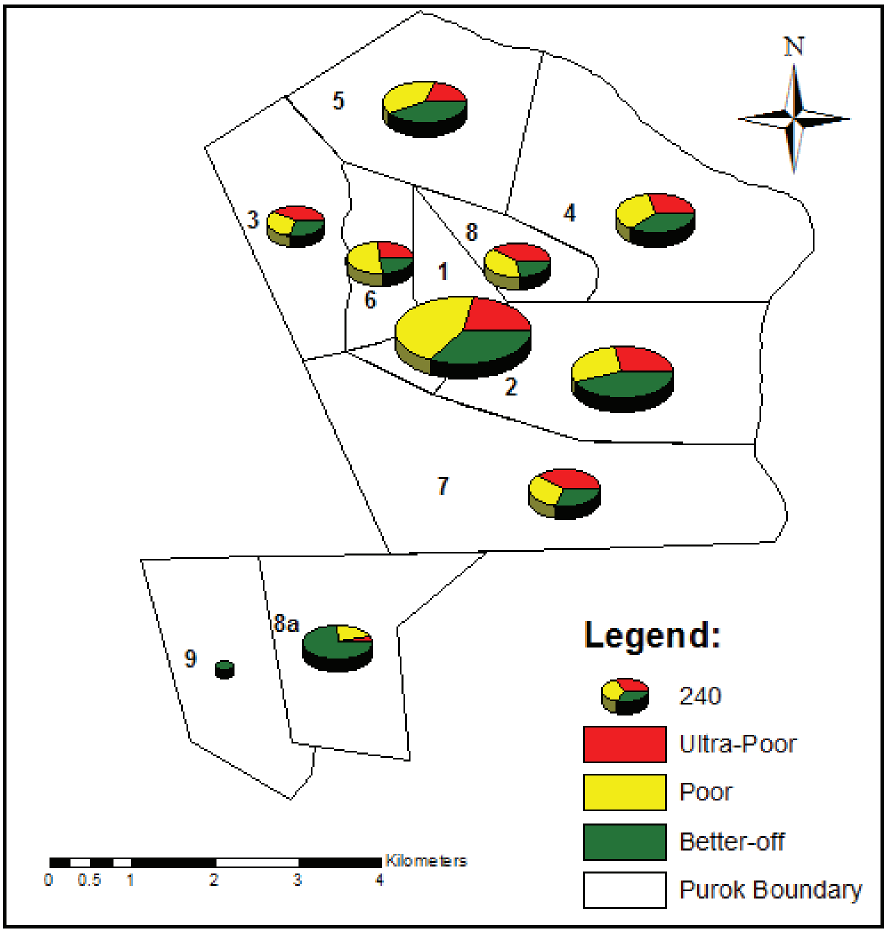

Figure 6.11 Spatial distribution of total benefits by income group across *puroks* (in PhP)
Source: Author's construct

6.1.4. Ways to Estimate the Distribution of Other Benefits

The original CBA was not able to account the benefits derived from forestry which partly accounted for a degree of savings in hauling costs due to the road improvement project. In addition, only the benefits from the public transport were considered but the CBMS data showed that there were households that owned private vehicles. Hence, the total benefit of PhP7.2M was a little bit underestimated. This chapter provides the ways on how to further estimate these benefits that were not considered as well as some other indirect benefits mentioned during the FGD.

6.1.4.1. Distribution of Benefits from Savings in the Hauling of Forestry Products

Using the approach described in sub-chapter 5.1.2, the relative benefits from the road users engage in forestry were distributed. Again, the net time saved of travelling from the location to the main highway (similarly with hauling cost, the *purok* centroids were used to describe the location) and the number of road users across *puroks* (taken from 2009 CBMS data) was used to compute the weight factor. This weight factor was further disaggregated across the income group by multiplying the actual percentage of road users engaged in forestry.

Table 6.5 showed the distribution of relative benefits by income group and across *puroks*. Across *puroks, Purok* 1 in San Lorenzo could gain the highest benefits from the savings in the hauling of forestry products with 23% while across income groups, the highest gainers were the poor groups with 37%.

Table 6.5 Distribution of relative benefits from savings in hauling of forestry products (in %) by income groups and across *puroks*

Purok	INCOME GROUPS (in %)			
	Ultra Poor	**Poor**	**Better-off**	**ALL**
8a	-	1	2	3
9	-	-	-	-
1	7	10	7	23
2	4	6	6	15
3	1	1	2	5
4	4	4	4	12
5	5	7	5	17
6	-	4	2	6
7	5	3	4	11
8	4	2	1	7
ALL	**30**	**37**	**33**	**100**

Source: Author's construct

On the other hand, Figure 6.12 showed that the poor are gaining more from the savings in hauling costs for transporting forestry products than the better-off and the ultra-poor when compared to the population of all road users engage in forestry. Although, the ultra-poor had 30% of the benefits but almost equal with the other income groups where the poor had slightly higher 37% share and the better-off getting 33%.

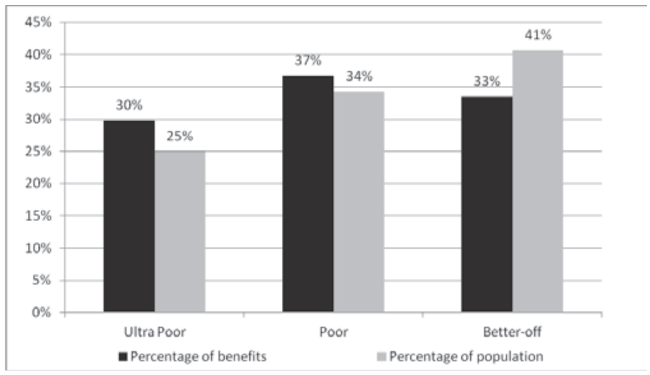

Figure 6.12 Comparison of the distribution of benefits and percentage population of all road users engage in forestry from relative benefits derived from transporting forestry products
Source: Author's construct

The value of the benefits can be estimated by getting the total area planted with forestry products and the average production per hectare as well as how much percentage of these forestry products was being sold.

6.1.4.2. Distribution of Benefits from Savings by Owners of Private Vehicles

The number of vehicle owners by income group and across *puroks* was taken from CBMS data. The net time saved from their location (using built-up centroid) and the number of road users by *purok* were used to estimate the weight factor and disaggregated further across income groups in terms of the actual percentage by income groups. Table 6.6 shows that the relative benefits from VOC savings were only shared by 6 out of the 10 *puroks*. The highest benefit could be gained by *Purok 1* with 45% and *Purok* 2 with 34%.

Table 6.6 Distribution of relative benefits from savings in operating cost of vehicle owners by income groups and across *puroks*

Purok	INCOME GROUPS (in %)			
	Ultra Poor	**Poor**	**Better-off**	**ALL**
8a	-	1	7	8
9	-	-	-	-
1	6	17	23	45
2	-	-	34	34
3	-	-	-	-
4	6	-	-	6
5	-	-	6	6
6	-	-	-	-
7	-	2	-	2
8	-	-	-	-
ALL	**11**	**20**	**69**	**100**

Source: Author's construct

Figure 6.13 shows the distribution of benefits for vehicle owners only. The perceived benefits derived from the vehicle owners could favor the poor and ultra-poor more than the better-off. The most common type of transportation in the area is single motorcycle. Single motorcycle requires relatively cheaper investments that even the poor and ultra-poor household could afford it. The distribution of ownership, however, is skewed towards the better-off with 69%, while the poor had 20% and ultra-poor with only 11%.

The formula for the estimation of the VOC savings for public transport can be applied to compute for the monetary benefits of the vehicle owners.

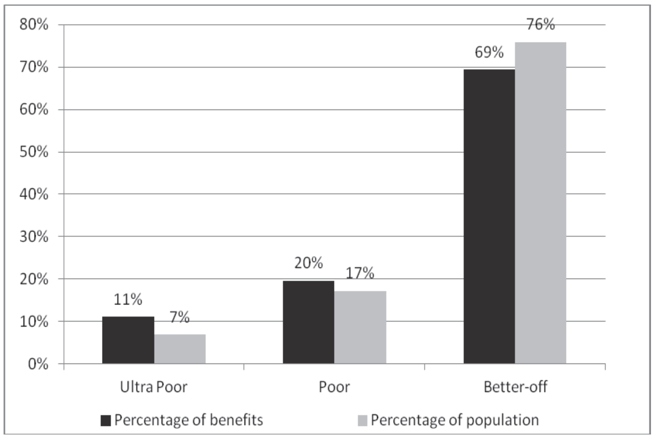

Figure 6.13 Comparison of the distribution of benefits and percentage population from perceived benefits derived from VOC savings for vehicle owners
Source: Author's construct

6.1.4.3. Distribution of Benefits from Attendance to Schools

One of the main indirect influences of road improvement as discussed earlier is the increase in attendance to schools. This was brought out during the focus group discussion with the beneficiaries. Due to the improvement of the road an estimated 10-15% of the students were able to continue with their schooling due to the incentive brought by the road improvement project. The students no longer walk far for them to be able to attend to school due to the availability of all-year round motorized means of transport.

