MAKING RURAL ROADS WORK FOR LIVELIHOOD DEVELOPMENT IN DEVELOPING COUNTRIES

Dr. P. Ekanayake
Consultant and Executive member of "Lanka Forum on Rural Transport Development
Sri Lanka
palithaeka@yahoo.com
and
Professor N. Attanayake
Head of the Department of Economics, University of Colombo,
Sri Lanka
nimalk@webmail.cmb.ac.lk

ABSTRACT

Fifty years into the life of Sri Lankan's after independents, poverty reduction has become an on-going agenda and remains unrealized for around 80% of the rural population. This study attempts to demonstrate robust benefit evaluation of a rural village development programme on household livelihoods and social wellbeing. The evaluation methodology is based on standard "before and after" technique on 100 rural villages survey undertaken 13 districts in Sri Lanka. The results clearly demonstrate that the rural village road network is an integral part of its economy that works as a transmission mechanism stimulating and sustaining the poor people's livelihoods. Analysis showed that internal mobility and outward connectivity improved the villager's income/consumption levels making their life style easy and convenient. Amongst all, poor households are the real beneficiaries than the rich. Road infrastructure has generated many other complementary opportunities and income sources including the transport services. Improved rural road network keeps the village open and resilient for enhanced livelihoods

Findings of this study provide inputs for policy makers in designing and implementing policies for rural poverty reduction in developing countries like Sri Lanka. If comprehensive econometric procedure is adopted, it is likely to find more empirical support than it has heretofore.

1. INTRODUCTION

Sri Lanka is at a critical junction on its economic development path [Kar, 2003]. It has achieved comparatively high level of social progress together with some of the impressive Millennium Development Targets [World Bank, 2007] whilst there is a considerable level of consumption income poverty persisting, together with almost half of the population living as recipients of Samurdhi[1] income support by the government. Poverty reduction efforts in Sri Lanka are long-outstanding recurring agenda and the rural sector is being still home to the majority (80% percent) of the poor [Ekanayake and Attanayake, 2006]. A sluggish rural economy and its long outstanding infrastructure backlog, especially the rural road network and transport services have undermined the growth potential of the rural sector

[1] Amongst direct income transfer schemes for addressing the poverty, Samurdhi is the biggest poor relief program costing the government about Rupees 13,826 million or 9.87% of GDP in 2001 while around Rs. 10000 million or 8.3% of GDP was spent in 2005. According to the Annual Estimates of the Government of Sri Lanka (2005) the demand for Samurdhi benefits covered nearly 2 million households, apart from other social related expenditure.

[World Bank, 2004; Dorward and Kydd, 2005]. Poverty is concentrated on rural areas where functional connectivity, mobility, openness and access to markets and average infrastructure and human welfare services that are relatively low with inadequate income earning opportunities [Ekanayake, 2006; World Bank 2007]. As shown by Dorward and Kydd [2005] sluggish rural road network has resulted in lethargic operation of pro-poor growth drivers and undermined the multiplier benefits from growth driver stimuli for rural people. Among many gateway solutions to livelihood improvement, the rural road network is impacting on almost everybody in the village making a profound support on the well-being of the poor [Atapattu, 2003; Khandker at el 2006]. Therefore, the objective of this study is to identify and evaluate the existing discrete interest on rural road network ensuring it to work for the village household livelihood development drawing empirical evidence from rural Sri Lanka.

The literature on distributional effects of rural road investment still remains few and is progressing. Walle [2000: Vietnam] identified the poverty and economic potential of rural road projects and showed the difficulty in assessing benefits in monetary terms. Studies by Jacoby [2003: Nepal], Songco [2002: Vietnam] and Lokshin and Yemtsov [2003: Georgia] have justified the size and the nature of benefits and distributional consequences of rural road investment. Khandker at el [2006] examined the rural road projects using household panel data from Bangladesh and demonstrated some of the positive effects clearly. Atapattu [2003: Sri Lanka] showed a large number of issues are still unclear but, significantly affecting livelihood development and well-being of the rural people. Schelling and Liu [2000] and Starkey [2003] too recommended further country-specific evidence for clearing the gaps and addressing the emerging issues on livelihood development. Hence, it is required to sort out further empirical support to clear the knowledge gaps on the subject and examine how the benefits filter back into household livelihood outcomes and its distributional consequences across the board minimizing the rural poverty in developing countries. This paper provides empirical evidence regarding a successful strategy demonstrated in Sri Lanka which makes rural road network livelihood-friendly and a solution to poverty reduction.

The paper is organised as follows: Section Two provides background of the study whilst Section Three describes the methodology followed. Section Four discusses the results and Section Five, presents the concluding remarks.

2. BACKGROUND

2 . 1. Overall poverty in Sri Lanka

Fifty years into the life of Sri Lankan's since independence including three decades of trade liberalization, the social, economic and political justice remains as an unrealized dream for around 80% of the population in Sri Lanka [Ekanayake,2006; World Bank. 2000; Amarasinha at el, 2005]. Economic and political turmoil have led to a critical fall in living standards especially in Northern and Eastern provinces in Sri Lanka irrespective of historically followed social welfare concerns. In spite of many time-consuming, costly policy interventions, rural poverty still remains stubbornly high [World Bank, 2004]. Currently, poverty related, publicly funded welfare programs perform well below potential.

Table 1: Poverty indicators

	1990-91	1995-96	2002	2005*
Population (million)	16.3	18.1	19.1	*19.7*
National Poverty line (Rs.)	475	833	1423	*1978**
US Dollar value	11.7	16.2	15.1	*19.2**
Poverty head count ratio (%)	30.4	28.8	23.9	
Urban sector	18.2	14.0	7.9	
Rural sector	34.7	28.9	26.4	
Estate sector	20.5	26.1	22.1	
Estimated no of households (mn)	3.9	4.3	4.5	*4.6*
Households under Samurdhi (mn)		1.5	2.0	*2.0*
Colombo consumers' price index	*1,065*	*4,621*	*8,925*	*11,396*

* Indicate the estimated probable poverty line based on the rate of inflation.

Source: Department of Census and statistics ISSN1391-4693: Poverty indicators, household income and expenditure survey [2002] and Central Bank [2005].

