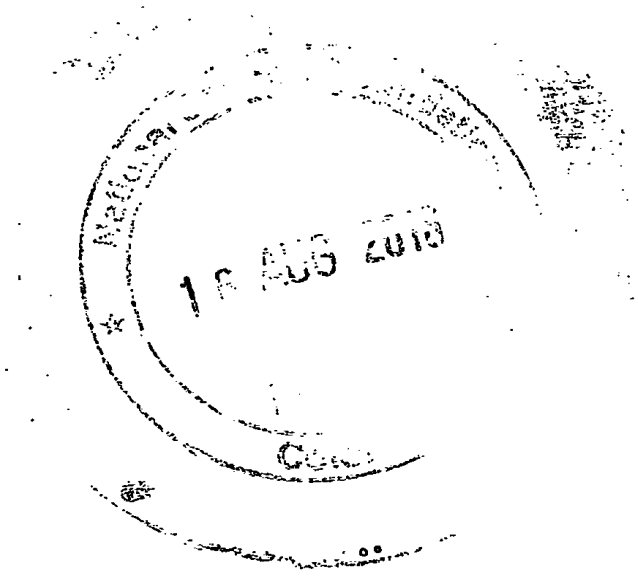
WORKING PAPER

EFFECTS OF RURAL ROAD DEVELOPMENT ON HOUSEHOLD AGRICULTURAL INCOME AND FARMING SYSTEMS IN HAMBANTOTA DISTRICT

RENUKA WEERAKKODY
SHARMINI K. KUMARA
S. EPASINGHE

HARTI
Hector Kobbekaduwa
Agrarian Research and
Training Institute

Effects of Rural Road Development on Household Agricultural Income and Farming Systems in Hambantota District



Renuka Weerakkody
Sharmini K. Kumara
S. Epasinghe

Working Paper No: 5

April 2015

Hector Kobbekaduwa Agrarian Research and Training Institute
114, Wijerama Mawatha
Colombo 7
Sri Lanka

First Published: April 2015

FOREWORD

Rural roads in good condition facilitate efficient fulfillment of duties and responsibilities relating to productive community roles of rural communities. Hence, the development of rural infrastructure facilities, particularly rural roads, aiming at converting the village into the 'centre' of development while improving the living conditions of the rural people is a commendable step taken towards the development of the nation during the past decade. Through this, many social and economic values were tied to the rural life. It is also undeniable that there were unrevealed political interests.

I am pleased to present this document comprising the results of an effort to create awareness on such a sensitive topic to the interested parties.

Haputhanthri Dharmasena
Director/HARTI

ACKNOWLEDGEMENTS

The authors are very much grateful to Mr. Haputhanthri Dharmasena, Director, HARTI for his guidance and direction to publish this under the HARTI working paper series. The honor of encouraging the completion of this academic exercise lies with Mr. Lalith Kantha Jayasekara, former Director of HARTI. Special thanks also go to Dr. L.P. Rupasena, former Additional Director (AD), HARTI and Mr. J.K.M.D. Chandrasiri, the present AD, HARTI for their expertise in making this effort a success.

We appreciate the staff of the Agricultural Resource Management Division, Statistics and Data Processing Division and HARTI Administration for their support extended in diverse means to prepare this report and present it in an attractive manner.

Renuka Weeakkody
Sharmini K. Kumara
S. Epasinghe

ABSTRACT

Development of the road to the village is a key requirement of the people in rural agrarian communities in the country. The national development policy framework saw this importance and paved the way for rural road development with the ultimate goal of converting the village into a prosperous centre of living which encompasses all facilities. It is absolutely accurate to say that village road development is the only development intervention from which the people of each and every village benefited during the past decade.

There was an era when rural road development was succeeding in rural villages at varying scales. At the same time, it was a subject of intense debate among many parties. The Hector Kobbekaduwa Agrarian Research and Training Institute made this attempt to assess the effects of rural road development on agrarian communities, particularly on agricultural income of farm families and farming systems in 2012. This effort completed during a limited time period was specifically aimed at testing the available methodologies to assess the effects of village road development on the agriculture sector and therefore restricted to a regional assessment on pilot basis.

The study found that people had benefited from rural road development in two ways: mental satisfaction and physical relief in day-to-day activities. Roads had bridged the distance between people and socio-political institutions both temporally and spatially and lessened the effects of exclusion of people living in less favored areas ensuring their mental satisfaction. Physically, roads had linked farming areas with input and output markets and enabled swift access to markets/service points; a variety of transport modes emerged and ensured convenient travelling and travel time fell noticeably. Mobility of extension personnel has significantly improved.

Though farm-to-market roads was seen as one among the five essentials for agricultural development, the study found little evidence establish that development of rural roads had significantly contributed either to increase the agricultural incomes of farming households or to diversify farming systems owing to stagnant macro polices in the agriculture sector and the prevailing structural distinctiveness of paddy faming system in agrarian communities. Severe distraction between road development and upland farming system which generates the most part of the agricultural income has also been poorly contributed to the increase of the agricultural income of farm families. The authors emphasize that methodological improvements are a must to derive multi-faceted benefits of rural road development by various sub sectors of the rural economy in quantitative terms.

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION ONE

Introduction

1.1 Background and Importance

Having understood the importance of rural infrastructure in economic development, Sri Lanka endorsed its national development policy framework paving the way for rural infrastructure development (RID) with the ultimate goal of converting the village into a prosperous centre of living which encompasses all facilities. Thus the prime attention of the development agenda of the last decade was upgrading of rural infrastructure in each Grama Niladhari Division (GND) of the country. The entire RID effort comprised development of agricultural roads and minor irrigation works and electricity extensions to villages and households with the potential of enhancing entrepreneurial capacity of rural communities and thereby diversifying employment opportunities and household incomes. Investment priorities were largely for the development of rural roads which were referred to as agricultural roads that facilitated the mobility and accessibility of rural people to markets and service institutions that pursued diverse means of living and other household needs of rural agrarian communities. It was anticipated that the benefits of the said development intervention will seep into rural areas including the farthest villages in the country at varying extents.

While RID was succeeding in rural villages at varying scales it was subject to an intense debate among general public and other interested groups including policymakers, political parties and socio-professional organizations. Some were of greater concern on the quality of RID and compared the differences by looking at the quality and costs of various RID efforts whereas it was a research priority for others who sought scientific analysis on how and to which extent RID had impacted on the people and their means of living and quality of life (SLCARP, 2011; Ministry of Finance and Planning, 2012). Despite the general understanding that the RID is central in promoting rural economic growth, assessing the effects of the said development has been a less explored area of research. In this context, this study attempted to assess the effects of rural road development (RRD) on diversification of household income and farming systems of the rural agrarian communities in the Hambantota district.

1.2 Role of Infrastructure in Development

Though frequently used in the literature, there is no precise meaning for the word 'infrastructure' and it is interchangeably used with the term 'social overhead capital'. As pointed out by Ahmed and Hossain (1990) the constituent of infrastructure differs by author. Lewis (1955) defined public utilities, ports, water supplies, and electricity as distinct infrastructure elements whereas Higgins (1959) includes transport, public utilities, schools and hospitals. Hirschman (1958) lists facilities for law and order,

education, public health, transportation, communications, power, water supply, irrigation and drainage and there is no consensus in economic literature on its precise meaning.

In the opinion of Ahmed and Hossain (1990) the role of infrastructure is complex and its effects are indirect thus has far-reaching implications for alleviation of poverty by indirectly generating income. Hence the development economists have not focused on infrastructure as much as they have on directly productive activities such as agriculture and industry. Ahmed and Hossain (1990) further explained that there is a hidden role of infrastructure in development by various means: the opening of new land, geographic variation of the intensity of farming systems, productivity of labour –urban industrial pull, technological effects of agriculture –diffusion model, ability to reduce the cost of marketing of agricultural products (in Africa) and opening opportunities outside agriculture. According to Asian Development Bank (ADB), (2000), infrastructure has wide ranging impacts, both direct and indirect, on individuals, households and communities both in terms of income and other quality of life indicators. Among the economic benefits due to RID are increased income, employment, productivity gain in farming systems, better income distribution and opportunity for income diversification in rural households. Social benefits such as saving of time, increased school enrolment levels and access to health services, environmental improvement, skills development, capacity building and improved access to information and gender impacts are less transparent, but ultimately they lead to improvements in quality of life thereby reduction in poverty (ADB, 2000).

Mosher (1966) explained the concept of farm-to-market roads in his well known publication –Getting Agriculture Moving- in which he recognized five essentials for and five accelerators of agricultural development. Transportation is one of the five essentials for agricultural development. He further explained many ways in which local farm-to-market roads can contribute to agricultural development, more than what is already recognized; rural roads as an essential part of the agricultural transportation network and drastic increase in the mobility of educational and service officials to the remote areas. Rural roads reduce isolation of villages which contribute to rural poverty (http://www.rural roads.org/en/poverty). Roads also serve other aspects of rural welfare by increasing the mobility of all types of governmental services, broaden the market for industrially produced consumer goods and encourage dispersion of small scale industries throughout rural areas (Mosher, 1969).

The contribution of good farm-to-market roads to agricultural marketing is significant as there may be an increasing demand for a product in one region and abundance in another (Posda, 1996). Therefore development of farm-to-market roads is the need for consumers to buy products cheaper and producers and sellers to sell products at higher prices. Generally prices increase (and incomes) as the number of buyers increase. Distance from the producer and the level of development of the road system are important factors that provide a dual advantage to the farmer who can bypass the trader and approach the town rapidly and at low

cost and sell the produce and buy what s/he needs at lower prices. Good roads with proper transport facilities have the potential for creating increased competition among traders. This can result in both high prices for farmers and less prices for urban consumers. It is also accepted that proper roads are also essential for minimizing post-harvest losses of perishable products such as fruits and vegetables.

Access to markets is not only important for buying inputs and selling of outputs. Their importance as means of access to advice, useful information and various products and services only available outside the village need to be recognized. Rural road facilities are considered as essential for diffusion of technology in agriculture both for the production and value addition for a number of reasons as extension officers could travel frequently in areas where roads are constructed. In general, demonstration plots by extension officers tend to be established in areas with roads in good condition. Good road conditions that encourage increased mobility of rural population including women could have an impact on attitudinal change too.

As per the Sri Lankan experience, both input markets for seeds, fertilizer, pesticides and agricultural implements and product markets are located far away from the villages and farm fields. Rural road facilities are thus essential for distribution of inputs and raw material and for product marketing. Similarly, access to institutional services such as health care, education, credit, extension and other public services providing through divisional secretariat are essential for sustaining agriculture based livelihoods of rural people. According to Ahmed and Hossain (1990), credit constraints are expected to lower in areas with developed infrastructure because of high degree of specialization and commercialization of production including non-farm sources of income.

Food production, mainly paddy, is generally the main source of income for the rural farming population in Sri Lanka. Paddy which is harvested by many farming households is transported from field to the household or village. Other field crops (OFCs) are harvested several times through the season and therefore each time the harvest needs to be stored till the farmer acquires a sizable quantity for sale. Such markets are usually situated close to or often on a motorable road and at walking or cycling distance. Traders visit these markets or collection points and collect a load sufficient to ensure a profit at a more distant market situated far away from the village or collecting point. In some cases, the farmer himself brings them to such markets avoiding the trader either by walking, cycling or using alternative means of transportation. At the same time, the farmer buys inputs and other consumption goods that s/he does not grow at a low cost. Thus an adequate transport network from farm to market is crucial for efficient marketing structures.

On the other hand, policymakers often stress the need for increasing non-farm employment or income diversification particularly in rural areas, but they often ponder as to how to realize it effectively. Increasing the production in main sectors such as agriculture and industry is a necessicity, but more important is the way in which the production increase is brought about where infrastructure development is

a critical element. A farm-to-market road serves to connect rural areas to markets and farmers and traders and for transporting the products to market towns and/or distribution centers.

It has been recognized that without minimum of reliable and efficient access to locations of basic social and economic activities, rural life stagnates and local development prospects remain limited (www.mohsl.gov.lk, 2013). Rural transport networks in most developing countries are undeveloped and are of poor quality. It is estimated that about 900 million rural dwellers in developing countries do not have reliable 'all season access' to main road networks, and about 300 million do not have motorized access at all (www.mohsl.gov.lk, 2013). Worldwide experience provides evidence that poverty is more pervasive in areas with no motorized access- referred to as unconnected areas. Thus roads are clearly a critical enabling condition for improving of living conditions in rural areas (Hettige, 2006). There is also a growing body of evidence that rural transport infrastructure is an essential but not a sufficient ingredient for rural development and sustained poverty reduction. According to Hettige (2006), the distribution of socio-economic benefits resulting from a rural road is a separate issue, and there are no guarantees or inherent mechanisms to ensure that these benefits will be distributed equitably between the poor and the non-poor in communities.

1.3 Recent Move towards Rural Infrastructure Development in Sri Lanka

Understanding the fact that for the success of any development initiative there must be a mechanism to address all kinds of needs of the rural communities, Sri Lanka placed RID on the top of its list of priorities during the last decade. On par with the pro rural development concepts such as 'inclusive growth' and 'total rural development' the government initiated a special program to support village communities, the *Gama Neguma* programme (Village uplift) in 2006 under the national development framework -*Mahinda Chinthana*: Way Forward. It was deemed necessary to develop all villages in the country so that they could emerge as micro centers of growth in the modern context. It was expected that every person including the vast majority of people living in rural areas would benefit through this policy of inclusive economic development. *Gama Neguma* not limited to building roads and providing electricity to villages, it was about uplifting the life of every single family in the village. The government had spent Rs. 6.37 million for the development of the rural economy through the *Gama Neguma* programme in 2010. The expenditure covered the implementation of 32,526 projects in 10,567 GNDs throughout the country (http://med.gov.lk, 2011).