Again the net time saved and the number of out-of-school youth (13-16 years old) by income group and across *puroks* was used to distribute the relative benefits for attendance to school. Specifically, the data on the number of children not attending school was used as proxy indicator since this represents the number of out-of-school youths that benefited and could benefit from the road improvement project. The high school is located along the highway in Los Arcos. The real impact or benefit on attendance to schools is quite difficult to quantify in monetary terms but only could say something about the perceived distribution of these impacts.

Table 6.7 Distribution of relative benefits from increase in school attendance by income group and and across *puroks*

Purok	INCOME GROUPS (in %)			
	Ultra Poor	**Poor**	**Better-off**	**ALL**
8a	0	1	2	3
9	-	-	-	-
1	5	9	7	20
2	2	3	5	10
3	2	2	2	7
4	5	3	8	16
5	2	5	6	13
6	3	4	3	10
7	3	2	2	7
8	5	5	4	13
ALL	**27**	**34**	**39**	**100**

Source: Author's construct

Figure 6.14 shows the distribution of youth from ages 13 to 16 years old not attending school. The data shows that the better-off were gaining from the benefit of the road more than the ultra poor while the poor are just slightly gaining. This means that the road improvement project can have a negative effect on the ultra-poor with regard to the attendance to school. The distribution of benefits also showed that the better-off were gaining most of the benefits (39%) compared to the poor (34%) and the ultra poor (27%).

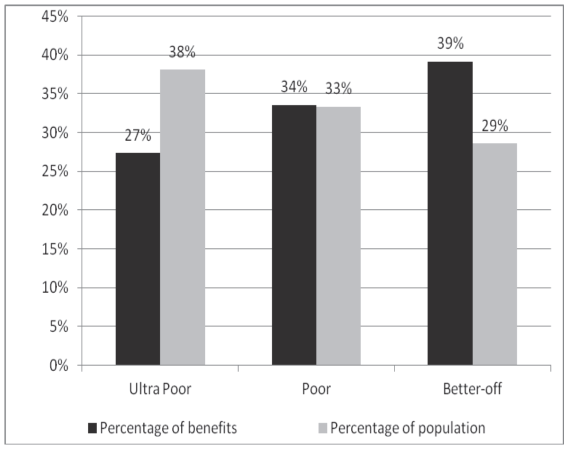

Figure 6.14 Comparison of the distribution of benefits and percentage population from perceived benefits derived from increase in school attendance
Source: Author's construct

6.1.4.4. Distribution of Other Indirect Benefits

The other benefits described that gained a huge impact in the area were the improved delivery of health services (improved malnutrition). Due to the road improvement project, the frequency of visit of health workers were increased tremendously providing more access for the households with malnourished children to be supplied with the needed health care supplies and services particularly in San Lorenzo. Before the road improvement project, these health services can be accessed to other barangays frequently visited by health workers hence, access of households to these services were always constrained. The nearest health center was located in San Lorenzo. Potentially, the network analysis can be used to determine the travel time spent to the nearest facility where it can give value to the net travel time saved for each household with malnourished children across *puroks*.

The other impact is on employment through increased opportunities for hired labor. Due to the road construction, most of the areas abandoned were being cultivated, hence requiring additional labor. The network analysis can give insight on how the hired labours from each location could potentially benefit from decrease in travel time spent from going to the different farm locations. The potential indicator could be by comparing the number of opportunities/destinations reach *without* and *with* the project within a given cut-off time. This could be a potential addition and research direction in the future specifically for the appraisal of rural roads.

6.2. Equity Analysis

The subsequent equity analysis was limited to the total benefits across income groups and across *puroks* and was not done across ethnic and gender groups. This is because of the limitation of data since the CBMS data could not be disaggregated across road users in these groups.

6.2.1. Project Impact Ratio

The project impact ratios (PIRs) were computed across each income group by adding the benefits gained by the poor and ultra poor and dividing this with the overall benefits. These PIRs computed per *purok* were in turn compared to the proportion of the population below the poverty line to determine whether equity is achieved. The project is said to have a positive poverty reducing impact if the project impact ratio is greater than the proportion of the population below the poverty line. The project has a slightly overall positive effect on the reduction of poverty with the computed PIR of 61% compared to the poverty incidence of 60%.

In terms of spatial distribution of PIR across *puroks* (Figure 6.15), the highest impact was along the south to northwest portion of San Lorenzo (*Puroks* 3, 6, 7 and 8). It is noted earlier that these *puroks* were the areas with high incidence of poverty, which implies that the poor can benefit from the road project.

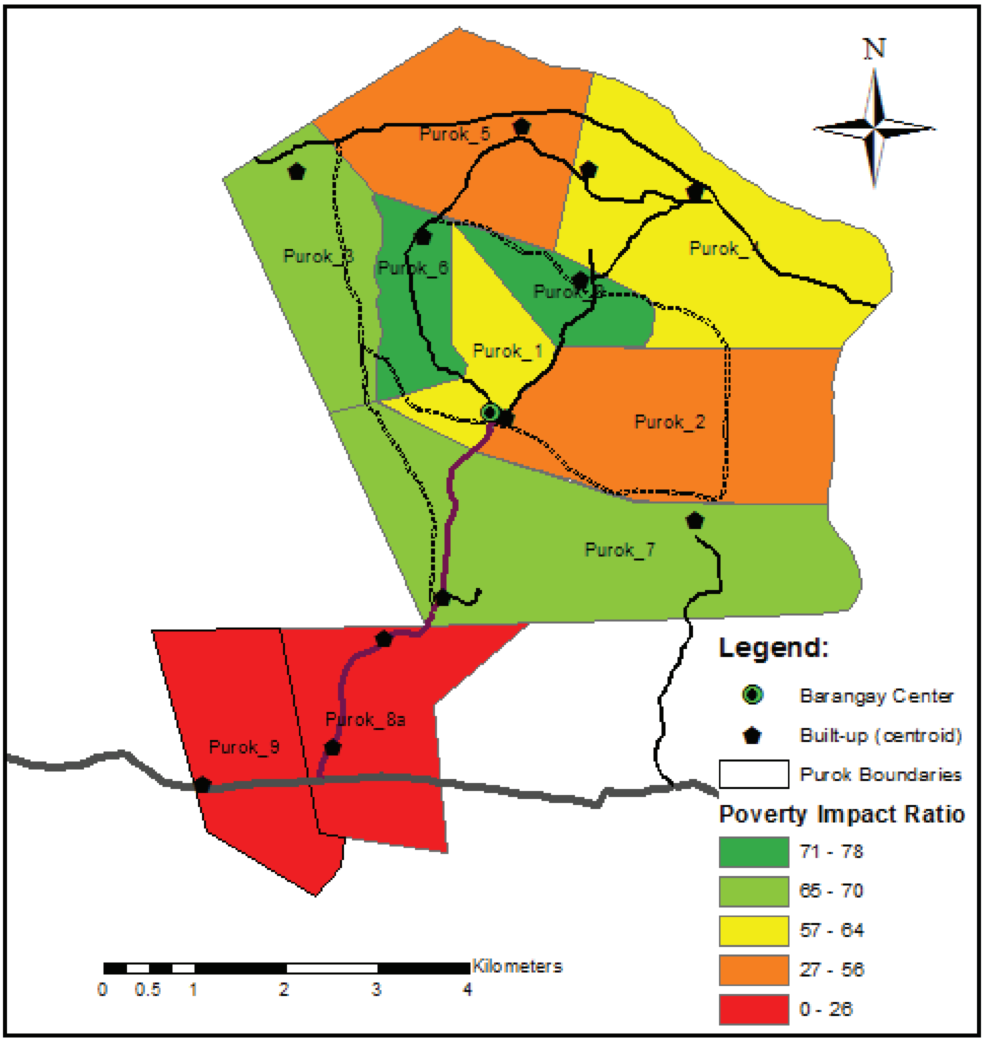

Figure 6.15 Map showing the PIR across *puroks*
Source: Author's construct

Although overall, the project has positive reducing effect on poverty, Figure 6.16 shows that the road improvement project had negative poverty reducing effect on majority (70%) of the *puroks*. It is also interesting to note that even *Purok* 1 who gained most of the benefits, had a negative poverty reducing effect due to the road improvement project. On the other hand, *Purok* 3 and 7 who were among the highest in terms of poverty impact ratio in Figure 6.15 but still were among those who had negative poverty reducing effect as shown in Figure 6.16. As mentioned earlier, these are the groups that were least connected to the road network; hence the gains from the benefits could not be maximized.