Table 1 has shown disappointing achievements on poverty reduction during the last 15-year period. The population under income support assistance also remains the same (around 2 million households) irrespective of other welfare packages for the poor. Colombo District centered economic development and the very poor regional districts allowed the country's majority to live in lagging regions [World Bank, 2006]. Poor people's locations are isolated in the provincial remote areas where connectivity to developed areas and markets and access to infrastructure remain relatively low [Ekanayake and Attanayake, 2006].

2 . 2. Sluggish road transport network

Sri Lanka is one of the luckiest among the developing countries had an opportunity to enjoy fairly comprehensive, well-managed colonial road transport network linked to railway and maritime transport at the time of independence in 1948. Thereafter, although many national roads and main roads were added to the network almost all the rural roads have been neglected keeping a massive infrastructure backlog [World Bank, 2006]. Atapattu [2003] pointed out nation-wide constraints such as: inadequate funding, high cost of road users, low road utilization and road safety affecting the long-outstanding rural poverty. The overall road network in Sri Lanka is given in Table 2. The provincial and local roads are largely, village-based. Most of them are unpaved and the majority are not motorable. These are maintained by the Pradeshiya Saba (PS). Some of them are graveled and motorable whilst the majorities are usable during dry weather. PSs generally neglect the maintenance of roads due to resource constraints. However, respective Divisional Secretariats (DS) and PS are used to helping and working hand in hand when outside authorities provide funds.

Table 2: Road network of Sri Lanka (Kilometers)

Road classification (Jurisdiction)	Paved	Unpaved	Total
National roads and main roads, A & B- class. (Road Development Authority)	11,694		11,694
Provincial roads, C-class (Provincial Councils)	10,796	4,500	15,296
Local roads, D-class (Local Government)	7,010	51,334	58,344
Special Agency's roads (Maintain by specialized agencies in Plantation sector, Mahaweli, Forest Department etc.	2,505	13,861	16,366
Total road network in kilometers	32,005	69,695	101,700

Source: Road Development Authority and Central bank Report 2005

2 . 3. Significance of rural village-based road network

According to many studies [Amarasinha at el 2005; World Bank, 2006] locational attributes and isolation of village economies are highly correlated with poverty. Rural Economy Resuscitation Trust Fund (RERTF) has designed a village specific prescription to solve the problem of village-based poverty. RERTF has launched the community driven livelihood development program known as "One Product-One Village Programme" (OPOVP). RERTF is also a new institutional arrangement set up under the Trust Ordinance in December 2002. The empirical evidence for this study comes from the OPOVP initiated by RERTF. All village development projects are programmed allowing the community to take the lead setting and driving their own development agenda. RERTF has organized a pool of resources from PS, Provincial Councils, Village Community Based Organizations (CBO) and from the other stakeholders. Every OPOVP has three stages: firstly, providing the basic needs empowering the rural village economy; secondly, the diversification of village economy for enhancing output, productivity, incomes and employment opportunities, and thirdly, the self-employment and entrepreneurship stage.

At the end of 2004 there were about 200 villages in 14 Districts[2] in Sri Lanka in the first stage and the total value of Rupees 390 million for village development projects while Rupees 165 million worth of work-in-progress remained for completion. In addition, village community contribution was around Rupees 100 million and about Rupees 50 million from other stakeholders. The total value of events by RERTF and the major activities as at 21.12. 2004 are given in Table 3.

Table 3: Total value of activities contributed by RERTF (In Rupees million)

Activity	Value	Activity	Value
Rural road construction and rehabilitation	168.48	Equipments, tools and utensils	7.88
Construction of small bridges, culverts and pavements	79.52	Technology transfer, training and skill building	11.04
Rehabilitation of tanks, irrigation cannels and anicuts	28.08	Electricity and rural energy	27.22
Plants, nursery & cultivation support	6.55	Sales centers and marketing facilities	23.25
Water supply, agri: wells & ponds	17.78	Machineries and light vehicles (Rural Dev: Banks' Credit facility)	11.48
Administrative cost	7.69	Miscellaneous expenses	1.03

Source: Annual report 2004 of the RERTF

[2] Northern Jaffna District has not been included in the survey due to unavoidable circumstance.

The programme was very popular among the village communities and their most preferred activities were rural roads and small bridges and culverts (around 60%). It shows the magnitude of the problems of mobility and connectivity faced by the villagers which has become an acute obstacle for livelihood development [Jacoby, 2003; Khandker at el. 2006]. Hence, the OPOVP is a very good model to study and it is worthwhile investigating the empirical evidence from a policy point of view. Therefore, the aim of this study is to test the effectiveness of rural village based road network for livelihood development drawing empirical evidence from an initial survey in Jan. 2005 and matching the progress data on the achievements of ten villages with similar characteristics in Jan. 2007.

3. METHODOLOGY

3. 1 Conceptual framework

The methodology followed in this study is comprehensive and economy-wide[3]. Improved livelihood levels may be aggregated results of improved access to, and efficient functioning of rural markets, healthcare, education, water supply and sanitation, mobility and connectivity, social services and improved low cost transport services generating incomes to households [Starkey, 2003; Ekanayake, 2006]. Rural road network is integrating and complementing all infrastructure services and has become a pre-requisite for everybody's livelihood. However, there are significant knowledge gaps remaining as to how all these benefits originated with the rural roads improving the livelihoods of the rural sector in developing countries [Schelling and Liu, 2000; Jacoby, 2003; Khandker at el 2006]. Therefore, the hypothesis was that the rural village-based road network affects the enhanced household income levels of a rural sector thereby creating better livelihoods. In testing the hypothesis this study follows a simple, standard econometric approach together with "before-and-after" technique [Lokshin and Yemtsov, 2003] to estimate the impact of rural village-based road network on household livelihoods and achieving other rural outcomes. Hence, it is assumed that enhanced household income/ consumption[4] levels would be resulted in better livelihoods for all. Furthermore, it is assumed that the rural roads are part of the public infrastructural services and it is also difficult to identify the precise role of rural roads separately on household outcomes. Hence, a comprehensive picture of other infrastructural services such as village market related infrastructure, educational services, water services and energy services are also built into the analysis. The data set covers the overall village infrastructure and income earning potential.