Sri Lanka is an island of village communities, the majority of the population, nearly 80 percent, one living in villages. Seventy two percent of the entire road network of Sri Lanka comprise of rural roads (www.mohsl.gov.lk, 2014). After the implementation of 13th amendment to the constitution in year 1987 there was no separate RRD programmes funded by the central government until the year 2004. Local government authorities played a leading role in RRD. In the year 2004 Rs. 213

million had been invested under a pilot project (http://www.development.lk/project_detail-1a--75.html) and in the year 2005 it commenced allocating funds through the general budget under the Ministry of Highways for the development of rural roads (Table 1.1). The special programme for RRD - *maga neguma* programme was initiated in 2004 under the Ministry of Highways. Then rural roads were improved to motarable level through direct labour from the Road Development Authority or with the participation of community based organizations. Construction of rural roads with pre-cast concrete block paving was encouraged in order to maintain the quality of material and for easy maintenance in 2010.

Table 1.1: Investment for Rural Road Development

Year	Allocation (Rs.mn)	Total Road Length completed (km)
2004	213.00	600.00
2005	500.00	731.38
2006	1,800.00	2,283.98
2007	3,082.00	1,201.83
2008	4,000.00	1,640.48
2009	3,000.00	1,996.83
2010	3,000.00	854.54
2011	3,640.00	553.30
2012	5,000.00	635.28
2013	6,000.00	236.44
2014 (as at 003.31)	7,000.00	434.55

Source: www.mohsl.gov.lk, 2013

Agriculture is the mainstay of the majority of rural people in Sri Lanka. Therefore, the RRD was justified and referred to as development of agricultural roads such as farm-to-market roads concept introduced by Mosher in 1965. Understanding the importance of village unit in rural development, *Grama Niladhari* Division (GND) was considered as the basic unit of development in the *Gama Neguma* programme and the rural road system consisted primarily of concrete or tarred roads. Nonetheless, the popularity of the program and the perceived need to connect the vastly isolated rural areas was made possible under the economic development policy. It ensured funding for the creation of an extensive system of rural roads to provide access to rural areas and to allow farmers to bring their goods to the market and vise versa.

The main component of the *Gama Neguma* program was the supportive infrastructural projects which aimed at improving mobility and accessibility of rural people. The national level data shows that 38339 development projects had been undertaken during the year 2010 and on provincial basis, the Southern Province has undertaken the highest number amounting to 6378 RID efforts (17% of the total number of development projects). The details of RID projects undertaken in the Hambantota district are presented in the Appendix 1 (Southern Development Authority, 2012).

1.4 Study Objectives

The main objective of this study was to assess the effects of RRD on the household income and farming systems of rural agrarian communities. The study specifically aimed at identifying and describing changes occurred in diverse fields that could lead to improvement in farming systems and household income; to examine the strength of association between RRD and household income and diversification of farming systems and to make recommendations on the ways as to promoting diversification of farming systems and agricultural income can best be achieved by pursuing RRD.

1.5 Structure of the Report

Followed by this introductory section, the rest of the content of this working paper has been organized into four sections: a methodological review in the section two; Socio-demographic characteristics of the sample population with reference to the scale on access to villages in the section three; an attempt to analyze the contribution from RRD to diversification of farming systems and household income in section four; with concluding remarks and areas for further research in the final section.

SECTION TWO

A Methodological Review

2.1 Measuring the Effects of Rural Infrastructure Development

Despite the fact that there is a gap in methods for measuring effects of infrastructure, the literature reveals that 'user cost savings' arising from the investment in transport development is used as a measure to understand the effects of infrastructure development (ID). In recent years some economists have used econometric techniques to measure the effects of road development on agricultural production. All these methods had demonstrated the complexity of measuring the effects of individual ID due to existing synergistic contribution of various infrastructure elements that are connected through rural roads. Ahmed and Hossain, (1990), developed a composite index on scale for infrastructure development (INF) by taking into account distinct markets which are connected through rural roads to develop an infrastructure network including a variety of markets (factor/product markets and service institutions that rural people deal with for various needs). This original index was developed based on the data on distance from the village to selected infrastructure elements, principal means of transport and the cost per km of travel. The index number indicates the degree of under-development; the higher the value of the index number the less developed is the infrastructure.

The methodological approach adopted for measuring the effects of ID was comparison of the effects on different areas pertaining to rural development such as agricultural production, rural labour markets, employment, household income, poverty, consumption, savings, rural markets and social development among villages with various degrees of ID. The drawback of this approach is the probability of other factors contaminating the pure effects of ID due to diversity among villages. Ahmed and Hossain, (1990) had minimized this drawback through selecting villages with similar agronomic factors, topography, and water supply for agriculture.

During the construction of INF the total cost of access (TC) had been computed by adding the individual cost of access (IC_i) of all elements. TC had then been correlated with each element (IC_i) resulting in different correlation coefficients (W_i). The components with the highest W values had been selected to construct the INF by adding the selected TCs each weighted by their correlation coefficient (W_i) divided by the sum of correlation coefficients. The following formula had been used to construct the infrastructure index for selected villages.

IC_i = Distance x Time per km to element i,

$$TA = \sum_{1}^{n} IA_i$$

W_i = Correlation of IA_i with TA and the selected number of components was n,

$$INF = \sum_{1}^{n} (W_i \times IC_i) \Big/ \sum_{1}^{n} W_i$$

Ahmed and Hossain, (1990) defined INF as the Index of Under-development, accordingly the higher the index value the lower the level of village development. He divided villages into two groups below and above the average index and termed as developed and under-developed villages respectively. Comparisons of target variables were made between two types of villages and also between the most developed village and the least developed village to sharpen the contrast in results between the developed and isolated villages in terms of ID.

In this background, preliminary investigations were carried out to explore the suitability of employing the above index in the local context.

2.2 Suitability of Infrastructure Development Index in the Local Context

Preliminary investigations revealed that among the diverse service points/markets with the people in the study locations frequently had contacts were educational institutions including pre schools, primary schools and secondary schools for their children's education, hospitals for health needs, input markets for fertilizer, seeds and agrochemicals, paddy and OFC markets for produce marketing, banks and Divisional Secretariats (DS) for other domestic needs. However, the roads developed at village level had no public transport services. Often they used alternative transport means to access all these markets they dealt with. The survey data also confirmed this situation. Data in the Table 2.1 contrasts the changes in the mode of travelling before and after RRD in village level.

The overall sample included only ten percent HHs with children in early childhood. Most of the rural villagers had chosen to walk to pre-schools located within the walking distance. In addition motor bicycles and push cycles were used to access preschools. The choice of transport means to access primary and secondary schools depended on the age of children, affordability to diverse transport means by HHs and distance from the residence.

No marked changes were observed in the transport means to access primary and secondary schools after RRD as most of the pupils were used to walk to primary schools and cycling to secondary schools - familiar scenery in the study locations for decades. Nevertheless villagers stated that road development facilitated the access to educational institutions.

Table 2.1: Percentage Distribution of Households Used Diverse Transport Means to Access Diverse Service Points and Markets - Before and After RRD

Markets	B=Before A = After	Mode of Travelling							
		Motor Bicycle	Push Cycle	Bus*	2W Tractor	4W Tractor	Three Wheeler	Walking	Lorry
Pre School	B	27	27	-	-	-	-	46	-
	A	27	27	-	-	-	-	46	-
Primary School	B	11	22	11	-	-	6	50	-
	A	22	17	11	-	-	6	44	-
Secondary School	B	22	36	11	-	-	-	31	-
	A	31	33	14	-	-	-	22	-
Hospital	B	32	16	20	-	-	10	21	1
	A	40	16	20	-	-	13	11	-
Fertilizer Market	B	5	3	-	78	9	2	-	3
	A	3	2	-	79	10	3	-	3
Seed Market	B	31	12	-	42	1	12	-	2
	A	31	7	-	46	2	12	-	2
Pesticide Market	B	40	28	12	4	1	3	12	-
	A	50	27	9	2	1	6	5	-
Paddy Market	B	4	-	-	64	21	2	-	9
	A	2	-	-	67	21	2	-	8
OFC Market	B	5	2	2	82	2	7	-	-
	A	5	2	2	80	2	9	-	-
Bank	B	44	19	20	-	-	4	13	-
	A	52	17	16	-	-	7	8	-
Divisional Secretariat	B	59	13	25	-	-	3	-	-
	A	63	11	21	-	-	5	-	-
Shop	B	42	13	25	-	-	3	17	-
	A	55	11	21	-	-	5	8	-

Note *: Used only to reach the destination

Source: HARTI Survey data, 2012

Whilst the use of motor bicycles and push cycles were frequently reported there was a slight decline in the number of households using push cycles as against an increase in the use of motor bicycles. The use of transport means to other markets depended on the percentage of HHs which had contacts with those markets. It was also clear from the data that the prominent transport means was determined by the purpose of travelling to respective markets. Two wheeled tractors were used for the transportation of bulky items and products such as seed paddy fertilizer and agricultural produce whereas motorcycles were used for other needs such as purchase of small quantities of inputs such as pesticides and to access other service institutions. A lesser number of HHs had travelled to seed markets due to heavy

dependence on farmer saved seeds. The limited number dealt with OFC market was due to less number involved in OFC cultivation. Table 2.2 presents the predominant modes of travelling to different markets by the villagers before and after RRD. The said improvement in the means of transport system after road development was primarily attributed to the increased mobility of vehicles along the developed roads such as three wheelers. A few had purchased motor bicycles. This had ensured easy access to markets and in turn traders could reach the villages within a shorter period of time. Villagers also benefited from convenient walking as they could reach various markets/service points within a short time. Few villagers who owned vehicles prior to road development said there was a reduction in the cost of maintenance after the road development though they were unable to express the cost saved in financial terms.

Thus it was evident from the preliminary findings that villagers had benefited from convenient travelling within a shorter period of time to reach the service points and markets though the cost saved was immeasurable. Therefore, the user cost saving method could not be employed to measure the effects of road development in the local context. It is also noteworthy to mention that though there was a saving in time than before it was insignificant to consider for the estimation of opportunity cost of road development and its effects on rural life due to limited length of road development.

Table 2.2: Prominent Modes of Travelling to Service Points and Markets - Before and After RRD

Markets	Prominent Mode of Travelling	Percentage of HHs used the Prominent Mode of Travelling	
		Before RRD	After RRD
Pre School	Walking	46	46
Primary School	Walking	50	44
Secondary School	Push Cycle	36	33
Hospital	Motor Cycle	32	40
Fertilizer Market	2W Tractor	78	79
Seed Market	2W Tractor	42	46
Pesticide Market	Motor Cycle	40	50
Paddy Market	2W Tractor	64	67
OFC Market*	2W Tractor	82	80
Bank	Motor Cycle	44	52
DS Office	Motor Cycle	59	63
Shop	Motor Cycle	42	55

Note*: Out of respondents involved in OFC production
Source: HARTI Survey Data, 2012

2.3 A Modified Index for Rural Road Development in the Sri Lankan Context

Given this situation, an attempt was made to construct an index on the scale of RRD by substituting user cost saving with user time saving as there was no other measurable variable that reflects effects of RRD. Thus the INF developed by Ahmed and Hossain (1990) was modified by replacing total cost of access (TC) with total time of access (TA) and the index was calculated using time data to access different markets with which the rural people often had contacts. The selected markets were (1). Pre-school, (2). Primary school, (3). Secondary school, (4). Hospital/Dispensary, (5). Fertilizer Market which was in most cases the Agrarian Service Centre (ASC), (6). Seed market, (7). Pesticide market, (8). Paddy market, (9) OFC market, (10). Bank (11). Divisional Secretariat and (12). Shop. Both the distance from the producer and the level of development of the road system are important factors that provide a dual advantage to the farmer who can bypass the trader and approach the town rapidly and at low cost and sell the produce and buy what s/he needs at lower prices. Therefore both factors were considered in the construction of the index.

Data required for calculating the total time of access by people in each village (TA) was gathered by considering the predominant mode of transport (Table 2.1 and Table 2.2) and it was computed by adding the individual time of access (IA_i) of all markets (Appendix 2). TA was then correlated with the access time to each market (IA_i) resulting in twelve correlation coefficients (W_i). The components with the highest W values were selected to construct the composite index.

This index was constructed based on distance and access time data both of which describe accessibility to villages. Therefore this modified index was termed as Village Accessibility Index (VAI) and was constructed by adding the selected TAs each weighted by their correlation coefficients (W_i) divided by the sum of correlation coefficients. The following formula was used to construct the VAI for selected villages and the index number was used to rank villages to reflect their scale of ID.

IA_i = Distance x Time per km to market i,

$$TA = \sum_{1}^{7} IA_i$$

W_i = Correlation of IA_i with TA and,

The selected number of components was 7 as per the Appendix 1.

$$VAI = \sum_{1}^{7} (W_i \times IA_i) \Big/ \sum_{1}^{7} W_i$$

One of the noteworthy points that need to be highlighted here is that the VAI was not entirely a reflection of degree of village development due to rural road development as it was based on two parameters (a). Distance to villages and (b). Travel time per km to different markets. Whilst the former showed a substantial variation across villages, the latter did not vary much as only few kilometers of roads were developed in each village. The quality of road development was more or less

the same and it failed to demonstrate a substantial variation in terms of travel time per unit length along the road. Therefore the most prominent variable in the index was the distance factor and thus VAI is largely a reflection of villages' proximity to the markets than the level of road development.

2.4 Study Locations

Before studying on a larger scale, this study was carried out in the Hambantota district - a district in which a higher level of investment had been made on rural road development - on pilot basis to explore whether there is a measurable effect of RID. The study objectives were clearly differentiated to place emphasis only on the benefits of road development but not on other parameters such as quality of roads, post construction maintenance, technical aspects and resource allocation for RRD.

Of the twelve divisional secretariat (DS) divisions in the Hambantota district, five DS divisions randomly selected for the study were Amabalantota, Suriyawewa, Tissamaharamaya, Tangalle and Angunakolapelessa. In consultation with officials in *pradeshiya sabha* in each DS division and by visiting a number of villages in the selected DS divisions, six villages were selected based on the selection criterion listed below.