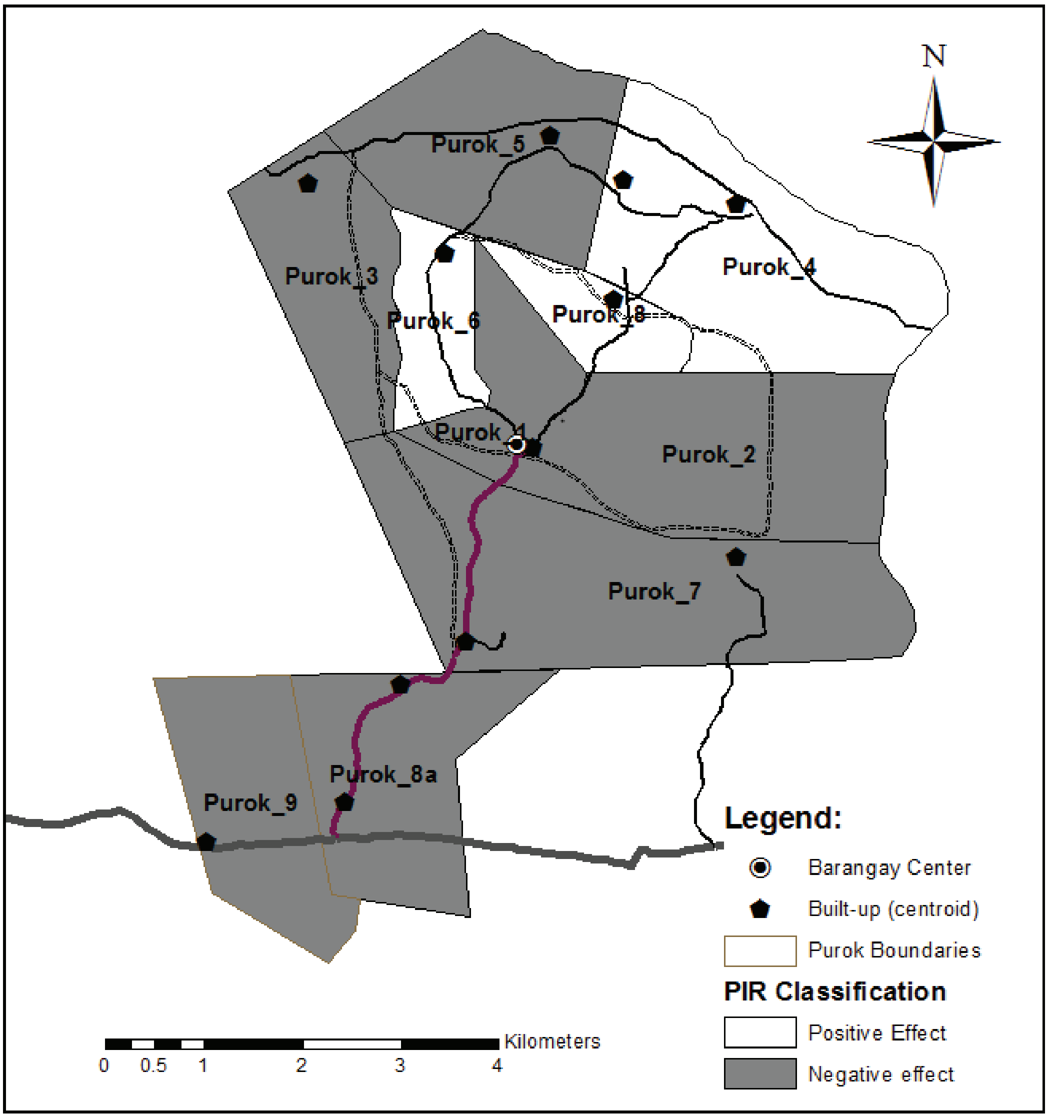

Figure 6.16 Spatial distribution of the effect of the road across *puroks* (PIR vs poverty incidence)
Source: Author's construct

6.2.2. Vertical Social Equity Analysis

Vertical social equity as defined in Chapter 2 looks into the equity among different income groups. The Lorenz curve and the Gini coefficient were used. Although the Theil's index can also be used to measure the vertical social equity, the Gini index was used because it is more popular and has been used widely in the Philippines, particularly in the national statistics body (NSCB). Based on the Lorenz curve (Figure 6.17), relative proportion of the poor and ultra-poor income group gained more from the benefits derived from the road improvement. This means that the road can contribute in improving the equity situation of the area.

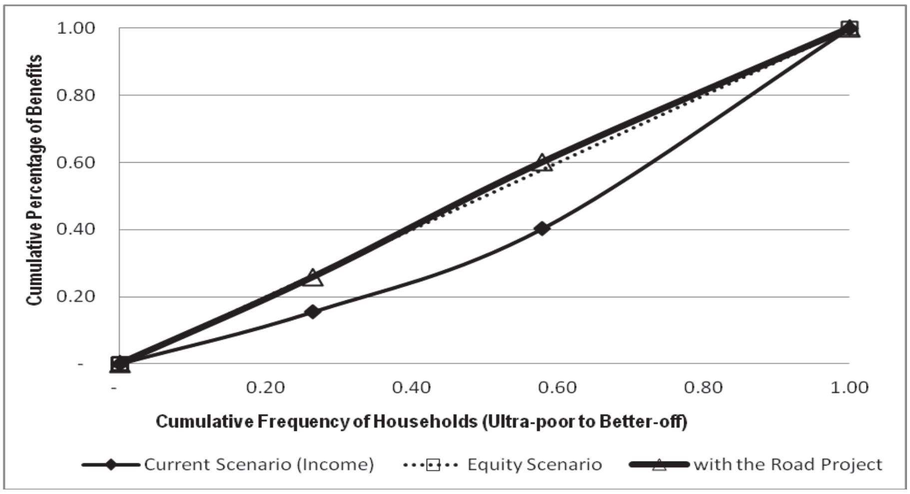

Figure 6.17 Lorenz curve showing the current, equity and the with the road project scenario
Source: Author's construct

The Gini index was computed using the covariance formula. The distribution of the total income across *puroks* using the income intervals across income groups were used to represent the *without* situation while the total benefits disaggregated across *puroks* and by income group were computed as well for the *with* project situation. The Gini index computed for the current income was 36% much higher compared to the Gini index of the distribution of the benefits across income groups with 4%. Hence it shows that the road can contribute in improving the equity condition of the target area. The Gini index was also computed across *puroks* using the total benefits gained by each income group (Figure 6.18). The Gini index computed ranges from 2 to 71% (except for *Purok* 9 which the project has not much significant effect). It should be noted that the index is a measure of inequality which means that the larger the Gini index, the higher the inequality. In general, inequality in distribution of the total benefits across *puroks* is relatively low considering that the Gini coefficients for majority of the *puroks* were below 19%. Inequality was highest in *Purok* 8a with 71% in Los Arcos.