3. 2. Sources of data

The data used in this study was collected by the RERTF in January 2005. The survey covered mainly the average per capita household income of the village and the village community infrastructure information. The sample included 100 selected villages out of 200 villages under the RERTF. The village has been considered as the primary sampling block. Allocations of the number of primary sampling blocks for a District were done proportionately to the number of villages under RERTF in that particular District. The data collected through each Grama Seva Officer in-charge of that particular village while the respective Divisional Secretary supervised the process. The survey had been undertaken covering following sections:

- Basic demographic information.

[3] As Schelling and Liu (2000) noted conventional road project appraisal methodologies are based on quantification of direct road user benefits.

[4] Jacoby (2003) followed the same assumption when estimating the benefits of rural roads in Nepal.

- Infrastructure facilities under each village: roads, markets, energy, water supply and education.
- Village level investment information on public infrastructure covering the ten year period from 1995 to 2004[5].

The survey parameters covered the information given below. Firstly, apart from the basic demographic information, the village income data was collected using three sources; employment income, income from productive activities, and the income supports received such as Samurdhi income support, remittances from family members, including the remittances from family members abroad. Secondly, information on infrastructure facilities of the village was collected in order to form an opinion on the real situation in the village. The third section of the survey was the information on ten year investment (1995 -2004) by all sources: the Central Government, Provincial Government, Pradeshiya Saba, NGOs, private parties, Donor funded projects, including the RERTF, and formed very useful information on the income earning capacity of each village.

In addition, a sample of panel data was collected in January 2007 from 8 villages in Kolonna DSD in the Ratnapura district, started in January 2003 and 2 in Ukuwela DSD out of 14 villages started in July 2003 in the Matale District. The total cost invested in the 10 villages was Rupees 16.6 million (Rupees 11.8 million allocated for rural roads) and the number of households benefited was 3787. Since the study covers the improvements to livelihood, qualitative panel data and evidence have been collected on the situation in the base year 2005 and follow-up year 2007.

3. 3. Study Locations.

Summary of the study sites is given in Table 4. The sample of 100 villages represented rural villages closer to Colombo, villages far away from the capital city of Colombo and also middle distance villages. According to the Table 04, 100 villages consist of 23690 households covering 83767 of the total population. The average income of the sample is Rs. 5762 while Samurdhi recipients are about 12029 or almost 53% of the total households, which indicates the level of poverty in the sample area.

Table 4: Study locations

Name of the District	Number of Villages	Total Population	No of Households	No of Samurdhi	Average Income
Colombo	4	6364	1644	429	8842
Kalutara	2	2316	585	267	6155
Galle	2	2683	686	319	6202
Hambantota	2	1882	414	232	5152
Kandy	6	3303	706	348	6103
Kegalle	8	6455	1642	887	5619
Kurunegala	25	15524	4353	2458	5746
Matale	24	15549	4622	2610	5678
Matara	7	6443	1838	928	5617
Puttalam	9	7541	2057	1114	5350
Ratnapura.	8	13702	3474	1991	5009
Nuwara Eliya.	1	420	132	101	4814
Badulla.	2	1785	537	345	4616
Total	100	83967	22690	12029	5762

[5] Out of the 100 villages sample, 12 villages have not received a single investment during the ten year period.

According to the poverty level, the poorest District is Badulla; having a household income less than a US $1 per day. Hambantota, Nuwara Eliya, Ratnapura and Puttalam are equally poor while the Colombo District is two times richer than Badulla. The basic village information summarised in Appendix No: 03 shows the main economic activity of each village, average income levels, and the number of Samurdhi recipients, rural road situation and the aggregate infrastructure index according to the survey. Basically Samurdhi beneficiaries' income is less than rupees 3000. Thus those household earning is less than one US $ a month. The average infrastructure index is the simple average infrastructure situation of each village calculated on the basis of the survey. The shaded area indicates panel data collected from 8 villages in Ratnapura and 2 villages in Matale Districts. The survey was undertaken in January 2007.

3 . 4. The analysis

Analytical framework of this study consists of two stages; firstly validation and examining the relational effects between the household income and income supporting rural village based road network including other infrastructure using the survey data in January 2005 and secondly, comparison of outcome and efficiency of rural road network of a village using the qualitative information collected from a sample of 10 villages in January 2007. At the first stage, the validity and the relationship will be examined in order to determine how rural road networks work for better livelihoods of the households, following variants of regression of the logarithm of per capita income or total consumption of the village household I_{ij}^{V}. In this case, the simple OLS can be applied and four models are:

(1). $I_{ij}^{V} = \beta_0 + \beta_1 R_j^R + \varepsilon_j$ (Income / rural road network relationship);

(2). $I_{ij}^{V} = \beta_0 + \beta_1 R_j^R + \beta_2 R_j^M + \beta_3 R_j^W + \beta_4 R_j^{Edu} + \beta_5 R_j^E + \varepsilon_j$ (Income/Infrastructure)

(3). $I_{ij}^{V} = \beta_0 + \beta_1 R_j^{AMR} + \beta_2 R_j^{DQP} + \beta_3 R_j^{DQU} + \beta_4 R_j^F + \beta_5 R_j^{CBO} + \beta_6 R_j^{DM} + \beta_7 R_j^{ADS} + \varepsilon_j$
(Income/ rural road dimensions relationship; Appendix No: 02);

(4). $I_{ij}^{V} = \beta_0 + \beta_1 R_j^{AMR} + \beta_2 R_j^{DQP} + \beta_3 R_j^{DQU} + \beta_4 R_j^F + \beta_5 R_j^{CBO} + \beta_6 R_j^{DM} + \beta_7 R_j^{ADS} + \beta_8 R_j^R + \beta_9 R_j^M + \beta_{10} R_j^W + \beta_{11} R_j^{Edu} + \beta_{12} R_j^E + \varepsilon_j$ (Overall income/infrastructure relationship).

Where I_{ij}^{V} is the per capita income or consumption of the ith household living in jth village, R_j^R is the overall level of rural road infrastructure in jth village, R_j^M is the overall level of rural market related infrastructure in jth village, R_j^W is the rural water supply situation in jth village, R_j^{Edu} is the educational infrastructure in jth village, R_j^E is the rural energy situation in jth village. ε is the composite error term representing unobserved variables affecting the household income (Appendix No 01 and 02 provide details).