1. Villages where RRD had been undertaken before the year 2010 so as to ensure that there is sufficient time for rural HHs to diversify farming systems or to find diverse means of income generation followed by RRD in respective villages and thereby benefit from the same.
2. The rural roads that directly connected different components of the farming systems of HHs in order to qualify for the farm-to-market-roads concept which was previously discussed.
3. Villages with the majority of HHs involved in agriculture as a means of income generation as the key concern of the study were on agrarian relations.

Whilst the length of the rural roads developed were few kilometers in each instance, the number of HHs directly benefited from RRD were also limited. Therefore strictly confining to the village selection criterion number two, only direct beneficiaries were selected as presented in the Table 2.3. Accordingly the total sample size was 117 from six villages.

Table 2.3: Study Locations

DS	GND and Village	# HHs	% HHs
Ambalantota	Hedawinna	14	12
Suriyawewa	Hathporuwa	20	17
Tissamaharamaya	Gotabhayapura	21	18
	Rubberwatta	21	18
Tangalle	Gotaimbaragama	23	20
Angunakolapelessa	Jandura	18	15
Total		117	100

Source: HARTI Survey Data, 2012

2.5 Data Collection

Both primary and secondary data was used for this study. The Ministry of Economic Development (MED) and *Pradeshiya Sabhas* in the selected study locations were the main sources of secondary data and information. Key persons from the MED, officials from *Pradeshiya Sabhas* in selected locations and key informants in selected villages were also interviewed to gather required information. In the absence of baseline data, cross sectional data from six villages were used as primary data which was gathered from direct beneficiaries of the selected villages. The survey was conducted by administering a structured questionnaire to gather information on the target variables including demographic characteristics, land holdings, costs of and returns from farm productions activities (seasonal basis), household income and occupational structure of each household, access time and distance from study villages to diverse markets. The reference year for field data collection was the year 2012.

Data on household income was collected based on two income categories; agricultural income and non-agricultural income. Key components of agricultural income were; income from paddy, other field crops, permanent crops, animal husbandry and agricultural wage income. Among the key components of non-agricultural income were income from permanent involvement in state and private sector employment, non-farm wage labour, income from self employment, income from assets and grants and subsidies. The total amount of harvest was priced on par with the prices prevailed in each season for the estimation of agricultural income irrespective of the amount sold from each harvest.

2.6 Data Analysis and Presentation

The data analysis comprised several steps. First the VAIs were calculated for each village based on the cross sectional data on distance, prominent modes of travelling and access time from each village to various markets/service points which the majority of HHs in each village dealt with for various purposes. Second, the villages

were ranked according to estimated VAIs. Characteristics of farming systems and socio-economic features of HHs estimated through frequency distributions and cross tabulations were presented in tabular and graphical forms. Further these variables were correlated with VAIs of selected villages.

Regression Analysis

Ahmed and Hossain (1990) had used the regression analysis technique to estimate the effects of ID on number of variables; such as agricultural production, rural labour markets, employment, household income and poverty, consumption, savings and investment behavior, rural markets and social development. INF was used as a predictor variable in the regression analysis. Instead VAI was used as the predictor variable to estimate association between household income (dependant variable) and RRD. It was also supposed to use Cropping Intensity Index (CII) and Simpson Diversity Index (SID) as dependant variables in regression analysis to estimate association between RRD and changes in farming systems.

Cropping Intensity Index (CII) was calculated based on the formulae below.
CII = Extent Cultivated/Area Owned x 100

Formulae for calculating Simpson Index of Diversity is given below.

$$SID = 1 - \sum (A_i/\sum A_i)^2$$

SID =Simpson diversity index, A_i=Harvested area of the i^{th} crop

However due to less/lack of marked changes observed in the intensity of cultivation and crop diversification the said analysis was not performed.

2.7 Methodological Limitations

This study encountered two methodological limitations that constrained achieving the study objectives as anticipated.

1. **Less Suitability of VAI to Compare the Effects of RRD**

The VAI was constructed based on two variables; the distance from villages to diverse markets/service points and the time saved while travelling one kilometer of length along the developed road. Eventhough there was a marked variation in the distance from each village to respective markets/service points, there were only slight variations of developed roads among villages in terms of quality. Further limited length in road development too has not caused a significant saving in travelling time. As a result, the distance factor became the most prominent variable

in the VAI than the time saving factor. Accordingly, the VAI was recognized as a factor of accessibility than a factor of road development. The use of VAI to compare the effects of road development thus became inappropriate to a certain extent. Once again the limited length of road development constrained the estimation of opportunity cost of road development and its impending effects on rural life.

2. Scarcity of Appropriate Study Villages

Selection of appropriate study villages was constrained due to two reasons mentioned below.

(A) A typical farming system of a rural dry zone village in Sri Lanka comprises three major components:

a. Paddy fields irrigated by diverse irrigation regimes located in low lying areas.
b. Upland areas occupied by perennial crops and other uplands cultivated with seasonal crops especially in *maha* season.
c. The households with adjacent home garden located between paddy fields and upland areas.

Beyond this boundary are the markets for inputs and outputs with which the households (HHs) keep constant contacts. An ideal road development effort in an agrarian village similar to the above requires connecting all three components of the farming system with such markets to ensure that rural people derive maximum benefits, as such a road network would facilitate inclusive growth and holistic development within the rural setting. Unfortunately, it was unable to find such villages with all the components of the farming systems connected via developed roads. Therefore selection of appropriate villages to assess the effects of infrastructure development, particularly on agrarian aspects, became difficult.

In the selected villages there were a few kilometers of rural roads developed which connected only few components of the farming systems (homestead, paddy field and outside markets). The upland component was not directly linked to markets in most instances as such lands were located in distant places where roads were not developed. As a result, the number of direct beneficiaries benefitted through road development were also limited.

(B) Homogeneity of villages was seen as a prerequisite for avoiding the probability of other factors contaminating the pure effects of ID due to diversity among villages. Ahmed and Hossain (1990) had minimized this drawback by selecting villages with similar agronomic factors, topography, and water supply for agriculture. The study villages were similar in some of those characteristics and also in terms of demographic characteristics such as education level and sex of HHs, family size and occupation. However, they were heterogeneous in terms of land accessibility and low land cropping intensity due to inherent diversity of socio-economic-cultural structure of the rural villages which evolved over time. These two factors could have

an impact on the HH income of villages. Therefore, finding appropriate study villages became a limitation in this study.

Therefore, the authors are inconclusive on two important aspects of this assessment. First, it was on whether the road development efforts undertaken in rural villages were adequate to assess the possible impacts on agrarian communities. Second the authors also emphasize the need for an improvement in analytical techniques so that any widespread effects generated through RRD would be captured. It is presumed that area expansion of study sites, for instance, considering larger administrative units (DS divisions) instead of villages would enable the selection of a greater number of beneficiaries and to capture any wider impacts of RRD at the local context. Given this background, the study was presented as a working paper leaving room for further research on this aspect.

SECTION THREE

Scale on Access to Villages and Socio-demographic Characteristics of Village Population

3.1 Scale on Access to Villages

The scale on access to villages was measured through village accessibility index (VAI) and it varied across villages from 7.5 to 29.3 with an average VAI of 16.2 (SD 8.5). VAI at the local context was a measure constructed based on the of distance and time factors to access various markets/service points from each village by prominent mode of transport. Accordingly, the distance to each village and differences in time taken to reach diverse market places/service points were attributed to variation in VAI across villages. Then the villages were ranked on the principle that the higher the value of the index number the lesser the access to villages. Based on the very obvious differences in the VAI, the villages were further divided into three categories: Highly Accessible Villages (HAVs), Moderately Accessible Villages (MAVs) and Less Accessible Villages (LAVs) as listed in the Table 3.1.

Table 3.1: Categorization of Villages based on VAI

Village	VAI	Level of Accessibility		Year of RRD
		Rank	Scale	
Rubberwatta	7.5	1	High	2010
Hathporuwa	9	2	High	2008
Gotabhayapura	9.8	3	High	2006
Jandura	15.8	4	Moderate	2006
Hedawinna	16.4	5	Moderate	2010
Gotaimbaragama	29.3	6	Less	2010

Source: HARTI Survey Data, 2012

3.2. Socio-economic Characteristics of the Sample Population

The sample comprised 90 percent male headed HHs (Table 3.2). The only female head of family was a 55 years old woman educated up to O/L. She was engaged in farming as the key means of income generation while working as a labourer during the rest of the time.

Table 3.2: Socio-demographic Features of Village Population by Scale of Village Development (% Distribution)

Sex of Head of Household	HAVs (N=62)	MAVs (N=32)	LAVs (N=23)	Overall (N=117)
Male	87	94	91	90
Female	13	6	9	10
Total	100	100	100	100
Age Category (Years)				
25 < 35	10	25	9	14
35 < 50	34	31	35	33
50 < 60	43	31	43	40
< 60	13	13	13	13
Total	100	100	100	100

Educational Level of Population above Five Years of Age					Educational Level of HH
	HAVs	MAVs	LAVs	Overall	
No Schooling but Can Read and Write	3	2	4	3	2
Grade 1 – 5	12	18	18	15	21
Grade 6 – O/L	49	58	43	52	67
O/L + Technical training	4	4	2	3	2
Up to A/L	23	12	23	20	6
Studying A/L	1	1	2	1	-
A/L + Technical Training	3	-	2	2	1
Basic Degree/Higher Education	5	4	7	4	1
Total	100	100	100	100	100

Source: HARTI Survey Data, 2012

According to the categorization of the heads of HHs into four age categories, the majority was in the age group of 50 to 60 years (Table 3.2). Whilst the majority of HHs (67%) was educated up to O/L there was a significant relationship (0.037) between age category and educational level of heads of households (Spearman's rank-order correlation (ρ) $= -0.193$). The negative association established the fact that younger the heads of households the higher the level of education. The data further confirmed the existing trend towards further education among the sample population which is at least up to O/L. Data in the Table 3.3 presents the employment pattern of HHs by scale on access to villages. However, there was no marked variation in the employment pattern of HHs across villages.

Table 3.3: Percentage Distribution of Households by Primary Employment of Head of Household and Scale on Access to Villages

Primary Employment	% of Heads of HHs			
	HAVs	MAVs	LAVs	Overall
Farming	89	88	96	90
Government Employee	2	6	-	2
Private Sector Employee	-	3	-	1
Self Employer	1.5	-	-	1
Non Agricultural Labourer	1.5	-	-	1
Foreign Employment	1.5	-	-	1
Unpaid Family Worker	1.5	-	4	2
Unable to Work	3	3	-	2
Total	100	100	100	100

Source: HARTI Survey Data, 2012

Most of the HHs comprised four or five members and the average family size was reported as four (Table 3.4).

Table 3.4: Percentage Distribution of Households by Family Size and Scale on Access to Villages

Family Size of HHs	HAVs (%)	MAVs (%)	LAVs (%)	Overall
1	2	-	-	1
2	3	9	13	7
3	19	25	13	20
4	32	31	39	33
5	32	28	31	31
6	11	6	4	8
Total	100	100	100	100

Source: HARTI Survey Data, 2012

3.3 Access to Land

The term 'access to land' has been used instead of the term 'land ownership' in this analysis because all the lands cultivated by the village HHs were not owned by the sample HHs instead they were operated under different ownership patterns. The access to land among the HHs in the sample under different land ownership types was 2.85ac/HH on average (Std. Deviation = 1.562). Data in the Table 3.5 shows the variation in average land accessibility between study villages. Analysis of variance in access to land indicates that there are significant differences by scale on access to individual villages (between six villages) ($F = 2.371$, $P = 0.044$) as well as between three categories of villages ($F = 3.679$, $P = 0.028$).

Table 3.5: Access to Land by Village Households and Scale on Access to Villages

Village	VAI	Average Land Area (ac)	Scale of Accessibility	Average Land Area (ac)
Rubberwatta	7.5	2.85	High	3.20
Hathporuwa	9	3.13	High	
Gotabhayapura	9.8	3.62	High	
Jandura	15.8	3.83	Moderate	2.53
Hedawinna	16.4	2.14	Moderate	
Gotaimbaragama	29.3	2.33	Less	2.32

Source: HARTI Survey Data, 2012

Farmer categories by access to land were estimated based on the average land accessibility among HHs in study villages (2.85 ac and SD 1.562). Accordingly three HH categories identified were;