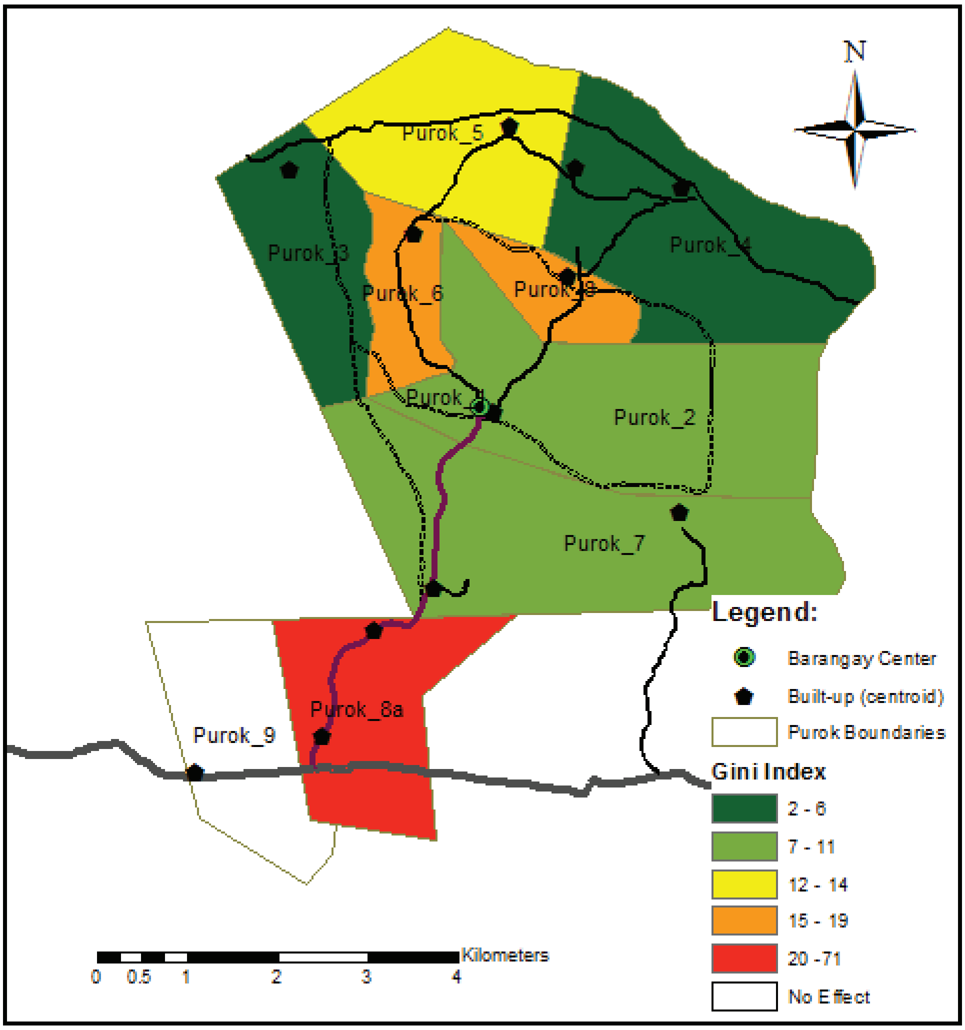

Figure 6.18 Gini index across *puroks*
Source: Author's construct

6.2.3. Horizontal Equity Analysis

The CV was used to measure inequity within income groups. The CV was computed using the distribution of the average benefits per HH across income groups to represent the *with* project situation. The standard deviation was computed using the average benefits per road user divided by the weighted mean of all the benefits within income groups across *puroks*. This was compared with the CV for the average distribution of income which represents the *without* project situation following the same computation. Inequity is highest among the better-offs with 31% and 64% both for the *without* and *with* project situation, respectively (Table 6.8).

Table 6.8 Coefficient of variation across income groups

Income Group	**Inequality within Income group (*with project*) in %**	**Inequality within Income group (*without project*) in %**
Ultra Poor	47	14
Poor	55	19
Better-off	64	31
ALL	49	25

Source: Author's construct

6.2.4. Geographic/Spatial Equity Analysis

6.2.4.1. Coefficient of Variation

The computed coefficient of variation for the average income distribution per HH (which represents the without the road situation) was computed at 25% while the average benefits per HH distribution was at 49%. This means that the road had worsened equity within the groups. However, further analysis is needed in order to further decompose the inequity index across *puroks*. This is done by using the standard score (z-scores) discussed in the next sub-chapter.

6.2.4.2. Z-scores

The difference in z-scores is computed for the *without* and *with* situation. The average income across *puroks* was used to represent the without project situation while the average benefits across *puroks* represented the *with project* situation. Figure 6.19 shows the distribution of the change in z-scores from the *without* and *with* situation. Majority (70%) of the *puroks* were gainers from the road improvement. Note that most of those gaining were the *puroks* with low income and high incidence of poverty which implies that the road can help improve the poverty situation across these areas. In contrast, *Purok* 8, which was located near the highway, was the major loser (+ to -) and *Purok* 2 located along the center was also losing (+ to + but $z_b < z_i$). The better-off households dominated these areas which coincide with the previous findings that the benefits from the road improvement project can be gained by the areas inhabited by the poor and ultra-poor.

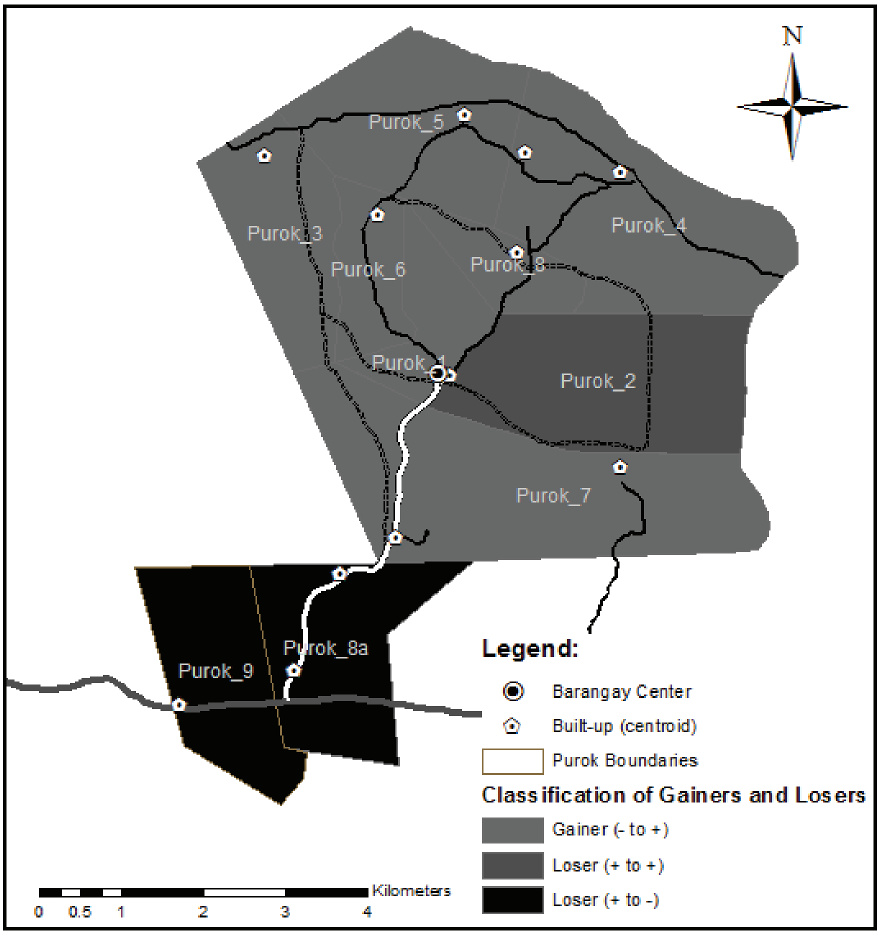

Figure 6.19 Spatial distribution of the gainers and losers across *puroks*
Source: Author's construct

6.3. Summary

The developed approach showed some potential in analyzing the distribution of the benefits of the rural road improvement project across *puroks* and across income groups. Although the main consideration is on the distribution of direct or economic benefits (i.e., VOC savings and savings in hauling costs), the approach can also give insights on the distribution of the perceived indirect benefits like effect on school attendance including other benefits not captured in the original CBA like savings in Hauling cost for forestry products and savings in VOC for private vehicles. The main parameter used was the net time savings from the *without* and the *with* situation which were captured using the network analysis. The net time savings was highest at the central most area of San Lorenzo for both the household (built-up centroids) and farm (*purok* centroids) locations. The net time savings for both locations showed that the central most areas of barangay San Lorenzo gained the highest.

Results of the analysis showed that the *Purok* 1 and 2 (located along the center of San Lorenzo) gained the highest in total benefits, while the least was *Purok* 9 (the area closest to the highway). *Purok* 1 was consistent to be the top gainer in terms of distribution of total benefits and also the benefits gained from savings in Hauling costs and VOC savings. However, in terms of distribution of the average benefits per HH, *Purok* 8 in San Lorenzo gained the highest, while *Purok* 9 in Los Arcos was the lowest gainer.

Benefits from the savings in hauling costs seem to be favoring slightly the ultra-poor and the poor while the VOC savings favored the poor and the better-off. Overall, the poor gained more from the total benefits compared to the other group.

The analysis was also able to give insights into the distribution of relative benefits not accounted in the original CBA(2009). For example, the savings in the hauling of forestry products was not included in the original CBA which was also one of the major sources of income in the area. Similarly, the poor and the ultra-poor seem to be gaining more from the benefit of the savings from the transport of these products. Other road users that the original CBA failed to account were the vehicle owners, who are the major users that benefit from the road improvement project. The relative benefits derived from the vehicle owners again could favor the poor and ultra-poor more than the better-off. This is because single motorcycle is the most common type of transportation and requires relatively low investments which even the poor and ultra-poor can afford it.

In the analysis of the indirect benefits, the indicator used was the number of high school drop-outs across *puroks*. The road improvement had a positive effect on the better-off compared to the poor income and the ultra-poor in terms of the effect on school attendance. For the distribution across ethnic groups, the distribution the ethnic group is favoured over the non-ethnic group.