At the second stage, the outcomes of road investment of 10 sample villages in 2007 were compiled into panel data and the benefits and changes to livelihoods of those villages, with the base year of 2005 will be compared. The outcome of road improvements has been compared using five livelihood qualitative criteria: Simple average price of major products; average market competition, change of transport modes, average travel time to markets, and access to educational and healthcare facilities. Some of those benefits are unquantifiable but comparable because they are complementary and they integrate with the other infrastructure. The developments to the livelihoods from base year (t=0) and road program in effect (t=2) could be identified clearly. Therefore, it allows straightforward "before and after" comparison of welfare outcomes and livelihood improvements between the two periods.

4. RESULTS

The primary concern of this study is to find out evidence and discuss the results of impact evaluation analysis between the rural village-based road network and improvement of household welfare/income potential. Empirical evidence has been sorted out to ensure solutions for the problems of connectivity, mobility and inward-orientation related low livelihood standard of rural villages. Further analysis was resorted to ensure whether development of road network in the village operate as one of the principal routes out of reducing rural poverty. Moreover, sample data showed that poverty is significantly low in villages where mobility, connectivity and integration are higher together with less isolation and remoteness. The analyses have supported the hypothesis that rural village based road network is positively correlated with accelerating household income levels thereby making a sustainable solution to livelihood development in the rural sector. The empirical evidence helps to explore rural road related economic and non-economic social outcomes. The panel data too supported the hypothesis and ensured that the rural road networks work as transmission mechanisms stimulating and sustaining economic transition of the poor people's livelihoods. The estimated results are given below.

4. 1. Role of village based rural road network

Firstly, the functional relationship between the household income and village –based rural road was examined (Table 5, Equation 1) and it was found that the model is significant. The R^2 is 81% and one point of investment to road system is resulted in Rupees 48 of income addition to the households. However, as Walle (2000) showed there are unquantifiable, non-monetary benefits According to the evidence there are short term as well as long-term benefits. The transport cost savings by the road users, producers, traders and consumer households and the distribution of cost savings particularly for the poor households are noteworthy livelihood benefits. Secondly, the results of model equation 2, shows the place held by the rural road network among other village infrastructure services. The results are statistically significant (Table 05), explaining 88% of the household income. Standard t-Test results clearly showed the positive, significant impact of rural roads, market related infrastructure and water supply infrastructure. They are directly responsible enhancing the household income and welfare.

Table 5. Impact of rural roads on household income

Explanatory variables/Equation	1	2	3	4
Value of R^2	81%	88%	91%	93%
Constant	48.7 (18.4)	42.9 (15.9)	58.1 (21.0)	51.2 (16.7)
Village road infrastructure	0.51 (20.5)		0.11 (2.1)	
Access to main/national roads			0.1 (3.97)	0.07 (2.2)
Distance/quality paved roads			0.1 (1.46)	0.0 (1.01
Distance/quality unpaved roads			0.2 (10.9)	0.15 (6.82)
Road maintenance by CBOs			-0.0 (-0.5)	-0.0 (-0.9)
Allocation of funds to rural road			-0.0 (-0.6)	-0.0(-0.8)
Distance closest market			0.0 (1.05)	-0.0 (-0.5)
Assessment of road situation			-0.0 (-0.29)	-0.0 (-0.5)
Village market infrastructure		0.31 (4.78)		0.2 (3.25)
Water supply infrastructure		0.08(2.23)		0.1 (1.87)
Educational infrastructure		0.04 (1.27)		0.0 (1.48)
Village energy infrastructure		0.01 (0.48)		-0.0 (-0.7)

Note: t Statistics are shown within brackets.

Furthermore, the empirical evidence helped to understand that the rural road system in a village is creating multidimensional benefits correlating with other infrastructural services. Access and entry to the markets, education, health services, energy services and other social services is largely dependant on rural road and transport services. The educational

infrastructure is not statistically significant but showed the real situation in the village. The academically educated graduates, O/L and A/L youth are unemployed and have become a burden to the households. The education system has not been reformed according to the job market. However, technically trained, skilled villagers are income supportive provided that the mobility and access is available. When there are poor roads, transport services are also not available and the health, education and other welfare services are beyond reach. Typical examples such villages are in Raththota, Daraniyagala, Ukuwela, Kolonna, Karuwalagaswewa and Wanathavilluwa DSDs. The livelihood related issues could be explained in terms of road connectivity and related transport services which do not make the village remote and isolated.

4. 2. Livelihood priority road infrastructure

Results of equation 3 are statistically significant with R^2 = to 91% and the model has provided rational for public investment in village based road network and their relationship to household income. According to the results, village based road network is the highest priority in terms of their livelihood. Most of these roads are paved and unpaved minor roads with single-line carriage-way, unspecified agricultural roads, bridle paths and foot-paths connecting houses and farm lands. In mountain-villages, there are foot-steps use as path ways to houses and farm lands. The OPOVP is primarily involved in constructing these infrastructures because they are the first priority of the communities. The estimated results too justified empirical evidence. The second priority, as per estimate has been given to linkage roads to national and main roads, means outward-orientation and openness of the village. Rehabilitation of link roads in off-road villages in mountain-DSDs like Kolonna, Raththota, Ukuwela, and Daraniyagala are justified by the estimates. Third priority was the paved small PC roads while the fourth is small link-roads to markets. However, R^F, R^{CBU}, and R^{ADS} are insignificance and not income-supportive. The results of Model No: 4 have shown a comprehensive view of the village-based road network. The results are consistent with the results of model 2 and 3 explaining 93% of the household income. Village level internal mobility and the outward linkages to national routes have resulted in enhance competitiveness, information flow and price increase which are easy turn-outs as income sources. In the long-run, both internal and outward openness has originated opportunities mainly creating employment and productivity, diversified activities, training and skill development and reduced migration from villages to urban areas[6].

4. 3. Distributional benefits “before and after’

The discussions of this section are based on several criteria on “before and after” village road network rehabilitation and construction under OPOVP. There are five basic “before and after” criterion (Appendix No: 02). The causal linkages and benefit occurred between before 2005 and after 2007 are positive and demonstrated well, making the village road development work better for villager’s livelihoods. Apart from the many other variables behind these changes, development of road network largely affects when considering the sample villages that are off-main roads and located in remote destinations. OPOVP is an identical example in policy points of view where development of road infrastructure causes voluntary improvements to village based transport services. Many villagers in sample villages are used to buying two-wheel tractors, three-wheelers, motor-bikes, agricultural tractors, and many other light machineries because of the mobility and transport worthiness occurred in the village.