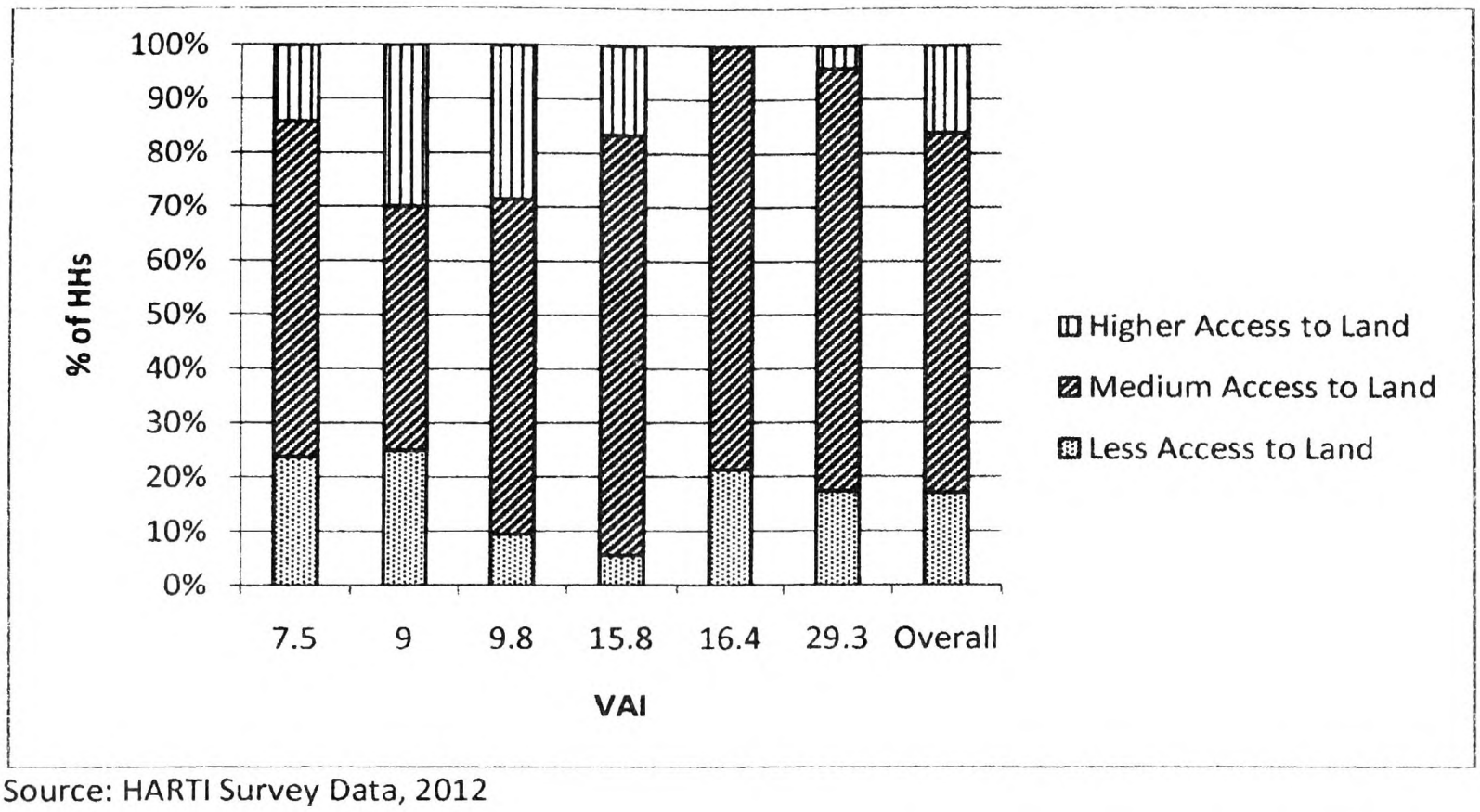
Small land owners = (Mean– SD) = Land owned less than 1.29ac
Medium land owners = (Mean –SD to Mean + SD) = Land owned 1.29 ac to 4.41ac
Large land owners = > Mean + SD = Land owned 4.41 ac

Table 3.6: Percentage Distribution of Household Categories by Access to Land and by Scale on Access to Villages

Farmer Categories by Access to Land	% of HHs		
	HAVs	MAVs	LAVs
Small land owners	19	13	17
Medium land owners	57	78	77
Large land owners	24	9	4
Total	100	100	100

Source: HARTI Survey Data, 2012

The percentage distribution of HH categories by three categories of villages presented in the Table 3.6 and the Figure 3.1 illustrate the distribution of HHs in each village by different level of land accessibility. Accordingly, the most HHs in each village were medium land owners with access to over 1.29ac to 4.41ac of land.



Source: HARTI Survey Data, 2012

Figure 3.1: Percentage Distribution of HHs by Land Ownership Category and Village

3.3.1 Land Accessibility by Type of Land

Table 3.7: Access to Upland and Paddy Lands by Scale on Access to Villages

Village	VAI	Average Paddy Land Area (ac)	Average Up Land Area (ac)	Scale of Accessibility	Average Paddy Land Area (ac)	Average Up Land Area (ac)
Rubberwatta	7.5	1.96	0.92	High	2.36	0.88
Hathporuwa	9	2.26	0.96	High		
Gotabayapura	9.8	2.85	0.77	High		
Jandura	15.8	2.19	0.71	Moderate	2.04	0.75
Hedawinna	16.4	1.83	0.80	Moderate		
Gotaimbaragama	29.3	1.56	0.83	Less	1.56	0.83

Source: HARTI Survey Data, 2012

Access to paddy lands by the HHs in study villages ranged from 0.13 ac to 6ac with an average value of 2.12ac (SD =1.192). Data in Table 3.7 shows that lower the VAI the higher the access to paddy lands and the said variations are significant between villages ($F = 3.057$, $P = 0.013$) and between three categories of villages ($F = 3.965$, $P = 0.022$). Accordingly HAVs had shown the highest access to paddy lands with the least access by LAVs. But there are no significant variations in access to uplands by scale on access to villages ($F = 0.160$, $P = 0.977$) or by three categories of villages ($F = 0.182$, $P = 0.834$).

Further analysis showed that the majority of HHs had access to one acre or less than one acre of paddy lands, stated mostly as rounded figures such as one acre or two acres or three acres. Around fourteen percent HHs in the overall sample had access to three acres of land whereas five percent HHs had no access to same (Table 3.8).

Table 3.8: Percentage Distribution of HHs by Access to Paddy Lands

Land Size (ac)	No. of HHs	% of HHs	% of HHs
0	6	5	5
<1	7	6	37
1	37	31	
>1 to <2	1	1	19
2	21	18	
>2 to <3	1	1	25
3	29	24	
>3 to <4	2	2	14
4	10	9	
>4	3	3	
Total	117	100	100

Source: HARTI Survey Data, 2012

Farmer categories by access to paddy lands

Small scale paddy farmers = (Mean– SD) = Land owned less than 0.93ac

Medium scale paddy farmers = (Mean –SD to Mean+ SD) = Land owned 0.93 ac to 3.31ac

Large scale paddy farmers = > Mean + SD = Land owned 3.31 ac

The percentage distribution of HHs by farmer categories by access to paddy land is presented in the Table 3.9. The data shows that most of the HHs are medium or large scale paddy farmers as per the paddy land categorization done for the purpose of this study.

Table 3.9: Percentage Distribution of Farmer Categories by Access to Paddy Land and by Scale on Access to Villages

Farmer Categories by Access to Land	% of Farmers		
	HAVs	MAVs	LAVs
Less Access to Land	6	3	9
Medium Access to Land	73	78	87
Higher Access to Land	21	19	4
Total	100	100	100

Source: HARTI Survey Data, 2012

3.4 Land Use and Cropping Intensity

During *maha* season almost all the paddy lands in the study villages had been utilized for paddy cultivation with no restrictions due to abundance of water. In contrast water scarcity experienced during the *yala* season had restricted the extent of paddy cultivated by each household. The Cropping Intensity Index (CII) in paddy lands varied from 110 percent to 210 percent (Table 3.5) and the average CII for paddy lands varied by scale on access to villages (180% in HAVs, 160% in MAVs and 110% in LAVs).

Table 3.10: Mean Cropping Intensity Index by Village

Villages	VAI	Cropping Intensity Index			
		Uplands		Paddy lands	
Rubberwatta	7.5	14%		210%	
Hathporuwa	9	47%		152%	
Gotabhayapura	9.8	35%	32%	177%	180%
Jandura	15.8	15%		156%	
Hedawinna	16.4	18%	17%	164%	160%
Gotaimbaragama	29.3	36%	36%	110%	110%

Source: HARTI Survey Data, 2012

The CII in uplands varied from fourteen percent to 47 percent with an average CII of 32 percent in HAVs, seventeen percent in MAVs and 36 percent in LAVs. Low CII in uplands was due to irregular use of lands by the majority of households providing a less contribution to household income. Data establishes that the scale on access to villages is negatively correlated with the cropping intensity in paddy lands CII ($r = -0.864$, $P = 0.000$) in contrast to the insignificant correlation with upland CII ($r = 0.124$, $P = 0.184$). A similar picture is depicted when category of villages are correlated with CIIs (For upland CII, $r = -0.056$, $P = 0.552$ and for low land CII $r = -0.970$, $P = 0.000$).

These data establishes the fact that the higher the access to villages the higher the intensity of paddy cultivation but no marked variations were observed in the intensity of upland cultivation across villages.

SECTION FOUR

Contribution of Rural Road Development to Diversification of Farming Systems and Household Income

4.1 Introduction

The outputs of the analysis on contribution from RRD to key areas under investigation in this study namely, **farming systems** and **household income** are discussed in this chapter. This assessment was carried out based on selected variables that are associated with the above two parameters. The selected variables to understand any effects of RRD on farming systems and household income were changes in land use, frequency of extension advice and level of farm mechanization, changes in factor/product market relations and means of transportation, returns from agriculture, entrepreneurship development and employment generation.

4.2 Crop Diversification and Cropping Intensity

Sources revealed that development of rural roads connecting farming areas with distant markets could result in a demand for diverse food products and thereby improvements in farming systems as a response to said demand. The data of this particular survey shows a negligible change in farming systems both in terms of land use (only 5% farmers made changes in the use of uplands) and crops cultivated (Table 4.1 and Table 4.2).

Table 4.1: Changes in Land Use

Type of Land Use Change	% Respondents who made changes in the use of uplands as a result of RRD			
	HAVs	MAVs	LAVs	Overall
Not Changed	95	94	96	95
Increased	3	6	4	4
Decreased	2	-	-	1
Total	100	100	100	100

Source: HARTI Survey Data, 2012

Only few farmers had commenced cultivation of banana and vegetables owing to easy access made to unutilized uplands through road development. The majority of the sample farmers had entirely used the lands available and accessible to them for cultivation even before the road development. Lack of additional lands was the primary factor that constrained expansion in upland cultivation by these farmers. None of the farmers had used their paddy lands for cultivation of crops other than paddy as the soil conditions and irrigation systems did not permit them to diversify into other crops. In addition to these, tenant farmers who operated paddy lands under *'ande'* system were not in a position to change the crops grown in paddy lands

without the consent of the land owner. This tenure system had also constrained the diversification of paddy lands to a lesser extent. Inadequate knowledge, lack of access to new technology and lack of capital were among other factors that constrained land use changes in study villages. In addition, labor was a constraining factor for diversification in some households that managed to cultivate a maximum extent of land with the family labor available. Only five percent farmers provided evidence on the increase or decrease in extent under cultivation before and after road development constraining estimation of changes in CII. Moreover, the estimation of changes in SDI was also constrained due the less number of HHs involved in crop diversification which amounted to eight percent of HHs out of the entire sample.

Table 4.2: Changes in Cropping Systems

Changed the Crops Cultivated	% Respondents who cultivated new crops in uplands as a result of RRD				% Respondents who cultivated new crops in lowlands as a result of RRD			
	HAVs	MAVs	LAVs	Overall	HAVs	MAVs	LAVs	Overall
No	92	91	96	92	95	100	100	98
Yes	8	9	4	8	5	-	-	2
Total	100	100	100	100	100	100	100	100

Source: HARTI Survey Data, 2012

4.3 Frequency of Exposure to Extension Advice

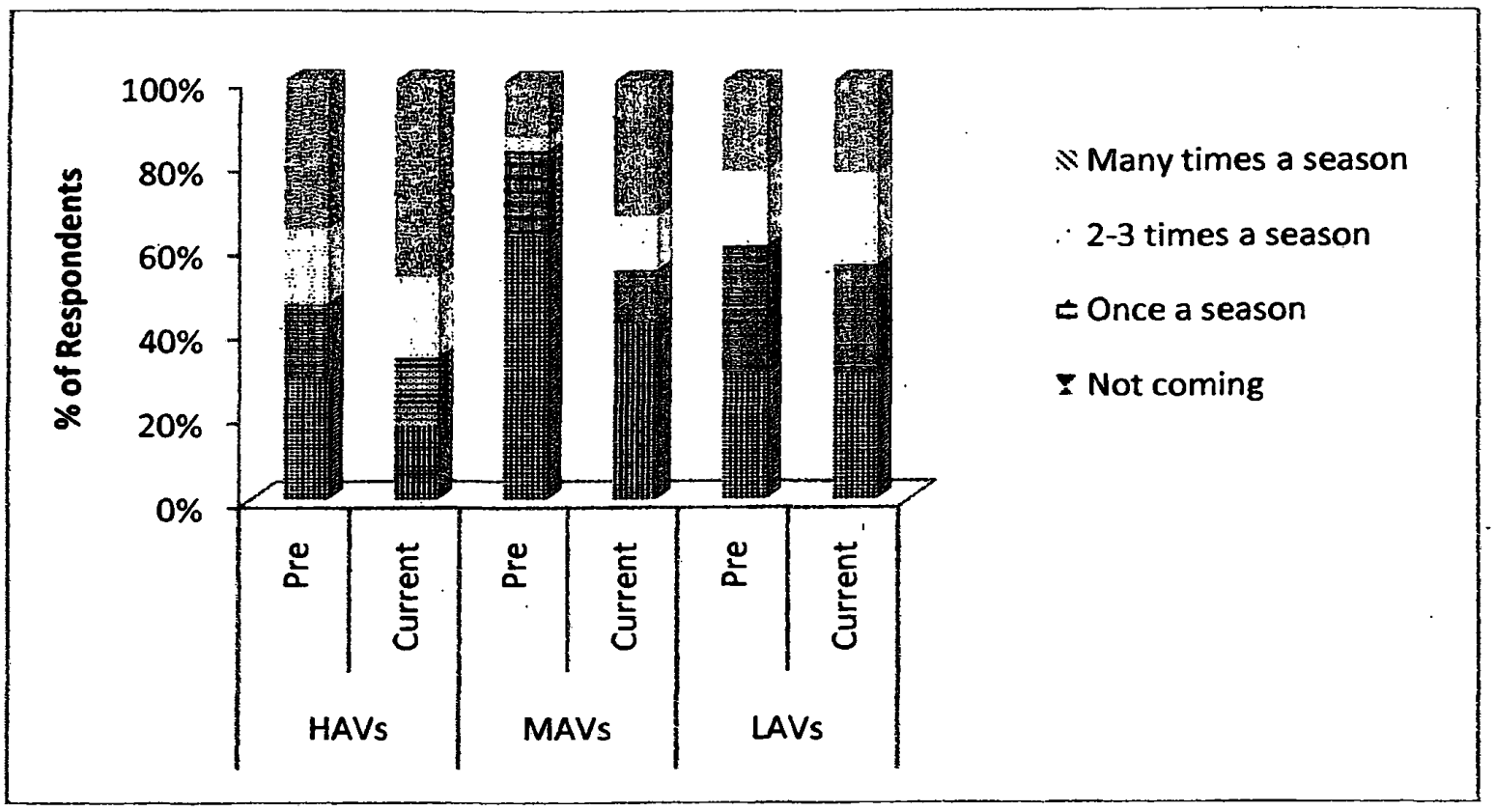
It is believed that improved road conditions encourage the mobility of officials to reach remote villages. The data relating to visitation rates by the Agriculture Instructors (AIs) to the villages before and after RRD revealed some important facts:

(a) An obvious change in the frequency of visits by AIs to HAVs and MAVs when compared with that of LAVs. This change is obvious when a comparison is drawn between pre and current status of visitation by AIs under data series – many times a season- in the Figure 4.1.