For equity analysis, in terms of PIR, the road project had an overall positive effect where PIR is higher (61%) than poverty incidence (60%). However, majority (70%) of the *puroks* gained negative effect in terms of poverty effect (PIR vs poverty incidence). The road improvement project however, is contributing for the improvement of equity across income groups (vertical social equity) as shown by the Gini coefficient and Lorenz curve and across *puroks* (geographic/spatial equity) as shown by the dominance of the number of gainers using the z-scores. However, in terms of horizontal equity or within income group, the road is not contributing but may worsen equity within each group.

7. DISCUSSION

Considering the nature of appraisal and the predicament of data availability in the Philippines, particularly on spatial information, the current approach developed exhibits a great potential to capture the needed information on how the benefits are distributed across social groups and across geographic locations in the appraisal of rural roads. This chapter contains the synthesis of the pre-conditions and justifications on how the framework was developed in Chapter 5 as well as the application of the approach developed in Chapter 6. Furthermore, the advantages as well as the limitations of the approach are also discussed.

7.1. Analysis of the Existing Appraisal Process

The existing appraisal process is limited to showing only the aggregated benefits of the rural road improvement project and does not include the distribution of benefits across spatial or geographic locations and social groups (e.g., income groups). Also, the appraisal is limited to the identification of the economic and environmental impact but not particularly dealing with other social impacts particularly its distribution. The concern of the main stakeholders, particularly the Provincial representative is to find out how benefits are being felt by the poor sector, especially the ultra-poor. This would further guide the planners in their development of programs and policies which focus on the provision of subsidized inputs and services to target areas. While the clamour for additional information is very high among the stakeholders, they claim, particularly the NEDA that additional information leads to additional data requirements that may not be possible due to limited human and financial resources.

In the Philippines, the current practice in conducting feasibility studies for road improvement employs a two-stage appraisal process. During the first stage, a set of selection criteria is developed. The criteria involves selecting first from a national scale, the areas with high poverty incidence, then further selecting the same down to the municipal level. According to the stakeholders, equity can be achieved by prioritizing the poorest areas and the areas with high number of disadvantaged groups (e.g., IPs). Van de Walle (2002) noted however, that targeting the poor is not a guarantee that equity is being achieved considering that the redistributive effects are not the same across targeted areas. The second stage deals with the preparation of the original CBA and the approval process where CBA is one of the main criteria. The ICC guidelines in the Philippines state that all projects should have at least an economic internal rate of return of 15%. The savings in hauling costs and VOC savings were the main direct economic benefits derived from the road improvement. The computation of these savings was based on specific standards set by the World Bank. The road under study has relatively low traffic volume with an average volume of 12 vpd.

The estimation of the road influence area or zone of influence was one of the most critical aspects for consideration in the feasibility study preparation. The standard set by Department of Public Works and Highways (DPWH) standard of 500 meters (both left and right) could be used. However, this is only applied to areas where there are alternative routes. In the case of San Lorenzo, there were no other access roads going out to the public market and main highway, therefore, this standard was not applicable. The use of a lower aggregation (*purok* level) was also useful in the determination of the actual users of the road and helped solved this problem. Also, a combined application of the focus group discussion and use of spatial information can further enhance the estimation of the road influence areas and population served.

On the other hand, in terms of social and environmental consideration, the Social Safeguards and Environmental Management Plan (EMP) was part of the appraisal process. However, social aspects only deal with the displaced people and IPs affected by the road project physically.

7.2. Review of Existing Methods and Tools for Distributional and Equity Analysis for Rural Roads

The review of existing methods and tools points out that the distribution and equity analysis can be accommodated within the context of CBA (World Bank, 2005b). However, an approach on distributional and equity analysis specific for CBA-based appraisal of rural roads is still lacking particularly on further disaggregating the benefits across spatial units. For example, Gajewsky et al. (2004) did apply the existing methods and tools described in TRN-5 for rural roads but failed to consider geographical/spatial concerns in the distribution of the benefits. Khanna's (2009) approach and also in Barone (2003) includes both dimensions, but the data requirements seem to apply only for urban settings (i.e., detailed traffic analysis) which might not match the characteristics of the appraisal of rural roads. Please note that one of the major setbacks in the use of these methods into actual practice is that they are complex and often require intensive data.

With respect to the CBA-based appraisal of rural roads, funding agencies, particularly the World Bank, keep on conducting researches in order to develop approaches specifically for rural roads that can fit with the existing limitations and characteristics of rural road appraisal in developing countries. For example, the World Bank designed a customized consumer surplus approach (RED Model) in dealing with the calculations of the direct economic benefits like VOC savings (see Chapter 2.1.2) for low volume rural roads. The modified/customized consumer-surplus approach was developed mainly to reduce input requirements. The RED model was used in actual practice for most WB funded projects to compute the direct economic benefits.

On the other hand, Van Wee and Geurs (2011) noted that it is not common practice for the inclusion of accessibility in the *ex ante* evaluation of transport projects. However, accessibility and CBA is linked through the travel time savings as expressed in monetary terms. Even when accessibility was included, limited researches have been conducted on accessibility particularly on the distribution of accessibility changes across income class and regions (geographic locations). Hence, the requirement was to be able to develop a robust but simple approach that can be used and integrated into actual practice of appraisal for rural roads.

7.3. Integration of Distributional and Equity Analysis in the Appraisal of Rural Roads

It has been mentioned that the link between accessibility and the CBA is through the travel time savings as expressed in monetary terms. The travel time savings is part of the generalized travel costs that is used to measure the benefit of a particular rural infrastructure (World Bank, 2005b). The existing appraisals of rural roads, however, do not account for the value of time savings due to the difficulty in estimating the benefits but instead the savings in hauling costs and the VOC savings were used. For the savings in hauling costs, the difference between the prices of shifting from a manual to a motorized means of transport due to the road improvement project accounts for the value of time saved for the transport of the agricultural and other products. Although, theoretically, for VOC savings, the link between the value of time savings and VOC is only in terms of the passenger time and crew costs which are part of the components as discussed by Archondo-Callao and Faiz (1994) and the World Bank (2005e). The use of time can still be justified because as noted earlier in sub-chapter 4.2.5, the road improvement project is the key to providing a whole year access for both the passenger and in hauling of agricultural and other products. Hence, the shift from the non-motorized to motorize means of transport generated savings in cost which is greatly attributed to the savings in time. On the other hand, according to Van wee and Geurs travel time savings alone is not the only parameter included in accessibility-based measures but there are also other factors that could be worth exploring which are hardly explored in transport appraisal particularly rural roads.

In the original CBA, the average savings in hauling computed was PhP 87.84 or PhP 17.01/kilometre while the computed VOC savings for *jeepney* per kilometre was PhP 35,260 while *habal-habal*, was PhP 25,320. Hence, the use of the net time saved to distribute the direct benefits of the road project could be a starting point for the integration of the distributional and equity analysis for the appraisal of rural roads.

The higher the travel time saved due to road improvement, the higher the benefit or weights accrued to the road users.

Equity, on the other hand, could be easily integrated into the appraisal of rural roads using different equity measures (van Wee, 2011). This is often complementary to distributional analysis. According to Litman (2011a), there is no single measure of equity but its evaluation is dependent on equity types, the group of people, and how impacts are being considered and measured.

While the main focus of the study was on the direct benefits, other important indirect benefits were also described during the FGD. These are effects on local employment, health and attendance to schools. These are the potential indicators for social impact assessment and very important to consider in appraisal according to Geurs, et al. (2009).

7.4. Development of the Approach

The approach used a combination of the several methods and tools for distributional and equity analysis as reviewed in Chapter 2. The approach developed considered certain limitations in the appraisal of rural roads as discussed in Chapter 7.2 as well as the utilization of the accessibility-based measures i.e., travel time savings linked with CBA. It was noted earlier that the CBA is still the most widely used technique in the appraisal of rural road projects. The CBA approach, however, is criticized for not being reporting distribution effects but actually according to van Wee (2011), the criticism lies of not putting it into actual practice. The approaches developed, then, were built on this context. Chapter 5 discussed the initial framework as well as the step-by-step process of developing the approach and how it could be accommodated within the CBA context and have potential for actual implementation. The framework could be a starting point towards expanding the approach to accommodate more accessibility-based indicators other than travel time savings.

The main goal of distributional analysis is to be able to show how the benefits of the rural road projects were distributed across locations and across income groups. Complementing the distributional analysis is the equity analysis. Consideration of equity in the appraisal process is useful because it provides the information on whether the benefits across income groups and across locations are equitable or not. Equity analysis is flexible in the sense that it could use different measures to provide the required analysis for rural road projects. The equity measures was presented in various literatures particularly Khanna (2009) and Litman (2011a). Specific measures were developed for each equity forms (i.e. vertical social equity, horizontal equity and spatial equity).