[6] World Bank (2007) and Ekanayake and Attanayake (2006) extensively discussed the impact of internal migration from village to urban-capital city as a major factor affecting the poverty and inequality in the rural sector.

The first criterion is increased prices for village produce. These accounted for a record increase of around 100% and villagers too responded very quickly (Appendix No 02). The most significant highlight is the related improvements to the consumption pattern of the households due the increasing income for their output and improved purchasing power of the villagers. Before 2005 farmers in all the villages used to carry banana, papaya and pumpkin to Kolonna, sometimes to Ebilipitiya (12 to 15 kilometers away), spending Rupees 500 to 700 as cost of transport. They were compelled to sell them at Rupees 3 to 5, a kilogram, not even sufficient to recover the cost of transport during the season while in the off-season or festive time, they sold at Rupees 5 to 10. The wastage during the goods in transit is around 10 to 20% in addition to the farmer's time and personal expenses. Very often, farmers used to destroy perishable-harvests as it was uneconomical to carry them to the market. This situation has changed in favor of farmers due to newly built entry facilities to the villages and related competition among buyers. In 2007, buyers used to offer Rs. 7 to 12 per Kg of banana and Rs. 7 to 15 per Kg for papaya at the farm land. Unlike 2005, they directly transport them to Pettha or Meegoda, the Colombo city wholesale markets saving time, cost with minimum wastage and handling.

The second criterion is the in-built market competition[7] in 2007 due to new access and entry to the village market. Pre-2005 period is almost a monopoly; buyer dominated market in the village and even if the farmer carried the output to the closest city centers a few designated buyers used to decide the price. Very often, farmers used to carry vegetables, fruits, tea leaves and kithul products daily to a buyer waiting at paved, motorable road-side, sometimes away from the village. According to the empirical evidence, these practices have changed completely and buyers are used to visit the farm land. It has been observed instead of animal powered-load carrying, walking-buyers have began to use bicycles, motor-bikes and three wheelers and come closer to the farm land using new entry paths. Because of the new opportunities farmers began to bargain with the buyers. The farmers realized that the buyer-seller competition has increased and evidence suggested at least 50% of new situation is due to new entry roads. In addition, buyers began to know information regarding availability of kithul products, pepper or cinnamon among the village households and how to reach the particular farm-land because of the easy access roads. At the same time, farmers began to understand the value of price information from buyers as well as other sources due to easy access. All these benefits could be translated into enhanced incomes or average consumption levels of farmers (rough estimates showed that the decrease in household consumables is around 10% to 25%) in sample villages.

The third criterion is the change into transport modes[8]. The most significant social welfare benefits due to new entry roads to the villages is the change of village transport modes (Appendix No: 02). Majority of villagers in sample villages used to walk and carry loads or used animal powered carts during the pre-2005 period. In 2007, light transport modes have been added to the system while some of the villagers have become vehicle owners. The change of transport modes in these villages has also resulted in new employments as three-wheel drivers (3 to 5 three wheelers and 5 to 10 motor-bikes in all the sample villages) and two wheel tractor drivers while few are self employed as motor-bike hawkers. New additions to road system made in every village have made a distinct improvement in the mobility and entry to farm land easier in 2007. The added transport services have resulted in convenient mobility of goods and services and complementary benefits to

[7] Enhanced market competition due to rural roads is a major benefit, discussed by many researchers: Jacoby (2003); Songco (2003); Ekanayake (2006); Khandker at el (2006).

[8] Starkey (2003) showed the road related pattern of adaptation and use of transport services by the private sector. The evidence of this study showed that the village households have become owners of transport modes.

village livelihoods. The fourth criterion is time saved by the villagers due to road and transport services making villagers' life more convenient. They began to enjoy reduced time taken to reach a desired destination, market or religious place, schooling and access to nutrition and health facilities. Therefore, distribution of benefits due to the village road network has village economy wide, favored the poor more than the better-off.

The fifth criterion is non-priced benefits due to rural road network which makes the villager's life easy and comfortable. Average schooling rate increased and travel time to health facilities was reduced due to easy mobility in 2007. Snake bites, heart cases, children's problems, maternity problems (child birth at home and related risks) are life threatening. Some in the village die as the sick are supposed to be carried for hours to a nearest government dispensary. According to the evidence, there were several cases where patients died due to time and lack of entry roads to nearest motorable road in Buluthota and Iththakanda villages in 2004 and life saving cases in the same villages in 2006. Empirical evidence showed additional village-economy-complementary type, non-price benefits in the sample villages. Some of them are: increased off-farm activities, new employment opportunities, mobility of workers and investment in diversified activities. Along the newly built roads, extended electricity lines have provided opportunities to begin off-farm activities like repairing of agricultural implements, radios, TVs, bicycles and motor bikes. Carpentry-work shops, cement brick making, paddy milling, juggery and honey making are other off-farm income earning new activities in the villages. Some of the villagers found jobs in off-farm activities in many villages making their lives better.

A rough average estimates of household income within the sample villages was Rupees 8200 in January 2007 (Rupees 5492 in January 2005) that showed a 49.3% increase. Apart from other reasons behind the increase, improved access roads and mobility may have complemented a larger share of the increase to livelihoods. According to the Grama Seva Officers' estimates there are 3.3% or 115 households in the sample 10 villages whose income is more than Rupees 17,500 in 2007 (1% or 35 households in January 2004). All these achievements and gains could be translated into livelihood improvements due to openness and outward orientation that occurred due to improved road network. There are many reasons to ascertain that the rural road network under OPOVP has created rural economy-wide benefits to villagers' livelihood levels and set out a model experience replicable anywhere in the developing countries.

5. FINDINGS

This study has carried out an investigation on the impact of community-driven rural road network building on livelihood development using 100 village samples under OPOVP implemented by the RERTF in Sri Lanka. The study sites are representing rural villages which are mixed of closer to and away from cities which are remote and isolated village economies where the connectivity and mobility to towns and markets, access to basic infrastructure are considerably low. It has demonstrated robust evaluation of the situation "before implementing village road network rehabilitation and reconstruction and after the programme" using baseline survey data in January 2005 and brief sample impact survey in January 2007. Matching "before and after" outcomes, it has ensured that the rural road network works as transmission mechanisms stimulating and sustaining economic transition of poor people's livelihoods. From the policy maker's point of view the programme is innovative, community-driven, stakeholder-supportive, rural village economy-friendly and villager's highest priority making better livelihoods and found quite sustainable in developing countries.