(b) A decline in the percentage of village HHs currently not visited by the AIs denoting 38 percent in HAVs, 33 percent in MAVs with no decrease in LAVs (Figure 4.2).

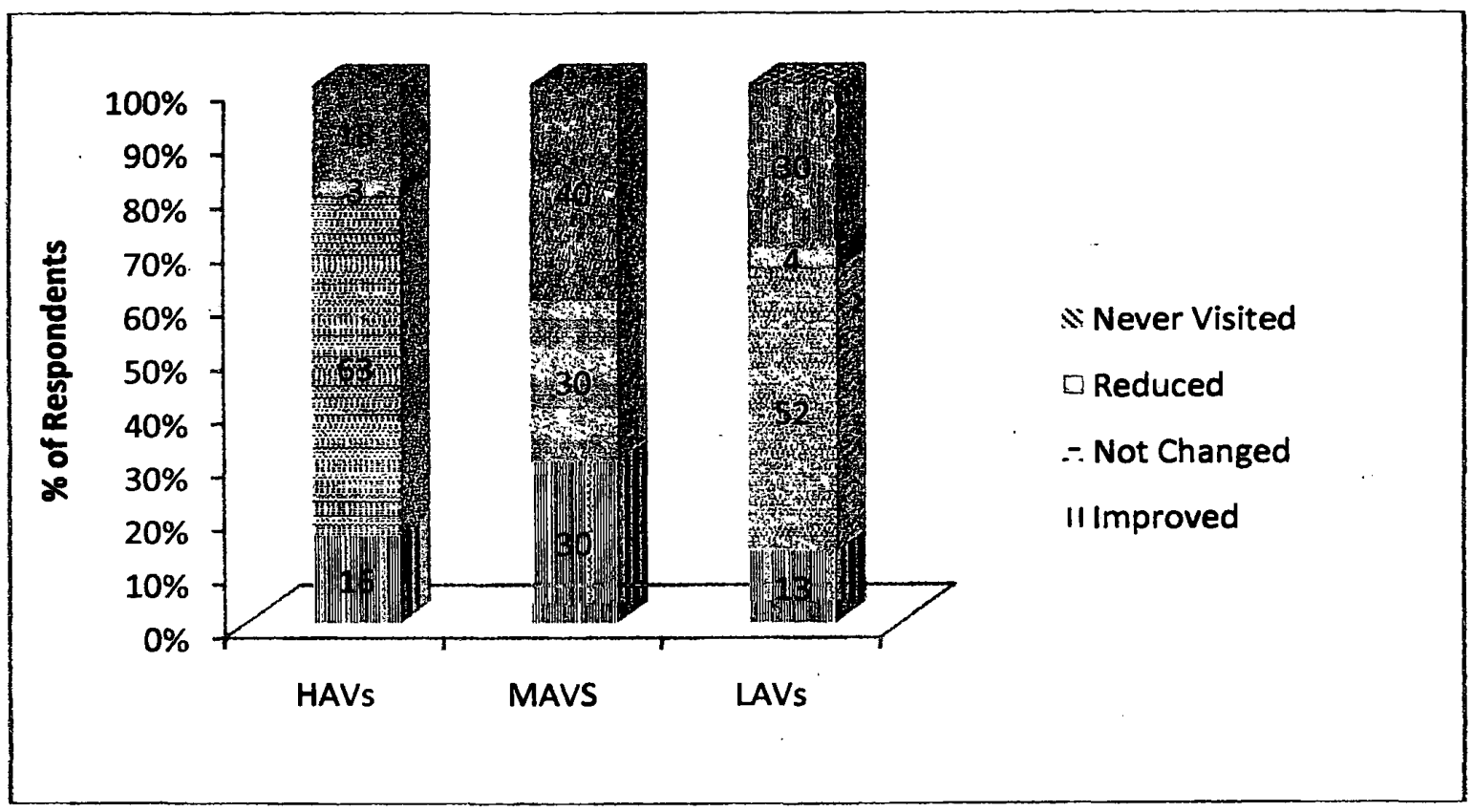
(c) The presence of a considerable portion of HHs that had never got the service of AIs (18% in HAVs, 40% in MAVs and 30% in LAVs - (Figure 4.2).

(d) Overall some improvement in the frequency of visits by AIs from 13% in LAVs through 16% in HAVs to 30% in MAVs (Figure 4.2).



Source: HARTI Survey Data, 2012

Figure 4.1: Visitation Rates by Agricultural Instructors to Meet Farmers before and after RRD (% Respondents)



Source: HARTI Survey Data, 2012

Figure 4.2: Change in Visitation Rates by Agricultural Instructors after RRD

It was evident from the survey that some farmers did not rely on extension advice if they had operated on smaller scale whereas some others got advice from 1920 telephone line or from pesticide traders. In general, AIs had visited farmers only when the need arose as they had regularly met farmers at the *kanna* meeting or at the ASC while they obtained fertilizer. Some respondents who did not experience any changes in the visitation rate perceived that it was a result of negligence or

inefficiency of extension personnel whereas others were of the view that the large area assigned to AIs made it a difficult task for them to achieve. Visitation rates by AIs to villages both before and after RRD show a significant correlation with scale on access to villages (Spearman's rank-order correlation coefficient = -0.192, P =0.040 before RRD and -0.233, P =0.012 after RRD). In addition to this, current visitation rates denote an increased association as well as higher level of significance than the period prior to RRD. The data indicates that the visitation rates by AIs have increased with the increased access to villages. Overall there was a significant improvement in visitation rates by AIs to villages compared to the period prior to RRD.

4.4 Farm Mechanization

As perceived by 55 percent of respondents (51% from HAVs, 69% from MAVs and 44%t from LAVs) the bringing in of tractors and harvesting machines to the villages was further facilitated by road development. Most of them also perceived that road development had not been a decisive factor for the use of farm machinery. It was revealed from the survey that most farmers used and a few both owned and used farm machinery even before the road development as the road conditions prevailed at that time were not critically constraining the mobility of farm machinery and mechanized operations in agricultural activities. Further, the degree of mechanization in agriculture especially in paddy cultivation was governed by the socio-economic circumstances of each household including labour availability, labour use pattern i.e. family, *attam* or hired labour or a mix of labour, affordability to hired labour, extent of cultivation, suitability of mechanized operations to the farming field and ability to access each plot of land to be cultivated/under cultivation. Therefore, in addition to the general trend towards increased use of farm machinery in each village and allied cost increases over time, there were no marked changes in farm mechanization particularly owing to RRD.

4.5 Relations with Factor/Product Markets/Service Points

The literature revealed that the effects of road development on various factor product markets were two fold: (a). Expansion of available markets due to growing demand and supply of a variety of products and (b). Development of new markets particularly in producing areas in further remote villages. This had enabled farmers to deal with more number of markets and/or change the market places for better prices and to increase the volume of sales. Increased mobility of traders, producers and consumers via developed roads that connected markets and farm fields was one way of expanding the available markets. Change in market places could also be possible due to increased access to markets through alternative routes which connected farms to markets that farmers had not previously dealt with. One noteworthy outcome of rural development was a gradual increase in the intervention by hire purchase trading system due to easy aceess ensued through the development of access roads to the villages. The data (Table 4.3) showed the extent to which the rural households experienced changes in market places which they had dealt with for various household needs followed by road development.

Overall 20 percent households had experienced changes in the means of paddy marketing with a slight variation across three categories of villages. In addition, fertilizer market of certain respondents had changed only in HAVs and LAVs. Changes in means of OFC marketing was reported among five percent respondents. The study also revealed that new markets such as pre-schools, branches of rural banks, sales centers for agricultural inputs and health centers had been developed followed by road development. The rest of the changes were due to parents having a choice in educational institutions that suits the age of their children. The most prominent changes reported in the means of paddy marketing are discussed below.

Table 4.3: Responses on Changes in Market Places by Type of Village

Markets/Service Points	HAVs		MAVs		Overall		
	Total Respondents (%)	% changed	Total Respondents (%)	% changed	Total Respondents (%)	% changed	% changed
Paddy Market	97	23	91	19	91	17	20
Fertilizer Market	98	13	78	-	100	9	7
OFC Market	55	3	41	3	57	9	5
Bank	89	6	91	-	100	4	3
Secondary School	37	4	28	3	26	-	2
Hospital	100	7	97	-	100	-	2
Seed Market	89	2	78	-	91	4	2
Pre School	8	2	13	-	9	-	1
Primary School	13	2	19	-	26	-	1
Shop/Bus Station	92	3	75	-	78	-	1
Pesticide Market	100	-	97	-	100	-	-
DS Office	92	-	88	-	100	-	-

Source: HARTI Survey Data, 2012

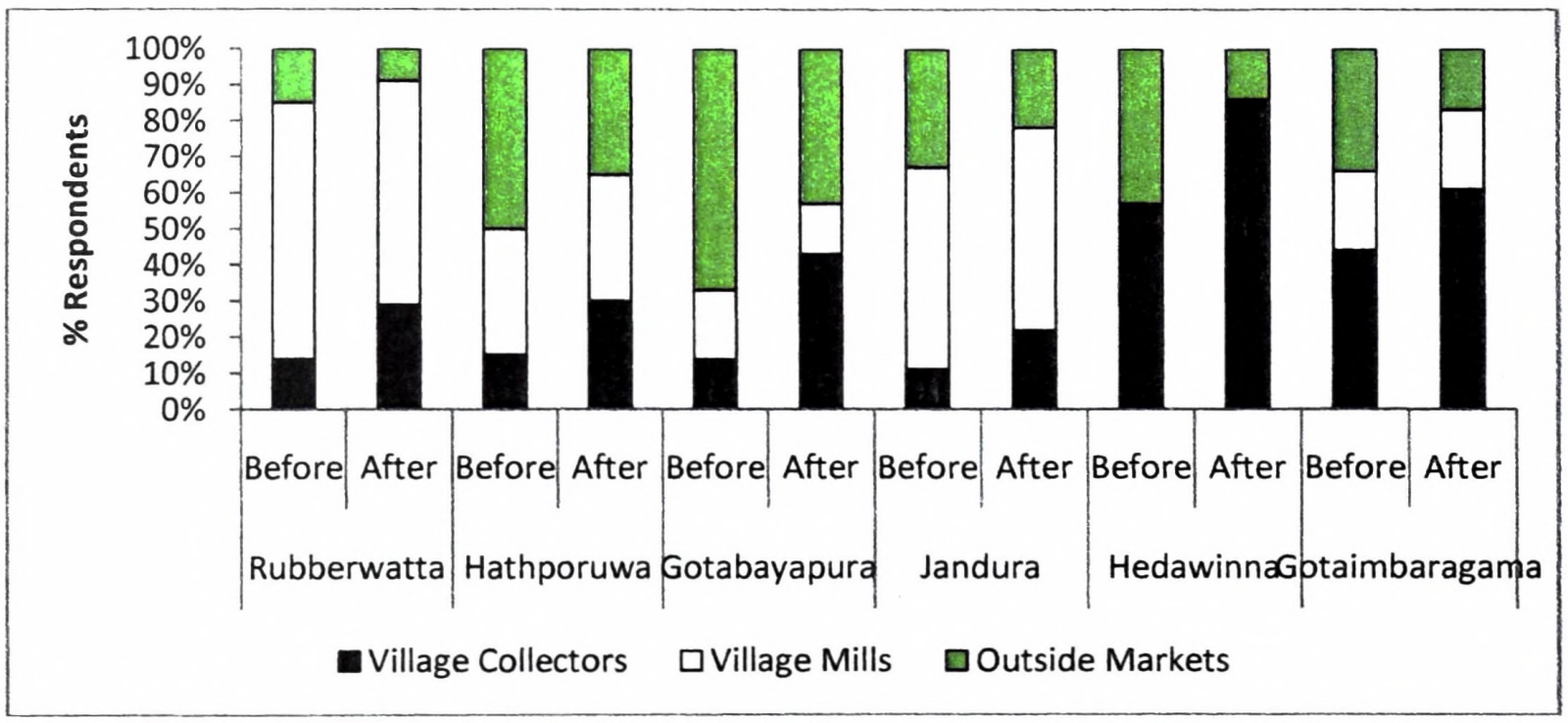
4.5.1 Changes in Paddy Marketing

The analysis on changes in paddy markets revealed the nature of and the extent to which these changes (Figure 4.3) had occurred in the study villages. There were three means of selling of paddy harvest by the farmers in the villages; (a) to the village collectors who came from outside areas, (b) to the paddy mills operating in close proximity to the villages and (c). to the previously known markets/paddy mills situated in nearby towns. As can be seen from Figure 4.3 and the Table 4.4, the role of village collectors in paddy marketing shows an expansion in each village against

the reduced involvement by farmers to sell their produce to the outside markets in nearby towns. The role of village mills in paddy marketing seems to be largely unchanged. Village-wise changes reported in paddy marketing in study villages are summarized below.