7.5. Application of the Approach

Disaggregation or distribution of the benefits at the *purok* level and across income groups using the approach proved to be successful despite the limited data (Chapter 6). Some of the specific results for the distributional analysis are indicated in Chapter 6.2.

The results of the distribution analysis showed that the central most portion of San Lorenzo (i.e. *Purok* 1 and 2) gained most from the total benefits of the road improvement project while the areas close to the main highway (*Purok* 8 and 9) gained the least. However, despite that *Purok* 1 is gaining most of the benefits, it was found out that in terms of average benefits, it was among the lowest and even gaining negative poverty effect because of the project. This is because the road effect has been shared by more households considering that people tend to abandon their current location and move closer to center for better access to the basic services. Moreover, in terms of distribution across income groups, while the poor is gaining more because of the project, it is also important to consider the ultra-poor being the most deprived in the community is somewhat losing. On the other hand in terms of poverty effect (where the PIR were compared to poverty incidence), it showed that majority (70%) gained negative effect. In particular, *Purok* 3 and 7 gained the highest in terms of PIR but the poverty effect was still negative. We note earlier that these are the areas who were least connected, hence travelling was constrained. These kinds of information were crucial for policies and programs in the future that will guide the decision-makers as well as the planners and implementers of the project. This will be in terms of possible reorientation of the road design in order to capture more of the areas that were not gaining.

For the equity analysis, although equity can add value into the existing appraisal process, further exploring equity across various forms could be a futile exercise. This is in consideration of the requirement mentioned by the stakeholders that the most important aspect or information is on how the road project has made an impact on human poverty as well as the vulnerable groups like women and the indigenous peoples. In this regard, the project impact ratio and the poverty effect could be the most appropriate measure. However, the other measures are still helpful to further give insight on the equity situation across *puroks* and across social groups. Hence, consideration of these measures was still vital.

Results showed that the road improvement project shows positive effect on both horizontal (equity across income groups) as indicated by the Gini coefficient (4%) and Lorenz curve as well as spatial equity having majority (70%) of the *puroks* are gainers based on the computed change in z-scores. This runs in contrast with the findings in the PIR and poverty effect. Hence, the author agrees with the recommendation of van Wee and Geurs (2011) that certain norms or standards should be developed considering the complexity of equity measures which could be subject to various interpretations. On the other hand, the use of Gini coefficient may not provide a complete picture whether the poor groups was benefitting since according to World Bank (2011a), the Gini had the tendency to vary the distribution regardless if the change occurs from the poor or rich income groups. Hence, other measures could be explored. Further, in the analysis in Chapter 6.2, most of the equity measures are compared from baseline e.g., for Gini and Lorenz curve, the current distribution of the benefits was based on the income before the road was constructed as documented in the Feasibility Study (2009). However, further validating this information to the stakeholders and come up with better indicators, may lead to better results.

Although, initially, the approach have been designed to capture only the distribution of direct benefits, other indirect benefits (or social impacts) could be potentially captured by the approach developed. For example, the effect on school attendance was included. Although this effect were already included in the economic benefits as the savings from travelling to school, it can still be included as part of the social indicators since the analysis was based on the number of out-of-school youths. Hence, the argument of Geurs, et al. (2009) was right that categorization of such impact was not that most important as long as there is no double counting and they are included in the appraisal process.

Other issue which could have great implication on the appraisal particularly in the CBA is the estimation of the road influence areas and the population served. The estimation of the road influence area or zone of influence is normally set according to the Department of Public Works and Highways (DPWH) standard of 500 meters (both left and right). However, this is only applied to areas where there are alternative routes. In the case of San Lorenzo, there were no other access roads going out to the public market and main highway, therefore, this standard was not applicable. The use of a lower aggregation (*purok* level) was useful in the determination of the actual users of the road and helped solved this problem. Also, a combined application of the focus group discussion and use of spatial-based techniques (i.e. GIS and other applications) can further enhance the estimation of the road influence areas and population served.

7.5.1. Advantages of the Approach

The main advantages of the approach of distributional and equity analysis for rural roads are the following:

1. The approach provides information on how the benefits are distributed across social groups and across *puroks* and can account who are benefitting and who are losing. This is in consonance with the findings of Gajewski, et al. (2004) and the goals set by ADB (1997) that distributional analysis presents a flexible approach in identifying who gains (gainers) and losses (losers) during the appraisal of projects. This kind of information could further aid in the appraisal of other rural road projects. Moreover, the information of the location of the gainers and the losers could be helpful in the planning and formulation of development strategies aimed at further improving the distribution and equity effects of the project during the actual implementation of the project. It will also provide information to decision-makers as to how the benefits are distributed across *puroks* and across social groups. Please note earlier that the main concern of these decision-makers is on how projects are faring in terms of contribution to the poor and disadvantage groups (i.e. women and indigenous peoples).
2. The approach can also give insights on certain aspects that are not captured in the existing appraisal process such as the distribution of other benefits (e.g., benefits from savings in hauling costs of forestry products and VOC savings for vehicle owners). It is also possible to describe the distribution of other the indirect benefits like increased in school attendance taking into account the number of out-of-school youths. This is possible with the incorporation of accessibility-based measures i.e., value of travel time saved in the approach. Other indirect benefits like impact on health and employment (hired labor) can be potentially captured in the improved approach but was not conducted due to time limitations.

7.5.2. Limitations of the Approach

Despite the potential of the approach to further disaggregate the benefits across geographic locations and social groups, it is limited by the availability of data which could hamper its application into actual practice. Other limitations of the approach are listed below:

1. The rural road appraisal still employs the conventional approaches i.e., VOC method due to the difficulty in estimating the value of time savings specifically for rural roads (World Bank, 2005f). Although the use of time savings shows some modest result in terms of its application for analyzing the distribution and equity of the benefits derived from the rural road project could still be improved. This is because aside from crew costs and passenger time there are other factors that could influence the differences among the various households (Archondo-Callao, (2004); World Bank, (2005e) which were not considered in the approach. These components include: fuel and oil, vehicle age, other maintenance costs, and some road characteristics like roughness, among others.
2. The approach only considers the net time saved as the main parameter across location and across social groups but there are other factors that could influence the travel. These factors include suitability of locations and the quality and cost of travel options, as mentioned in Litman (2011a). This can be a subject for future research.
3. In the disaggregation of the benefits, however, some limitations of the approach were encountered e.g. only the actual percentage from each income group across *puroks* was considered due to absence of detailed road user survey. To account for this, some secondary information from literature was used (Hettige, 2006). On the other hand, it was assumed that farmers gained equal proportion of the benefits due to the absence of data on average landholdings across income groups. However in reality, the better-off households have bigger land holdings than the lower income group which could have effect on the distribution of benefits. Moreover, the location of the farms being cultivated was the same area as the location of households was assumed where in some cases it was not. Hence, this could be one of the further refinements in the approach.

8. CONCLUSION AND RECOMMENDATIONS

As evident in the previous chapters, the approach developed for the integration of distributional and equity analysis in the appraisal of rural road projects showed a tremendous prospective. The discussion in this Chapter is focused on the advantages as well as limitations of integrating distributional and equity analysis in the appraisal of rural roads.

8.1. Conclusion

The research developed and implemented an approach to accommodate distributional and equity analysis within the context of the appraisal of rural roads. The approach shows a strong potential for integration into the project appraisal process through the use of travel time savings as a measure of accessibility. The aggregated direct economic benefits derived from the original CBA can be further disaggregated across geographical locations (e.g., *puroks*) and across social groups (income and ethnic groups). In addition, the approach provides information on the impact of project on human poverty and of its effects on the achievement of equity. Furthermore, the information on the distribution of benefits across social groups and across *puroks* from the rural improvement project during the appraisal process can be used by decision-makers. The decision makers are specifically interested whether the benefits were being accrued to the poor and disadvantage groups i.e. the poor, women and the indigenous peoples of which the integration of distributional analysis can provide such information.

8.1.1. Analysis of the Existing Appraisal Process

Equity is considered to be achieved when projects target poor areas. However, distributional analysis was never included across geographic (*puroks*) and social groups (i.e., income, gender, and ethnic groups) in the existing appraisal process. Hence, there was no further basis on how this is being achieved. On the other hand, other social benefits were hardly considered during the appraisal process.

8.1.2. Review of Existing Methods and Tools for Distributional and Equity Analysis for Rural Roads

Several methods and tools have been developed (as discussed in Chapter 2) but none were specifically designed for the appraisal of rural roads. Based on the review, the application of the different methods and approaches are mostly dependent on the type and availability of data which often determine the approach and its potential to be put into actual practice. Rural roads appraisal in developing countries require a different approach because of certain data limitations and difficulty in the acquisition of information. On the other hand, the demand for the application of accessibility-based indicators in CBA is high considering the limited researches conducted on it as well as the development of social-based indicators.