The analysis has set-out an ideal model experience that contributes and yields larger gains in rural livelihood development and rural economy-social welfare making the poverty reduction a reality. It has ensured that the intervention to rural road infrastructure and transport services can be a solution to resuscitate the sluggish rural village economies and make them work for village level livelihood development. According to the analysis, the village level road network favors economic activities enhancing the villager's income levels and the empirical evidence showed rural economy-friendly direct and indirect benefits when the village is open and outward-oriented particularly connected to markets. The model results have established a very strong functional relationship between household incomes and rural road network. Among the road infrastructure, paved and unpaved small roads, pathways, foot-steps and agricultural entry-ways within the village and connecting roads to markets and main roads have taken the priority. The study confirmed that the rural village roads make village-livelihood improved and villager's life style easy and convenient. Further, some of the villagers became the owners of light transport and agricultural vehicles. The evidence suggested that poor households in the sample villages are the real beneficiaries than the non-poor because of the reduced "transaction cost" of all economic activities. Finally, it can be concluded that the rural road infrastructure has supported to make villagers' lives easy and convenient and to generate economic benefits. Therefore, it is possible to make rural village road network work for the livelihood development in Sri Lanka and elsewhere.

The evidence presented in this paper provides inputs for policy makers as well as replicable in similar developing countries. However, there are methodological short comings, too. If comprehensive econometric procedure is adopted, it is likely to find more empirical support than it has heretofore.

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Appendix No: 01

Dimensions of infrastructure indexes

Dimensions of rural village road index (Weight in 100)

Dimension criteria	Weight	Remarks
Access and entry to main and national roads	20	When the village is closer or by the side of the main roads they enjoy easy access to market & competitive prices.
Distance and quality of paved motorable village roads	20	Quality & distance of paved roads played an integral part of village livelihoods.
Distance and quality of unpaved roads & pathways	10	Village road network: gravel & pathways provide access to basic needs.
Allocation of funds for village road construction and rehabilitation	10	Ten year allocation of funds from 1995 to 2004 data has been collected and a scale for each village constructed.
Maintenance of village roads by the villagers CBOs	20	A scale highlighted participation of road rehabilitation under Samurdhi, food aid and other CBOs projects.
Distance from village to closest market or supply point	10	Time and transaction cost are largely determined by the distance.
Overall assessment of village road situation by DS	10	DS has provided an unbiased assessment comparing all other villages.

Dimensions of village markets and marketing facilities index (weight in 100)

Dimension criteria	Weight	Remarks
Village based markets and boutiques-traders	20	When the village is isolated, the role of boutiques and traders are high and it affects the household income.
Village level producer/farmer societies, co-operatives	25	No of societies and their lobbying power is an integral part of bargaining power.
Contractual relationship between villagers and buyers	25	A scale represented the formal and informal contractual relationship.
No of village collectors and commission agents.	10	Collectors and commission agents used to compete with village boutiques.
No of lorries and carriages coming in a month	10	A scale was constructed to accommodate road accessibility.
No of village based welfare societies	10	Welfare societies like Samurdhi, death donation types are income supportive.

Dimensions of village water supply infrastructure index (Weight in 100)

Dimension criteria	Weight	Remarks
Village tanks and irrigated water supply	40	Village based tanks are popular symbol of agricultural activities. Size of the paddy fields is also considered.
Village level agricultural wells and other sources.	25	No of wells and natural water resources help year-round economic activities.
Pipe born water supply.	20	Pipe borne water supply is an indicator of the level of income of the village.
Rain water resources in a year.	25	A scale was constructed for the villages with rain water, during in the year.
Drought situation in the village in a year.	(10)	Income of the dry-zone and wet-zone are largely determined by the drought situation. Weight is adjusted accordingly.

Dimensions of village-level educational facilities index (Weight in 100)

Dimension criteria	Weight	Remarks
Availability of a public school in the village.	20	Primary enrolment is a basic indicator of village level educational facilities.
Availability of a high school or technical collage in village.	20	Higher level of education is associated with household poverty & income.
Average literacy rate of the village	20	Literacy rate has a significant impact on household income earning potential.
Technically qualified, skilled and trained number of people.	20	Households with skills and training have enjoyed better livelihood than others.
Number of graduates and qualified people in the village.	10	Unemployed graduate becomes a burden to the household income.
Overall assessment.	10	Comparative assessment of the DS considering level of educational level.

Dimensions of village level energy infrastructure index (Weight in 100)

Dimension criteria	Weight	Remarks
Electricity supply to the village	20	Hydro-power supply has been the core of the livelihood and social needs.
Number of electricity user & nonuser households.	10	A scale has been constructed on the basis of users and non-users.
Number of energy used economic activities and industrial ventures.	30	Correlation between the energy-powered economic activities and household income is high.
Generation of energy in the village. A scale represented the overall activities.	30	Energy generation using wind, solar power, hydro power, biomass and firewood and user activities like cooking, drying, lighting, transporting etc.
Energy sources managed by the village communities.	10	CBO managed energy activities. Some villagers engaged in energy saving, efficiency creation. For example: Brass products and clay products villages.

Appendix No: 02

Dimensions of qualitative panel data summary

Price of major produces: (One month price of a kilogram in rupees.)

Type of produce	January 2005	January 2007	Remarks
Green tea leaves	26	32	Household based small-plots of tea plantations are popular source of income of at least 50% of households.
Pepper, clove and cinnamon	80	250	Export mixed crops grown around households and small farms.
Kithul products: honey and juggery	128	180	Kithul is grown in mountains; reachable through foot-pathways.
Paddy and vegetable	10	18	Paddy and vegetables are grown in small scale depending on lands.
Average price	61	120	Simple weighted average price

Average market competition: (A range within a month.)

Type	January 2005	January 2007	Remarks
No of village based buyers, collectors	1 to 2	3 to 8	Village collectors, commission agents and boutiques.
No of outside buyers.	1 to 2	3 to 5	Competition is based on outside buyers and the price information to villagers.
No of lorries and carriages	None	2 to 3	Transport-worthiness of road allows better opportunities for the village.