Rubberwatta in Tissamaharamaya - the most accessible village:

- Disposal of the paddy harvest by most of the farmers (85%) was reported within the village (71% farmers to the village mills and 14% to the village collectors).
- The rest fifteen percent disposed the harvest to outside markets situated in Tissa and Weerawila towns.
- A drastic increase by 107 percent in selling the produce to the village collectors with a drastic decline (67%) in dealing with outside markets and a slight decline in village mills (6%) (Table 4.4). At the moment, only nine percent farmers sell their produce to the markets located in Tissamaharamaya, Weerawila and Debarawewa towns.



Source: HARTI Survey Data, 2012

Figure 4.3: Percentage Distribution of Respondents by Means of Paddy Marketing in Study Villages - before and after RRD

Hathporuwa Village:

- Embilipitiya, Suriyawewa and Mahagama were among the outside markets which farmers in Hathporuwa village had dealt with for selling the paddy harvest prior to road development to date.
- An increased intervention by village collectors (100%) and 30 percent decline in dealing with outside markets.
- No change in the involvement by village mills.

Table 4.4: Percentage Change in Means of Paddy Marketing in Study Villages

Village	Percentage Change Reported in Market Places of Paddy		
	Village Collectors	Village Mills	Outside Markets
Rubberwatta	+107	-6	-67
Hathporuwa	+100	0	-30
Jandura	+100	0	-33
Gotabhayapura	+207	-26	-36
Hedawinna	+51	NR	-67
Gotaimbaragama	+39	0	-50

Source: HARTI Survey Data, 2012

Jandura Village:

- Similar observations as in the case of Hathporuwa village as farmers had sold the paddy harvest to Angunakolapelessa, Hakuruwela and Thanamalwila towns with no marked changes followed by road development.

Gotabhayapura Village:

- Demonstrated a different picture denoting changes in all three types of paddy markets.
- A drastic increase in the involvement by village collectors (207%) in place of outside markets which demonstrated a 36 percent decline.
- Prior to road development, farmers used to sell their paddy harvest to several nearby towns such as Tissa, Yodakandiya, Weerawila and Kasingama whereas a few farmers sold paddy to mills located in Tissa and Weerawila at the moment.
- The role of village mills in paddy marketing has also declined by 26 percent.

Hedawinna Village:

- Farmers in Hedawinna had sold their paddy harvest only to the village collectors and nearby towns such as Ambalantota and Mamadala before the road development and continue the practice to date with a change in the choice between the two types of markets.
- As in other villages, the involvement of village collectors had further grown against the highest decline (67%) in outside markets.

Gotaimbaragama- The Least Accessible Village:

- Showed the same situation with regard to outside markets - Ranna and Angunakolapelessa - prior to road development.
- The only outside market which the farmers visit for selling paddy is Ranna at the moment. An increasing involvement though still at a low level of village collectors in this village can be observed.

The above data revealed several important facts with regard to paddy marketing in the study villages.

1. Lack of considerable change in the paddy milling industry prevailing within the village surrounding in terms of dealing with the previous customers for purchasing of paddy, other than losing few customers in certain villages, was observed.
2. A drastic decline (ranging from 30% to 67%) in selling paddy by farmers to known markets located in nearby towns was noted.
3. Increased intervention by the village collectors in the paddy milling industry through collecting paddy harvest at farmgate (paddy fields or farm households).

4.5.2 Changes in Paddy Prices

4.5.2.1 Paddy Prices in *Maha* Season

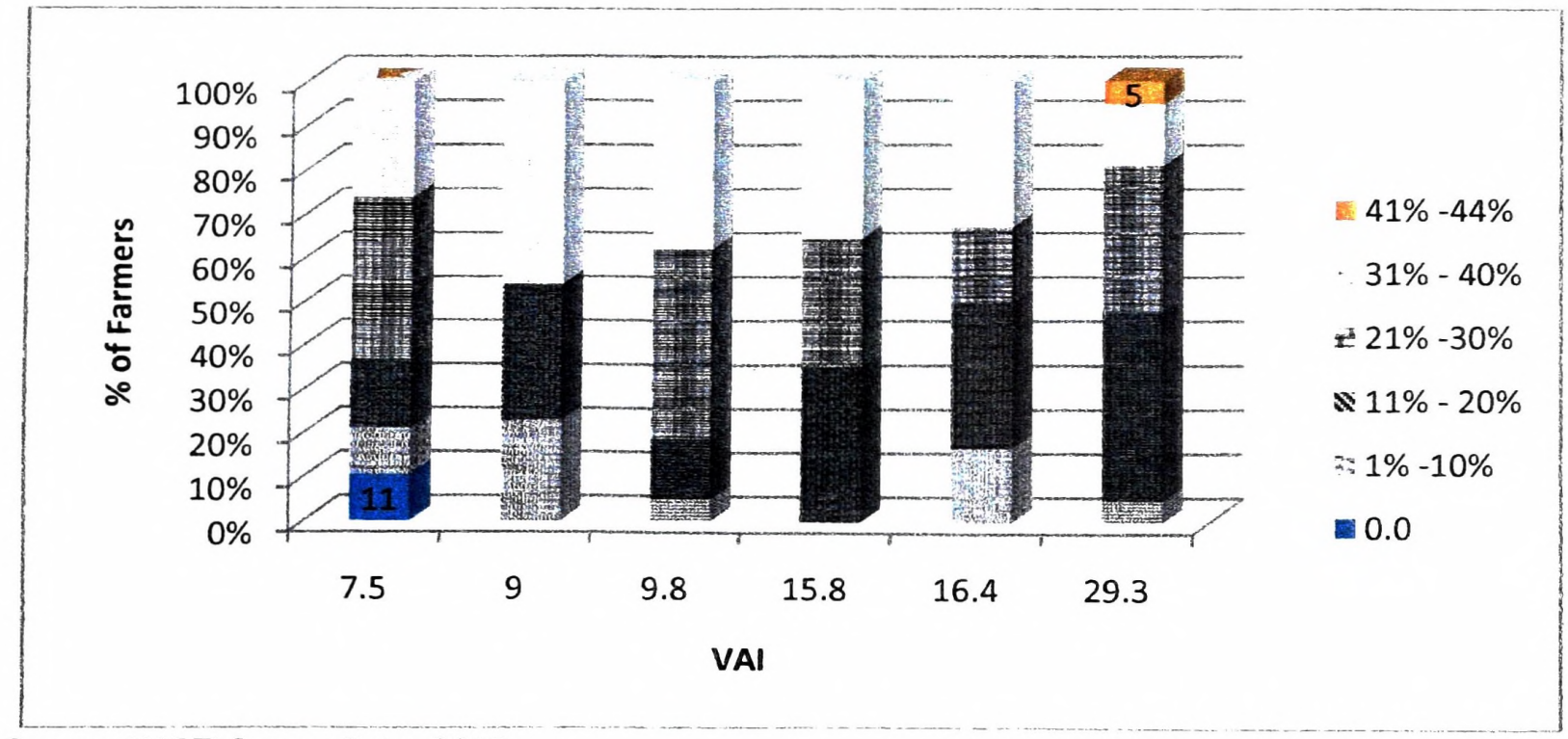
Table 4.5: Paddy Price Statistics (*Maha* Season) by Category of Villages

Village Category	Minimum	Maximum	Mean	Std. Deviation	Difference* (%)
HAVs	20	32	24.51	3.310	-3.8
MAVs	19	30	24.58	3.384	-3.5
LAVs	18	30	25.45	3.034	-

Notes*: Difference for HAVs= (HAVs- LAVs)/ HAVs X 100
Difference for MAVs= (MAVs- LAVs)/ MAVs X 100
Source: HARTI Survey Data, 2012

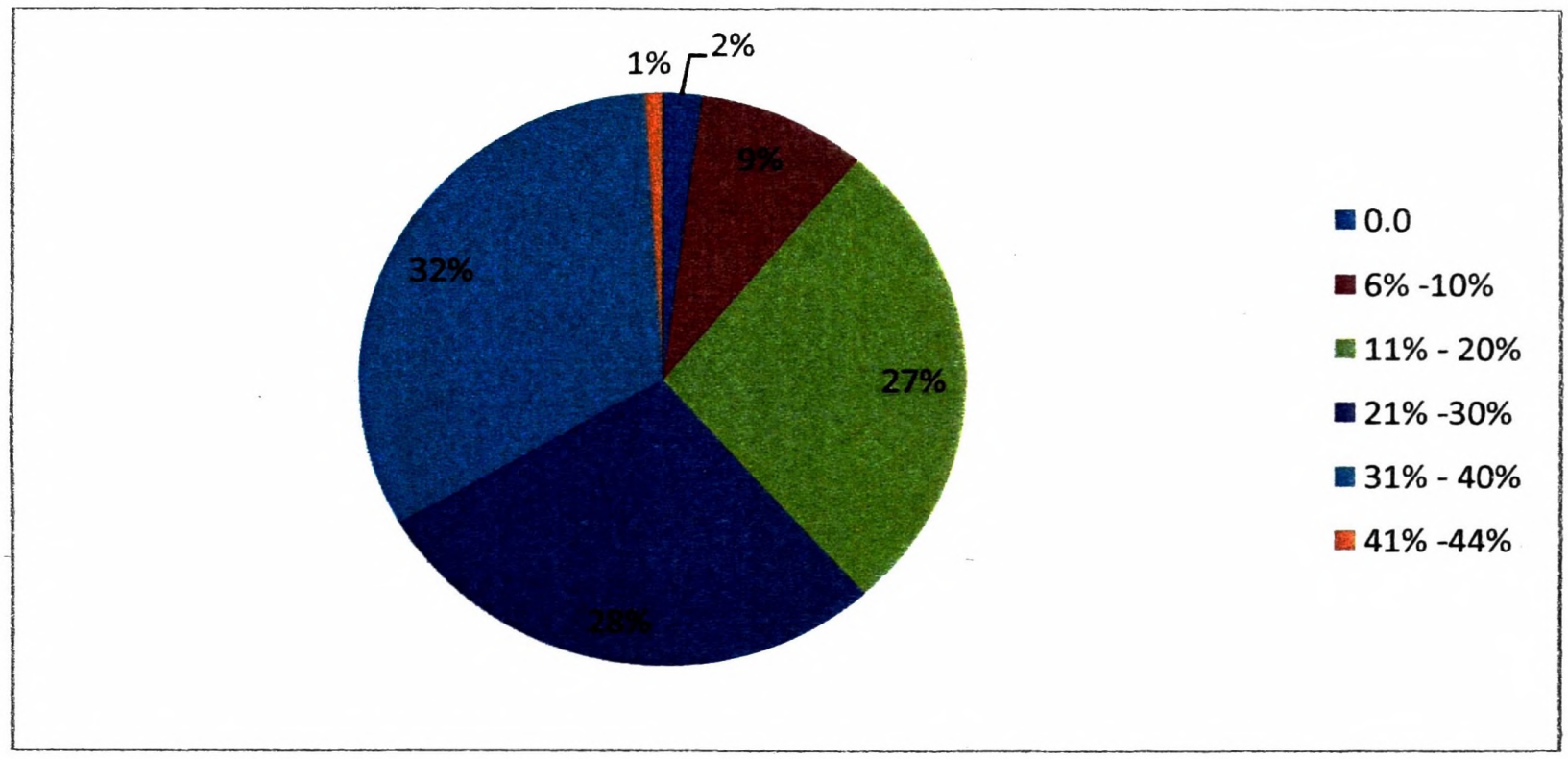
Table 4.5 shows that there is a slight decrease in paddy prices in *maha* season both in HAVs (3.8%) and MAVs (3.5%) when compared with that of LAVs. However, the data shows that the observed difference is insignificant ($P < 0.532$).

Data in Figure 4.4 shows a decline in paddy prices ranging from zero percent to 44% when compared to the guaranteed paddy price of Rs.32/kg. Only few farmers (11%) in the most accessible village had received the guaranteed price of Rs. 32/kg of paddy whereas around five percent farmers in the least accessible village had received the least price amounting to over 40 percent decrease when compared to the guaranteed price. However, the observed variation in paddy prices between six villages was insignificant ($F = 0.920$, $P = 0.471$).



Source: HARTI Survey Data, 2012

Figure 4.4: Percentage Distribution of Farmers by Percentage Decline in Paddy Prices from Guaranteed Price by Villages (*Maha* Season)



Source: HARTI Survey Data, 2012

Figure 4.5: Percentage Distribution of Farmers by Percentage Decrease in Paddy Prices from Guaranteed Price in the Overall Sample (*Yala* Season)

When compared with the guaranteed price of paddy, the majority of farmers (99%) had sold their *Maha* season produce at a loss which ranged from a minimum of six percent to a maximum of 44 percent. Only one percent farmers had managed to sell at the guaranteed price to the village collectors (Figure 4.5).