8.1.3. Integration of Distributional and Equity Analysis in the Appraisal of Rural Roads

Distributional and equity analysis could be integrated within the context of CBA through the use of travel time savings as part of the accessibility-based measures. The method and tools developed were sufficiently flexible to allow integration or incorporation into the existing appraisal process. However, travel time savings alone is not the only parameter included in accessibility-based measures but there are also other factors that could be worth exploring in order to identify further indicators focusing on social benefits which are hardly explored in transport appraisal particularly rural roads.

8.1.4. Development and Application of the Approach

As mentioned in the previous sub-chapter, the link between CBA and other concepts is through the time value of money expressed in monetary terms. Rural road appraisals in developing countries are often characterized by limited detailed analysis because of the limited data availability. Hence, there is a need for a simplified approach in order to account for these limitations. The approach developed was applied to a specific rural road project in Agusan del Sur in the Philippines. The main results are detailed below.

a. The developed approach showed some potential in analyzing the distribution of the direct benefits of the rural road improvement project across *puroks* and across income group as well as the distribution of the perceived indirect benefits such as the effect on school attendance and other benefits not captured in the original CBA like savings in Hauling cost for forestry products and savings in VOC for private vehicles.
b. In terms of distribution of the total benefits across geographic locations, *Purok* 1 and 2 (located along the center of San Lorenzo) gained the highest in total benefits, while the least was *Purok* 9 (the area closest to the highway). *Purok 1* was consistently the top gainer in terms of total benefits and savings in Hauling costs and VOC savings. However, in terms of benefits per HH it was among the least gainers. This is because more households were sharing the benefits.
c. For the poverty impact ratio and poverty effect, the PIR is high across all *puroks*, however in terms of poverty effect, majority of the *puroks* gained negative effect (PIR < poverty incidence).
d. For equity analysis, the road improvement project could contribute to the improvement of equity across income groups (vertical social equity) and across *puroks* (geographic/spatial equity) based on certain equity measures. However, horizontal equity or within income groups could not be improved.
e. Overall, the poor were the top gainer of the direct benefits of the road improvement project. For the other direct benefits not captured in the original CBA, poor and the ultra-poor seem to be gaining more from the benefit of the savings from the transport of forestry products and the vehicle owner savings.
f. In terms of the indirect benefits, the road improvement had a positive effect on the better-off in terms of the effect on school attendance. The approach also showed potential to capture the other indirect benefits like employment (in terms of hired labor) and health (improved malnutrition) but was not able to be dealt with due to time and data limitations.
g. The approach shows information regarding how the benefits of the road improvement project can be distributed across *puroks* and across social groups which could further aid in the planning and during the implementation of the project. However, this strength is dependent on the availability of data which is often a constraint in rural road appraisals.

8.1.5. Overall Conclusions

Overall, integrating distributional and equity analysis into the appraisal of rural roads is very important because it provides information on how the benefits are distributed across geographic locations and income groups that could be utilized by decision-makers, planners as well as project implementers. On the part of the decision-maker, the new information could further enhance the quality of decision-making. This is because the distributional and equity analysis could provide information as to how benefits were being distributed across different social groups and across *puroks* which is linked to the interest of the decision-makers where they are concerned on how the benefits can be beneficial to the poor and disadvantage groups i.e. women and the indigenous peoples. On the part of the planners and implementers, the information on where and who are the gainers of the project will be an input into developing a more appropriate development strategies for the community to better address poverty. This could also be an input in further developing the appraisal manuals for rural roads. However, the issue lies in putting it into actual practice. Most approaches to distributional and equity analysis fail because of intensive data requirements that could not match with the characteristic of rural road appraisal in developing countries. This is because of limited human and financial resources.

8.2. Limitations of the Study

Despite the potential of integrating distributional and equity analysis into the project appraisal process particularly for rural road projects, the research faced some limitations which somehow have an effect on the accuracy of the information regarding the distribution of benefits across social groups and across *puroks* from the project. Some of these limitations were the following:

1. The research was based entirely on the existing and available CBA. Hence, the distributional analysis was mainly confined to the benefits identified and measured in the existing CBA. In this regard, some possible benefits were not considered. Also, the research had to work entirely within the frame of the current valuation methods employed. Hence, the emphasis on the valuation of travel time savings might limit the scope for a more insightful/realistic valuation of benefits.
2. Initially, one of the aims of the study is to test the approach to several rural road projects and to validate the approach and results to the various stakeholders. However, this was not carried out, because of time and data limitations. Instead one detailed study was done and limited possibility existed to discuss the final results with the decision makers.
3. Another weak point of the study is the lack of data particularly on spatial information. There still exist some boundary conflicts across regions, provinces, and municipalities particularly in Agusan del Sur which are still being reconciled. Hence, there is difficulty in acquiring of such information. Aside from this, the network analysis lacks more detailed footpaths and other access roads within the road influence which could provide more accurate information with regard to the estimation of time savings. In addition, more detailed spatial data on updated land use and land cover specifying the location and type of crops as well as the average landholding by type of income group could lead to a more accurate estimation of where specific road users groups are located and therefore to a better disaggregation of for example the time saved in the hauling of agricultural products. There were also some limitations in terms of data on the frequency of travel for each of the road users because a detailed survey for these road users was not conducted. Hence, the study relies only on secondary information. While the assumptions taken from various literatures can be modest, further development of these assumptions could be done country or region-specific in order to have more accurate results of the distribution of the benefits. However, careful consideration should be done considering the limitations in both the human and financial resource capabilities of the various proponents of rural road projects.
4. There is some overestimation and underestimation of the benefits in the original CBA. Some of the assumptions which are typical in conducting project appraisal process particularly during the preparation of the original CBA are based on secondary information and discussion with key stakeholders and beneficiaries. One of the main weaknesses of the original CBA is the identification of the zone of influence or road influence area which through employment of GIS can be further improved. One example is that, the original CBA only considered the benefits for the hauling of farm products in San Lorenzo but not in Los Arcos while in fact there are also agricultural and forestry areas in those *puroks* traversed by the road in Los Arcos. Hence, the savings in hauling costs maybe under-estimated. This finding maybe outside the scope of the research but certainly has an effect on the distribution and equity. Therefore it is important that land use or land cover information (as mentioned in Item 3) must be updated and reconciled.

8.3. Recommendations and Future Research

The ultimate goal of this research is to eventually able to fully integrate distributional and equity analysis and put it into actual practice in the existing appraisal not only for rural roads but for other rural development projects in the Philippines. The way forward therefore is to further develop the approach by improving on some of the limitations discussed in Chapter 7.5.2. Also the limitations discussed in Chapter 8.2 could be potential areas for further research. Other aspects include the following:

1. It should be noted that different types of road users across income groups vary in terms of travel behaviour. However, the effect of the road improvement project on income could trigger different patterns of travel. In this regard, sensitivity analysis can be conducted by varying some of the assumptions in the analysis of structural constraints to see the effect on the PIR as well as the various equity measures. The other option could be the development of several scenarios in order to account for these differences. Hence this could be further explored as part of future research undertakings.
2. While initially, the approach shows potential to capture other social benefits like school attendance, further study is recommended to be able to develop and define further other indicators like the effect on hired labor and health i.e. improved malnutrition which was initially defined conceptually on this research but needs more elaboration. The other important benefits mentioned in Chapter 4.2.6.2 could be potentially explored in future researches.
3. Equity measures come in various forms and often conflicting results lead to different interpretations. It is important therefore that further analysis should be conducted and development of certain norms could be done further in order to have more or less the same interpretation of the results.