Change of transport modes: (Most popular modes)

Type	January 2005	January 2007	Remarks
Users are villagers, school children and traders for transport of goods and people	Walking and load carrying and foot bicycles. Animal powered bullock carts	Bullock carts and load carrying, bicycles, motor cycles, three wheelers, two and four wheel tractors.	Load carrying and bicycles are still using as the producer points are on mountain and hills.

Average travel time to markets: (Time taken in hours by an individual.)

Type	January 2005	January 2007	Remarks
Walking and load carrying: village market	½ to 1	¼ to ½	Only walking possible to certain places: houses and farm lands.
To a motorable provincial road	½ to 1	¼ to 1	Distance varying from 1/2 km. to 2 km. through difficult pathways
To the city market	1 to 2	½ to 1	To Kolonna and Owilikanda

Access education and health facilities: (Depending on closest school & dispensary.)

Type	January 2005	January 2007	Remarks
Average schooling primary to grade 8, percentage.	50%	80%	Household situation, distance to school limits schooling.
Travel time to closest dispensary/doctor (Hours)	1 to 2	½ to 1	Some are un-qualified doctors 1 to 5 km away.
To: Govt. basic hospital.	1 to 3hrs	1 to 2hrs	Ebilipitiya and Matale

Appendix No 03

No;	Name of the Village	DS Division	Average income Rupees	Samurdhi as a %	Main Income sources	Rural road index	Average infra: index
	COLOMBO DISTRICT						
1	Ihala Kosgama	Hanwella	7775	39.8	Handicraft, export agri: & mixed	65	66.8
2	Lahirugama	Hanwella	8443	29.5	Fruits, export agri; & paddy	66	67.6
3	Palagama	Homagama	10084	22.0	Green leaves, Govt: employees	75	74.0
4	Kiriwaththuduwa_North	Homagama	9064	19.2	Govt: employees & mixed agri:	70	68.6
	KALUTARA DISTRICT						
5	Katukurudugahalanda	Beruwala	5621	49.6	Export agri: & mixed	35	40.2
6	Yala	Anguruwathota	6688	35.2	Export agri: & pottery	40	34.4
	GALLE DISTRICT						
7	Ellaihala	Thawalama	6756	30.0	Export agri; fruits and paddy	36	37.0
8	Udegalpitiya	Hikkaduwa	5649	69.2	Fishing, tourism services & mixed	32	38.6
	HAMBAMTHOTA DISTRICT						
9	Mihidupura	Beliaththa	5105	57.6	Pottery,. Paddy & mixed	26	31.0
10	Madhagoda	Beliaththa	5200	54.9	Paddy & mixed	28	29.6
	KANDY DISTRICT						
11	Kuradeniya	Udunuwara	5705	45.2	Handicrafts	42	34.0
12	Kowilakanda	Udunuwara	5583	66.7	Export agri: and mixed agriculture	42	34.8
13	Handessa	Udunuwara	3900	80.0	Musical instruments	18	24.8
14	Pamunuwa_East	Udunuwara	6896	48.1	Brassware products & mixed	42	49.8
15	Pamunuwa-west	Udunuwara	7863	46.6	Brassware products & mixed	44	51.6
16	Hondiyadeniya	Udunuwara	6672	31.1	Mixed agriculture	40	39.4
	KEGALLA DISTRICT						
17	Lewke	Mawanella	5985	42.1	Pottery, paddy & mixed agri:	18	29.6
18	Delgasthenna	Daraniyagala	5130	63.0	Mixed Export agri: & paddy	22	28.0
19	Nilwala	Daraniyagala	6147	33.7	Mixed Export agri: & paddy	40	38.2
20	Magala	Daraniyagala	5733	46.7	Mixed Export agri: & paddy	32	35.2
21	Keerihena	Daraniyagala	5738	53.5	Mixed Export agri: & paddy	40	33.2
22	Viharakanda	Dehiovita	4996	70.5	Mixed Export agri: & paddy	22	30.2
23	Maniyangama	Dehiovita	5681	55.6	Handicraft & mixed agriculture	36	42.6
24	Bomaluwa	Dehiovita	5541	61.0	Mixed Export agri: & paddy	32	33.4
	KURUNEGALA DISTRICT						
25	Badigama	Ehatuwewa	4442	87.4	Mixed dry zone agriculture	6	9.4
26	Werahara	Pannala	6246	47.9	Pottery, coconut and paddy	42	35.8
27	Ambahenehawewa	Paduwasnuwara	5736	50.0	Pottery, coconut and paddy	40	41.6
28	Baddegama	Bamunakotuwa	4915	77.1	Pottery, coconut and paddy	22	25.2
29	Amunuwela	Edabaddawa	5931	69.8	Coconut and paddy	35	36.6
30	Waduraba	Ududaddawa	6434	38.4	Coconut and paddy	42	39.8
31	Wellarawa	Bingiriya	6840	40.8	Coconut fiber and paddy	44	42.0
32	Hiripathwella	Polgahawela	6985	52.5	Handicraft and mixed agriculture	44	44.0
33	Egalla	Polgahawela	5998	64.9	Paddy & vegetable	42	39.4
34	Wadakada	Polgahawela	7309	38.3	Coconut, paddy and mixed agri:	50	48.2
35	Embalawaththa	Polgahawela	7074	42.6	Coconut, paddy and mixed agri:	48	48.2
36	Habarawa	Polgahawela	7064	40.7	Paddy, coconut & vegetable	48	46.4
37	Lihinigiriya	Polgahawela	6866	33.9	Paddy, coconut & vegetable	46	43.8
38	Kongolla	Katupotha	6378	61.6	Pottery, coconut and paddy	40	47.2
39	Yahalegedara	Katupotha	7159	28.4	Pottery, coconut and paddy	48	48.8
40	Makalanegama	Galgamuwa	5570	52.6	Coconut fiber	36	40.4
41	Palugama	Galgamuwa	4682	67.0	Pottery and dry zone agri:	22	27.2
42	Padipanchawa	Galgamuwa	5164	60.0	Paddy and dry zone agri:	24	29.2
43	Waligodapitiya	Polgahawela	6763	45.8	Coconut, paddy and mixed agri:	50	46.4
44	Morathanna	Mallawapitiya	3553	89.5	Coconut, paddy and mixed agri:	18	21.4
45	Beligodakanda	Mallawapitiya	3696	84.5	Coconut, paddy and mixed agri:	19	20.6
46	Watagoda	Mallawapitiya	3321	92.9	Musical instruments	20	22.2
47	Manawa	Kuliyapitiya (E)	3781	70.8	Handicraft and mixed agriculture	22	27.8
48	Hauluwa	Kuliyapitiya (E)	6141	43.5	Pottery, coconut and paddy	40	42.6
49	Yalawa	Weerabugedara	5590	54.1	Coconut and paddy	36	35.4