4.5.2.2 Paddy Prices in *Yala* Season

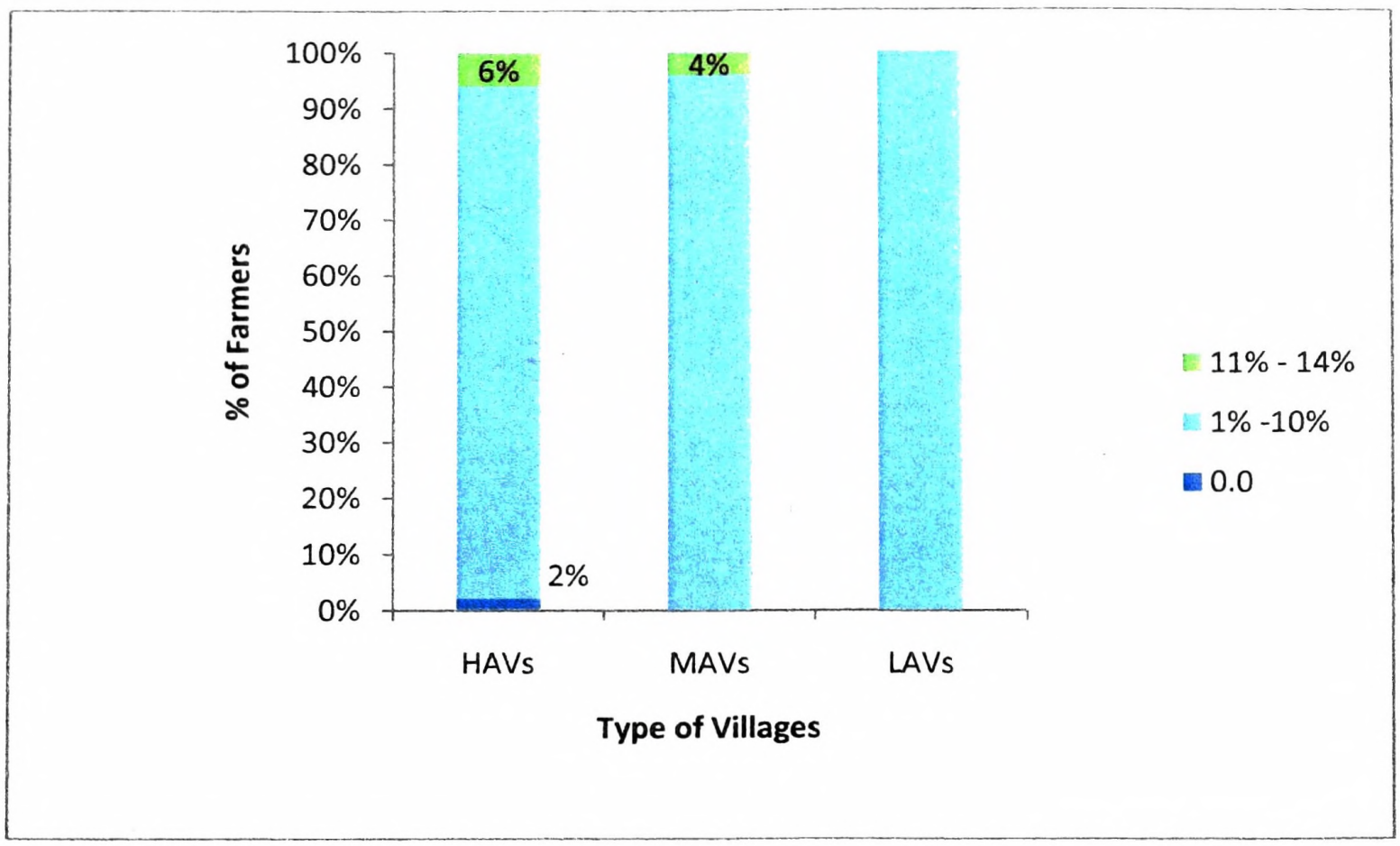
A different situation can be observed when *Yala* season prices are considered. As it is evident from the Table 4.6, paddy prices in *Yala* season had demonstrated a lesser variation (from Rs. 26/kg to Rs. 32/kg) and higher average prices (from Rs.26/ to Rs. 28/kg). This indicates the general behavior of paddy prices in the country. Still the higher average price is reported in LAVs with a significant price decline (F = 4.852, P = 0.001) between three categories of villages (Table 4.6).

Table 4.6: Paddy Price Statistics (*Yala* Season) by Category of Villages

Village Category	Mean	Maximum	Minimum	Std. Deviation	Difference* (%)
HAVs	26	32	20	3	-7.1
MAVs	27	30	18	3	-3.6
LAVs	28	30	22	2	-

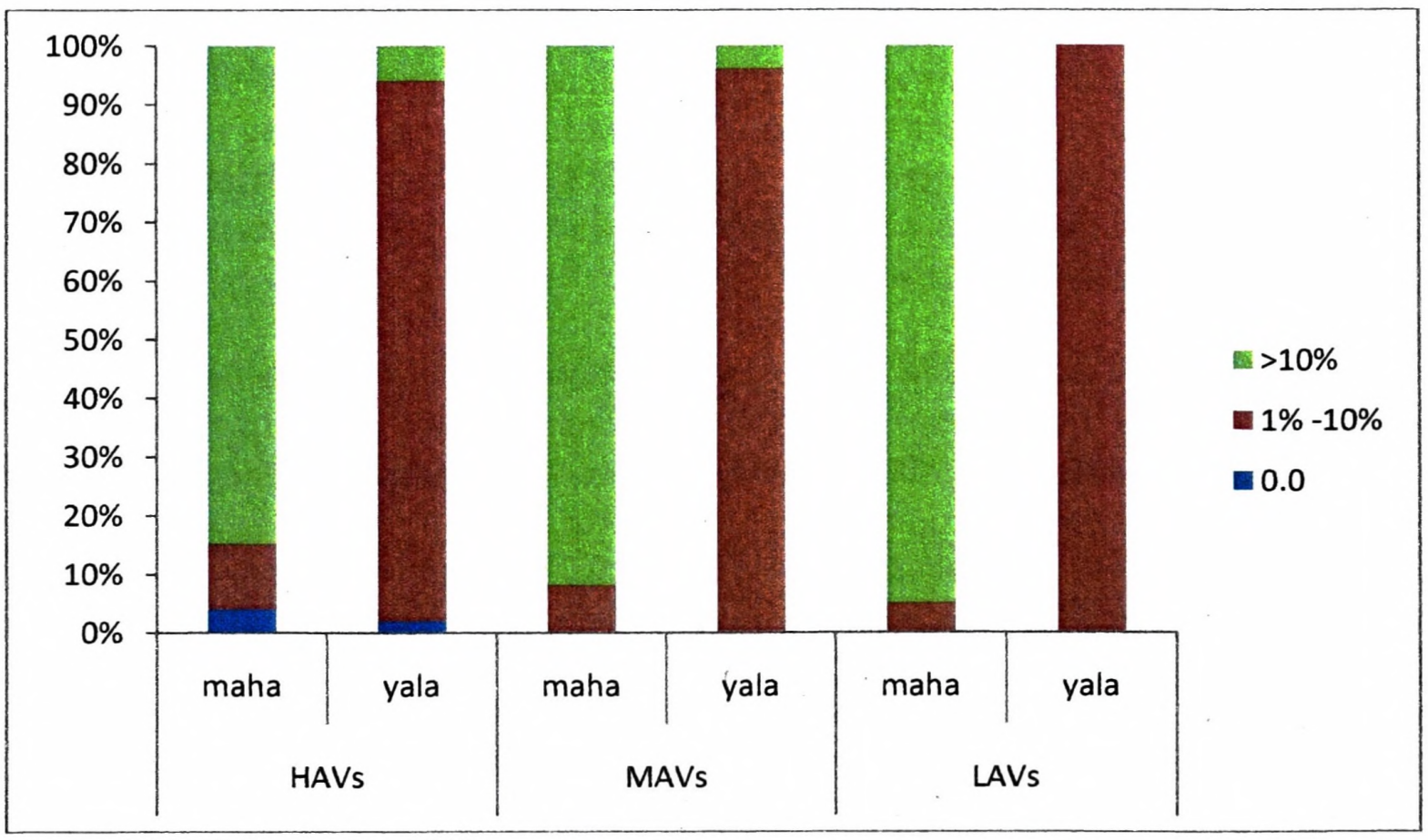
Notes*: Difference for HAVs= (HAVs- LAVs)/ HAVs X 100
Difference for MAVs= (MAVs- LAVs)/ MAVs X 100
Source: HARTI Survey Data, 2012

Data in Figure 4.6 shows that a decline in paddy prices during *yala* season ranged from zero percent to eleven percent, a lesser variation with compared to *maha* season prices (Figure 4.7). Only Gotabhayapura and Hedawinna villages showed a decline in paddy prices which was more than ten percent (Figure 4.8) whereas two percent farmers from HAVs had received the guaranteed price. Reported variations between three types of villages are significant (F =3.358, P = 0.039). This means that the higher prices received by LAVs are significantly higher than that of MAVs and HAVs.



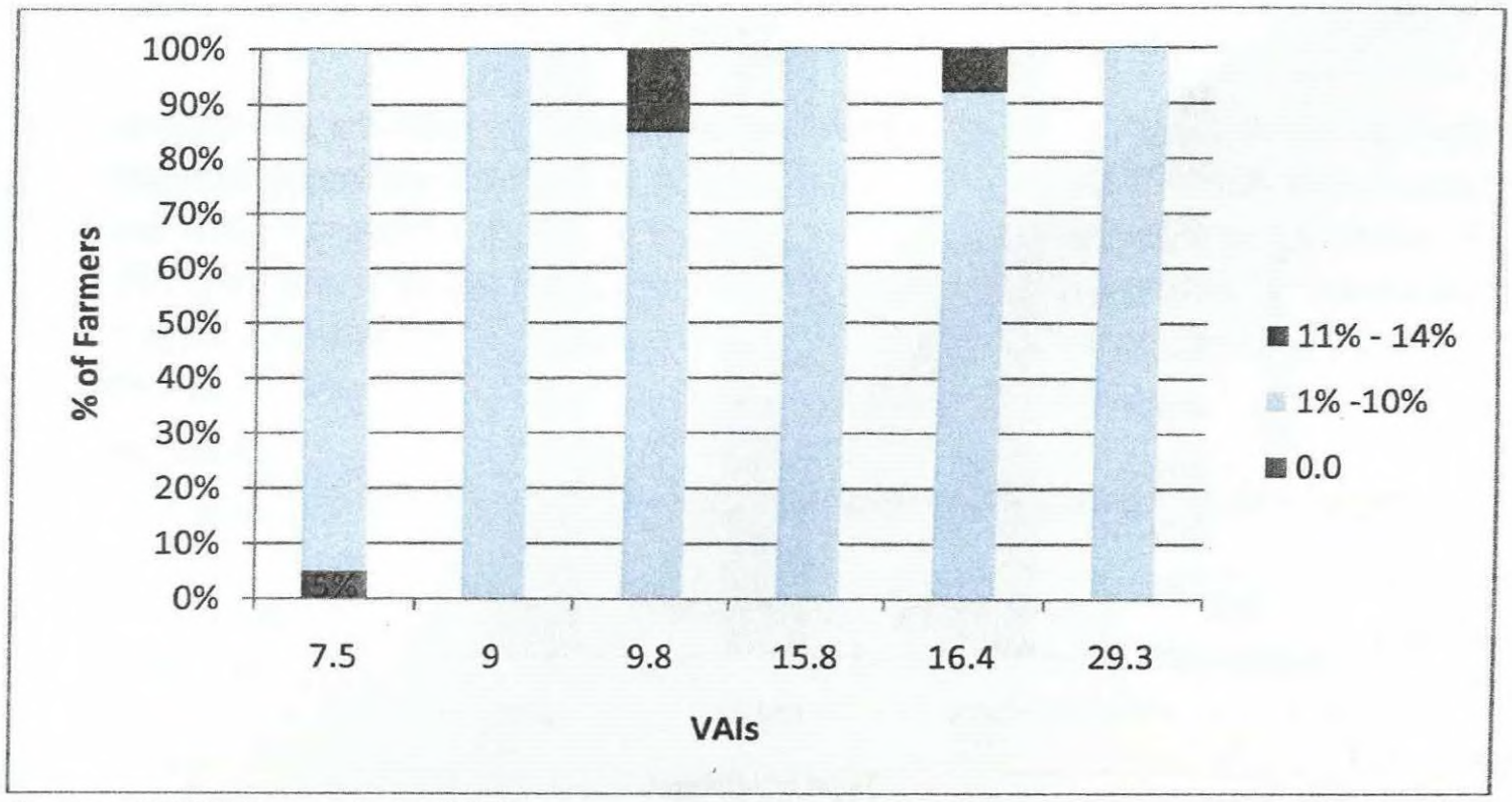
Source: HARTI Survey Data, 2012

Figure 4.6: Percentage Distribution of Farmers by Percentage Decline in Paddy Prices from Guaranteed Price by Scale on Access to Villages (*Yala* Season)



Source: HARTI Survey Data, 2012

Figure 4.7: Percentage Distribution of Farmers by Percentage Decline in Paddy Prices from Guaranteed Price by Village and Season



Source: HARTI Survey Data, 2012

Figure 4.8: Percentage Distribution of Farmers by Percentage Decline in Paddy Prices from Guaranteed Price by Villages (*Yala* Season)

The qualitative information gathered from farmers and key informants provided the following explanation on the behavior of paddy prices in the study villages. In spite of the fact that there was a variation in access to villages and the presence of guaranteed price schemes, large scale milling industry operated in the country has succeeded in influencing paddy prices in the rural villages through their agents termed as village collectors. The village millers, as a response to this, had in certain instances attempted to prevent the entry of outside traders to the villages. This scenario establishes the fact that the village paddy milling industry is experiencing a gradual decline while farmers had enjoyed an increased opportunity of having a choice in their traders. This was more obvious in HAVs than LAVs as price variation in HAVs is higher than that of LAVs.

The respondents' perception on the contribution from road development to paddy marketing which is presented in the Table 4.7 also provides evidence on the same. A one fourth of the respondents believed that road development largely contributed to paddy marketing and for another one fourth of respondents it was a moderate contribution. The rest, half of the households, had not experienced or perceived such contribution. There is a slight increase in respondents in HAVs than in MAVs and LAVs who perceived this opinion. As observed, the positive perception prevailing among the farming community towards road development seems to be an acknowledgement for the convenience they experienced during the involvement of a variety of agrarian relations.

Table 4.7: Respondents' Perception on the Level of Contribution from RRD to Paddy Marketing (%)

Level of Contribution	% Respondents by Village Category			
	HAVs	MAVs	LAVs	Overall
Very High	27	19	22	24
Some	26	31	22	27
No	11	19	26	16
Uncertain	36	31	30	33
Total	100	100	100	100

Source: HARTI Survey Data, 2012

4.6 Changes in OFC Marketing

Overall, 52 percent households in the study villages were involved in the production of OFCs and 26 percent had earned an income from the same. Some of them perceived that they benefited in OFC marketing in two ways: (a) Traders have come to villages to purchase the produce and (b) Some farmers have also sold their products to outside markets (pola) due to travelling convenience. This had reduced post harvest losses to a certain extent and thereby increased the quantity sold. However, some others were of the opinion that they could not derive additional benefits owing to lack of variation in cultivating crops and/or receive higher prices from the same traders who had been visiting the villages over a long time. Changes in OFC market places (Table 4.8) were decided based on the extent to which the percentage of farmers who sold their products to a particular market had been increased or decreased prior to rural road development and after road development.