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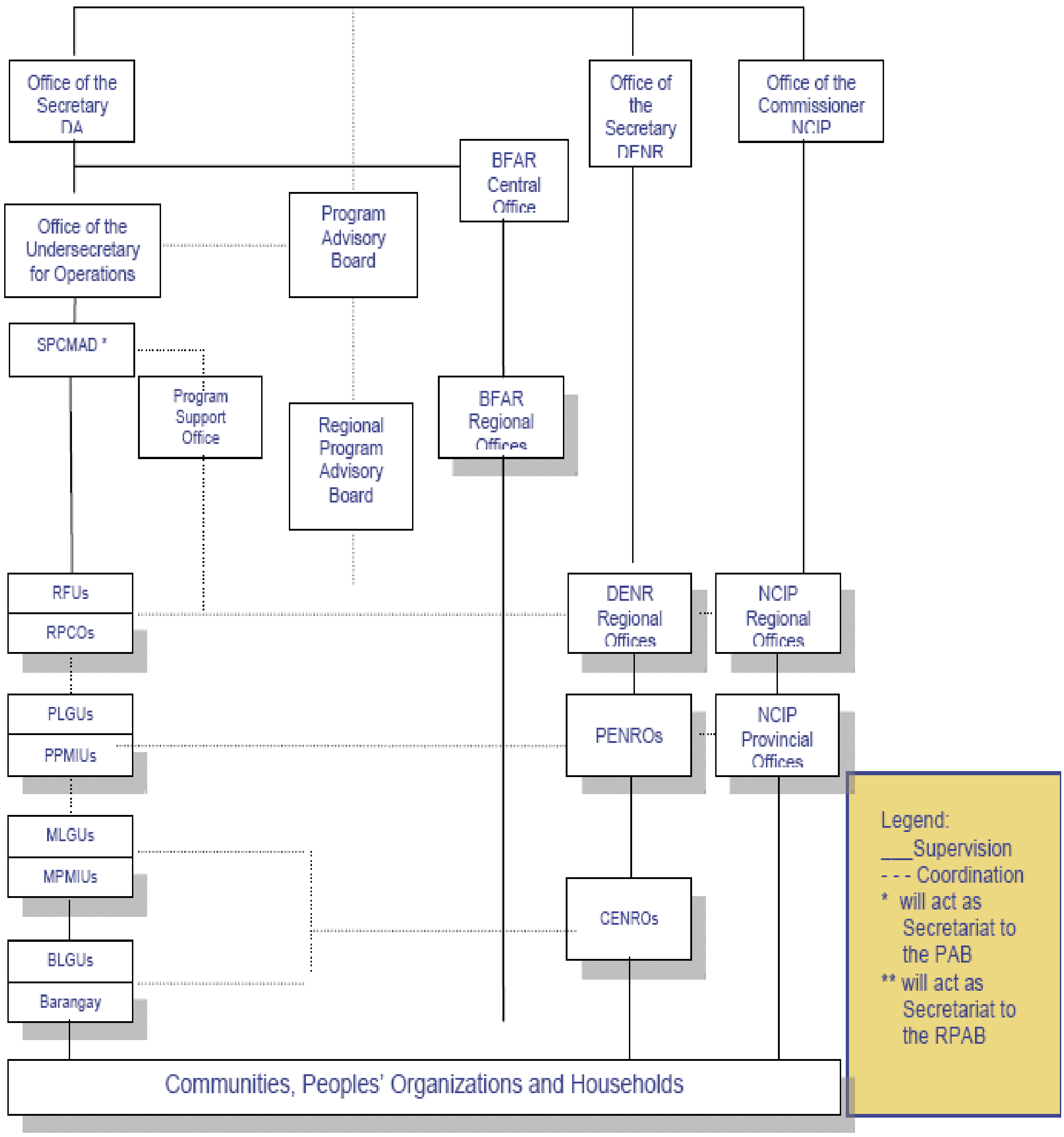
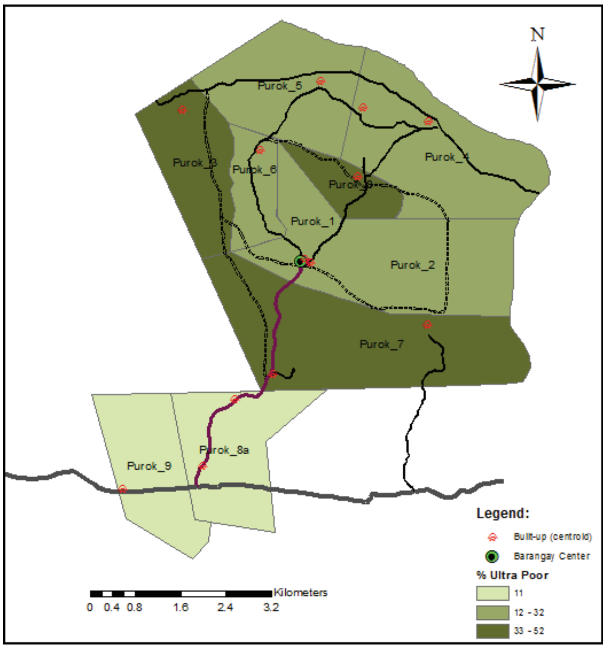
APPENDICES

Appendix 1 MRDP overall implementation structure

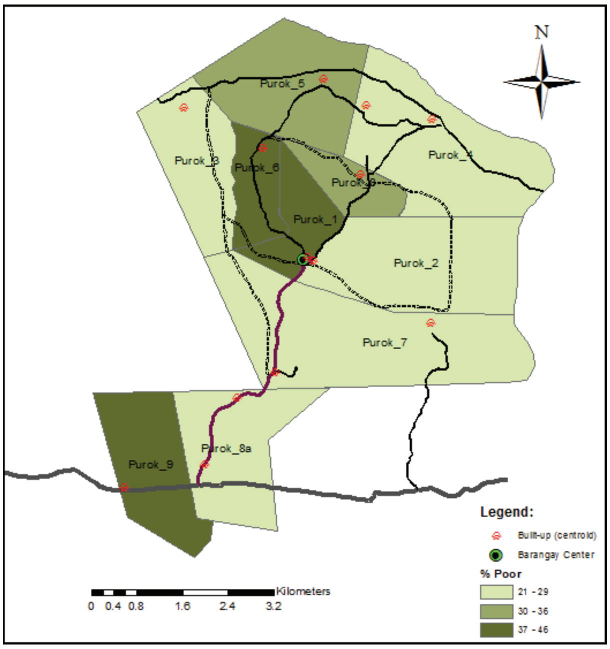


(Source: (MRDP2, 2011)

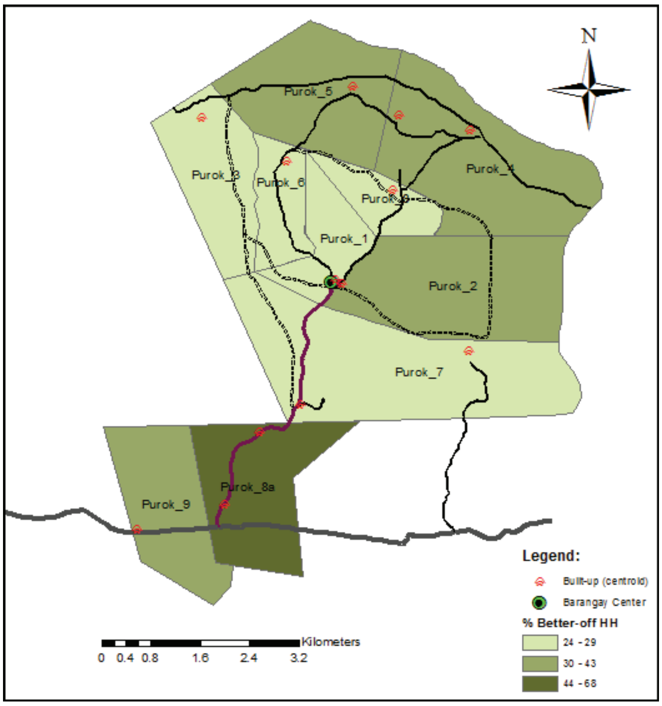
Appendix 2 Maps showing the spatial distribution of HH by Income class across *puroks*



(a) Spatial distribution of Ultra-poor HH



(b) Spatial distribution of Poor HH



(c) Spatial distribution of Better-off HH

Appendix 3 Guide Questions for Interview with Key Stakeholders

1. What are your views on the present practice of appraisal/evaluation?

    a. What are its strengths?

    b. What about its weaknesses?

2. To which extent is equity important in the appraisal of projects?

3. Is equity properly addressed in the present practice of appraisal/evaluation?

    a. If yes, how this is being addressed?

        What are the possibilities for improvement?

        How it is being used?

        How is the information (on equity) used?

    b. If no, is it necessary?

        What is missing?

        What information is needed?

        Which terms will this information needs to be available (per group; which groups, what kind of areas, etc.)?

        How can this be achieved?

4. To which extent Financial and Economic Analysis (FEA) or Cost Benefit Analysis (CBA) provided information on equity? Do you consider it as a problem that FEA or CBA indicators are highly aggregated and possibly hide inequitable effects of projects?

Appendix 4 Activities and Guide Questions for Focus Group Discussion with Beneficiaries

A. Delineation and validation of Road network, build-up areas farm locations (with google maps)

B. Guide Questions

1. What are the effects of the road construction/improvement project in your barangay? *To ask about the before and after construction. For example: increase in businesses (sari-sari stores), etc., improvement in services*

2. What are the modes of transport? Before and after?

3. What are the purposes of the trip? __ go to school, ___ferry products to the market, ___ go to the center, ___ others

4. Who are the users of the road?

5. Identify the road network and specify the travel speed before and after road construction.

6. Is the road accessible to anyone?

7. Who are the project affected persons, how many of them?