No:	Name of the Village	DS Division	Average income Rupees	Samurdhi as a %	Main Income sources	Rural road index	Average infra: index
	MATALE DISTRICT						
50	Kirimatiyawa	Ukuwela	6087	65.2	Export agri: paddy & mixed	42	33.8
51	Mathulemada	Ukuwela	5917	58.3	Export agri: paddy & mixed	36	33.6
52	Panwaththa	Ukuwela	6036	59.2	Export agri: paddy & mixed	35	37.4
53	Katuaththamada	Ukuwela	6413	47.7	Export agri: paddy & mixed	36	28.4
54	Galaudahena	Ukuwela	5071	57.1	Export agri: paddy & mixed	24	37.6
55	Pallekumbura	Ukuwela	6357	57.1	Export agri: paddy & mixed	38	28.6
56	Wattegedara	Ukuwela	4872	64.1	Export agri: paddy & mixed	26	38.2
57	Owilikanda	Ukuwela	6386	49.5	Export agri: paddy & mixed	38	36.8
58	Pathiregalla	Ukuwela	5596	71.2	Export agri: paddy & mixed	32	39.8
59	Alawathuwala	Ukuwela	6558	50.0	Export agri: paddy & mixed	38	39.2
60	Enagulada	Ukuwela	6199	65.1	Export agri: paddy & mixed	38	32.8
61	Wademada	Ukuwela	5457	70.0	Export agri: paddy & mixed	34	27.0
62	Horagahapitiya	Ukuwela	4342	73.4	Export agri: paddy & mixed	24	42.2
63	Pallehapuvida	Raththota	6137	42.9	Handicraft & export agriculture	36	34.0
64	Madakumbura	Raththota	5035	59.0	Export agri: paddy & mixed	36	30.2
65	Maussagolla	Raththota	5485	69.2	Export agri: paddy & mixed	32	45.0
66	Dambagolla	Raththota	6746	35.6	Export agri: paddy & mixed	35	24.2
67	Polwaththakanda	Raththota	4739	68.5	Export agri: paddy & mixed	20	31.2
68	Welangahawaththa	Raththota	5841	41.6	Export agri: paddy & mixed	34	35.8
69	Bambarakiriella	Raththota	5800	43.8	Export agri: paddy & mixed	34	33.2
70	Dankanda	Raththota	5337	65.2	Export agri: paddy & mixed	34	24.8
71	Kirimatiya	Raththota	4387	70.6	Export agri: paddy & mixed	20	24.0
72	Horagolla	Raththota	5171	65.9	Export agri: paddy & mixed	22	39.2
73	Bodikotuwa	Raththota	6394	47.6	Export agri: paddy & mixed	40	36.6
	MATARA DISTRICT						
74	Galabada	Pitabaddara	5724	52.8	Export agri: paddy & mixed	30	36.2
75	Kalubowitiyana	Pitabaddara	5728	49.1	Export agri: paddy & mixed	31	35.8
76	Abewela	Pitabaddara	5316	53.9	Export agri: paddy & vegetable	27	38.2
77	Mahepothuwila	Pitabaddara	5535	51.5	Export agri: paddy & mixed	26	26.8
78	Ihalaainegama	Pitabaddara	4568	69.3	Export agri: paddy & mixed	20	35.8
79	Siyambalagoda	Pitabaddara	6047	42.8	Export agri: paddy & mixed	36	39.4
80	Diyadawa	Pitabaddara	6398	29.6	Export agri: paddy & vegetable	37	25.4
	PUTTALAM DISTRICT						
81	Kandeyaya	Mahakubukkadawara	5349	54.9	Cashew & dry zone agriculture	19	29.2
82	Palugassegama	Karuwalagaswewa	5502	55.5	Cashew & dry zone agriculture	42	20.8
83	Egodapitiya	Karuwalagaswewa	4174	75.9	Vegetable & dry zone agriculture	16	20.0
84	Thabbowa-South	Karuwalagaswewa	4772	71.6	Paddy & dry zone agriculture	26	33.0
85	Thewanuwara	Karuwalagaswewa	5991	40.0	Paddy & dry zone agriculture	34	34.2
86	Pawattamaduwa	Karuwalagaswewa	5813	39.7	Paddy & dry zone agriculture	38	37.0
87	Thambapanniya	Karuwalagaswewa	6078	31.6	Paddy & dry zone agriculture	38	33.4
88	Mangalapura	Wanathavilluwa	5367	53.3	Animal Husb: & dry zone agri:	36	25.0
89	Wanathavilluwa south	Wanathavilluwa	5106	56.6	Animal husb: & dry zone agri:	26	30.6
	RATNAPURA DISTRICT						
90	Iththakanda	Kolonna	5329	51.6	Export agri: paddy and mixed	28	31.6
91	Podhdhana	Kolonna	5138	55.0	Export agri: paddy and mixed	32	37.2
92	Ranhotikanda	Kolonna	5769	42.5	Export agri: paddy and mixed	32	32.2
93	Buluthota	Kolonna	4919	60.3	Export agri: paddy and mixed	33	30.2
94	Kella	Kolonna	5132	57.8	Export agri: paddy and fruits	28	24.2
95	Pupulaketiya	Kolonna	4711	67.2	Export agri: paddy and mixed	24	21.8
96	Walakada	Kolonna	4697	75.8	Export agri: paddy and fruits	24	25.0
97	Koppakanda	Kolonna	4378	72.1	Export agri: paddy and mixed	25	22.8
	NUWARA ELIYA DISTRICT						
98	Wethalawa	Kothgmale	4814	76.5	Export agri and mixed	24	19.4
	BADULLA DISTRICT						
99	Dehigoola	Maiyanganaya	4208	80.0	Pottary and dry zone agri:	26	29.0
100	Tholabowaththa	Passara	5024	62.1	Export agri: and mixed	26	35.3