Table 4.8: Changes in OFC Market Places

Village	% of OFC Producers	% of Farmers Experienced Changes in Market Places		
		Village Collectors	Outside Markets for OFCs	
Rubberwatta	33	+107	-17	Tissa, Pannegamuwa
Hathporuwa	75	-3	+8	Suriyawewa, Mahagama
Gotabhayapura	57	+16	-21	Tissa, Debarawewa
Jandura	44	NR	0	Angunakolapelessa
Hedawinna	43	+94	-19	Barawakumbura, Ambalantota
Gotaimbaragama	57	0	0	Ranna, Netolpitiya

Source: HARTI Survey Data, 2012

Data demonstrated a more or less similar situation to that of paddy marketing where the involvement of village collectors had increased with a decrease in the percentage

of farmers who sold their products to outside markets. The change was more evident in Rubberwatta and Hedawinna. No changes were reported in Gotaimabaragama, the LAV.

4.7 Household Income

Rural households in the study locations earn income from both on farm and off farm activities.

4.7.1 Off-farm Income

The literature revealed that road development contributes to entrepreneurship development as it facilitates easy access to input markets, transportation of inputs and produce marketing of the products of village industries. Road development could also facilitate the utilization of natural resources available in remote villages for rural industries and for value addition to agricultural products in such locations. As it was evident from the survey, the achievements in this area were not that impressive. Despite an improvement in the area of paddy milling in Hedawinna, Gotabhayapura, Rubberwatta and Jandura villages, none of the farm households surveyed had benefited from the same.

In addition to above, road development had facilitated employment generation as per the following few occasions either directly or indirectly.

(a) Easy access to remote villages through developed roads had facilitated mobility of rural women who sought job opportunities in garment factories operated outside the villages.
(2) Job opportunities in road/bridge construction.
(3) Teachers joining the village school.

The slow progress in the development of off farm income generating opportunities within the villages was attributed to several reasons:

- Lack of investment interventions for the development of industries by the villagers or outsiders.
- Lack of interest among the respondents to involve in off farm income generating ventures as farming was the main employment.
- Lack of technical/professional knowledge to the village population to begin new industries and lack of capacity building interventions for them.
- Shortage of capital, land and other facilities and lack of investment support by agencies.

With this revelation, one could understand that the extent to which road development had contributed to promote off farm income generation opportunities within the village setting is less/not satisfactory. The general consensus among the villagers was that there was no noticeable development occurred within the entire

village setting along with the road development. The village HHs experience a shortage of required capital, knowledge and technology to find and involve in new income generating activities and there were no one to support and encourage them too. There was neither political commitment nor attention paid by the state authorities to complete the proposed development activities in the villages or to implement new village development plans. The given scenario emphasizes the need for multi-dimensional development interventions aimed at development of villages in their entirety rather than implementing piece-meal development plans like roads.

4.7.2 On-farm Income

On-farm or agricultural income of households was mainly from paddy, OFCs, permanent crops, animal production and agricultural wage income. Agricultural income was mainly from paddy cultivation. Data shows that all most all the HHs (97%) had earned an income from paddy farming; 26 percent from OFC production; 34 percent from permanent crops and two percent from animal production. The Table 4.9 illustrates the mean share of family income from agricultural and non-agricultural sources by types of villages.

It is also evident from the data (Table 4.9) that there are disparities in HH income between HAVs, MAVs and LAVs. Analysis of variance in income data does not establish significant differences in non-agricultural incomes between study villages (F 0 = 1.656, P = 0.151).

However, significant differences were recorded in annual income of farm households (F = 4.276, P = 0.001) owing to significant differences in agricultural income between villages (F = 3.621, P = 0.005). Therefore, it is important to test any association between road development and agricultural income of villages with varied accessibility.

Table 4.9: Mean Share of Family Income from Agricultural and Non-agricultural Sources by Type of Villages

Type of Villages	Average Income(Rs)/yr						Difference	
	Agricultural Income		Non-agricultural Income		Total Income			
	Rs.	%	Rs.	%	Rs.	%	Rs.	%
HAVs	326922	62	201065	38	527987	100	277128	110
MAVs	174321	55	140221	45	314542	100	63682	25
LAVs	152010	61	98850	39	250859	100	-	-

Source: HARTI Survey Data, 2012

As discussed under the section 4.5, paddy cultivation is the key agricultural activity that comprises the largest portion of agricultural income of rural households. Among the key factors that determine the income from paddy are area under cultivation, cropping intensity, paddy productivity and paddy price. Out of these four factors, extent under cultivation and cropping intensity in paddy lands are inherent factors that make up the socio-economic-cultural structure of a rural agrarian community which evolved over time. There is hardly any possibility for varying of these factors through road development. However, paddy productivity and paddy prices could have been impacted by road development either directly or indirectly. Paddy productivity may increase with the increased mobility of inputs such as fertilizer and extension advice due to increased mobility of extension personnel. Paddy prices can vary with the changes in paddy market relations.

As discussed in the section 4.5.2, paddy prices among villages and between cultivation seasons have been varied irrespective of the scale of village development. Paddy productivity among villages does not show significant variations too. Thus it can be concluded that the significant changes in agricultural income among study villages are not due to road development but it could be attributed to structural differences existing among the villages.

4.7.3 Relationship between Access to Villages and Household Income

Household income was correlated with the following variables.

1. APL - Access to Paddy Lands (ac)
2. VAI - Village Accessibility Index
3. AHH - Age of Head of Household (years)
4. NEF – Number of Family Members Employed
5. SFI - Sources of Family Income
   Agricultural only = 1
   Otherwise = 0
6. EHH - Educational Level of Head of Household
   No education = 1
   Can read and write = 2
   Grade 1 to 5 = 3
   Grade 6 up to O/L = 4
   O/L + Technical Training = 5
   Up to A/L = 6
   A/L + Technical Training = 7
   Basic Degree = 8
7. AES - Access to Extension Service
   Not Visiting AI = 1
   Once a Season = 2
   Two to Three Times a Season and = 3
   Many Time a Season = 4
8. UCI- Upland Cropping intensity Index
9. LCI -Low land Cropping Intensity Index

As evident from the data in the Table 4.10, access to paddy lands, the number employed in the family, upland cropping intensity index and source of family income had significant positive correlations with HH income. The village accessibility index negatively correlated with the same. This establishes the fact that HH income is higher in highly accessible villages.

Table 4.10: Relationship between HH Income and Other Socio-Economic Variables

Variables	Correlation Coefficient	Probability Level
APL	0.189*	0.048
VAI	-0.285**	0.002
AHH	0.006	0.951
EHH	0.026	0.784
NEF	0.246**	0.008
SFI	0.384**	0.000
AES	0.121	0.199
LCI	0.134	0.152
UCI	0.235*	0.011

** Correlation is Significant at 0.01 level
* Correlation is significant at 0.05 level

Further, VAI was significantly correlated with variables which can affect household income either directly or indirectly. For instance, low land cropping intensity index as a variable having direct impact on household income and arrival of extension officers and level of education of household heads as variables having indirect effects on household income. Appendix 3 shows that the household heads in HAVs are more educated than that of LAVs.

The prime focus of this analysis was to understand the relationship between household income and VAI. Therefore in order to test the statistical significance of the village accessibility on HH income a regression equation was estimated from the HH level data. The variables correlated with VAI were dropped from the regression due to theory of the model where VAI should have been. The hypothesis was that the HH income will increase with the increased accessibility to villages. According to the regression results presented in the Table 4.11, the VAI was found to be statistically significant variable. The negative sign of the co-efficient established that the lower the VAI the higher the HH income, in other words, the higher the access to villages, the grater the household income.

Table 4.11: Regression Results

Model	Un-standardized Coefficients	t	Sig.
	B		
(Constant)	5.482	20.469	.000
lnNEF	.049	.280	.780
lnVAI	-.542	-3.521	.001
lnAPL	-.027	-.232	.817
SFI	.820	3.198	.002
lnUCI	.340	2.221	.029

R^2 = 0.509; F= 7.271; P = 0.000

However, it is required to reemphasize that the status of road development is not the most influential factor in the VAI so that findings and conclusions arrived at by comparing study villages with the use of VAIs are not exclusively due to road development. The prevailing income changes between villages are largely attributed to inherent differences in socio-economic-cultural structure of rural agrarian communities. Therefore it seems that 'effects of infrastructure development' is an area that needs to be further researched to capture any widespread effects of rural road development on rural farming communities in the country.

SECTION FIVE

Conclusion and Areas for Further Research

Roads is an important precondition for improving living conditions of people in rural agrarian communities. Roads bring people who are residing apart more closer both physically and mentally, strengthen relations between people and other socio-political institutions and lessen negative effects of exclusion of people living in less favored areas. Development of rural roads was a lifelong need of the rural people who pursued their living with severe discomfort due to poor condition of roads which constrained their easy access to many socio-economic needs of life. In the present context, the development of rural roads has become a socio-political interest within the rural society. This interest was so sensitive and serious that the rural people in some locations in some instances cast their votes seeking support for road improvement against those who failed to pay attention to this aspect.

Given this background, the government during the last decade paid greater attention to improve rural roads throughout the country. Rural road development occupied a unique position in *Gama Neguma* programme which was founded on par with pro rural development concept with the objective of developing rural villages as micro centers of growth as anticipated in the national development framework *'Mahinda Chinthna'*. Accordingly, rural road development received attention and investment under the *Gama Neguma* programme, later under the *Maga Neguma* programme and currently under *'One Work for One Village'* programme.

Development of rural roads was seen as a critical need of the rural agrarian communities who pursued their means of living through agriculture which would not realize otherwise without rapid mobility of labour, knowledge, machinery, inputs and outputs. The road network in agrarian communities were termed as 'Agricultural Roads'; a concept comparable to **Farm-to-Market-Roads** introduced by the renowned agricultural extension scientist, A. T. Mosher. As stated by Mosher, farm-to-market-roads is one among five essentials for agricultural development in any country.

With the increased attention paid to road development during the last decade investments were flourished across rural villages in the countryside. Roads so developed linked farming areas with input and output markets. They enabled swift access to markets conveniently than before. Distance between people and socio-political institutions lessened both temporally and spatially. As evident from the survey, convenient travelling and swift access to different service points/markets were among the greatest benefit enjoyed by the villagers after road development. A variety of transport modes emerged and travel time fell to a certain degree in all study sites. Changes also occurred in the means of travelling. Increased use of motor cycles was one such marked difference. However, road development had not largely influential in altering the shape of the traditional rural scenery where people used

push cycles for day-to-day activities including reaching the school and field. A variety of sales agents/vehicles entered the village and were involved in their own businesses. This had conditioned outflow of village capital and resources through hire purchase systems operated for a variety of consumer goods and articles.

A significant improvement was reported in the mobility of extension personnel into the study villages. However, it had not been a substantial motivation for farmers to take up new directions in the way of farming despite policies and programmes to achieve self-sufficiency targets in the food crop sector having in place. The changes occurred in the use of paddy lands or in the cultivation of new varieties/crops in paddy lands were minute owing to structural composition of paddy farming systems, such as, lack of access to additional cultivable land, irrigation pattern, poor drainage conditions of soil, traditional land tenure patterns and scarcity of labour. All these had constrained crop diversification in paddy lands except for permanent diversification with banana in a single study location even at a lesser scale. The gap of knowledge, technology and skills had also stalled farmer progress in terms of innovative farming and techniques hence, they continue producing traditional agricultural products. The severe lack of co-ordinaion between road development and upland cropping component had prevented farmers from to optimizing the use and management of resources in upland cropping systems.

Farm mechanization in paddy cultivation was an area that improved over time irrespective of the degree of road development. It was a decision led by affordability of rural households, availability of labour and accessibility of farm machinery to the farm fields rather than scale on access to villages. Accordingly, road development had not been an added incentive that yielded significant improvement in the farming systems in production and diversification terms. This has hindered emergence of new market places. Instead substantial changes were observed in the pattern of paddy marketing. Despite of the resistance by village millers whose role in paddy marketing was diminishing, the village collectors had entered the villages and played a prominent role in paddy marketing. This could be shown as a good opportunity created through rural road development though farmers had failed to derive the benefits of the same due to constraining macro policies relating to agricultural produce prices. Thus there are evidence to support that rural roads contributed to an increase in agricultural income of rural households.

Nevertheless, agricultural income of rural households showed a significant and positive correlation with village accessibility index. This could be owing to structural differences prevailing between the study villages such differences are increased access to paddy lands and higher intensity of utilization of paddy lands in the villages with higher accessibility than that of villages with lower accessibility. Therefore, a significant increase in income from paddy in HAVs demonstrates a random behavior apart from the road development. Further, the factors that could have had an impact on agricultural income which are paddy productivity and the price of paddy had not shown any relationships with scale on access to villages. This depicts that

road development had not impacted on the agricultural income of households either directly or indirectly.

Further, there was no evidence to show that avenues for non-farm income generating opportunities opened up within the villages after RRD. Instead, RRD in a few occasions had facilitated out-migration of village labour for the garment industry at a low scale. Other than that contribution from road development towards income/employment generating activities within the village was minimal. Most of the village HHs had hardly any capital, knowledge and technology for the commencement of new income generating opportunities. There was neither the political commitment nor assistance from state authorities to encourage and direct the village people towards the same. Thus people do not see any noticeable development occurring within the entire village setting along with the road development.

This further proves that rural road development, as a piece meal development effort, is inadequate to produce tangible outputs that could prosper the rural lives and to develop the rural village as micro centers of growth. Therefore, increased attention of local and central government authorities (political authorities in practical terms) in planning and implementing income generating opportunities both inside and outside the agriculture sector is a must in order to derive the best benefits from the rural road development by the villagers. Thus it requires multi-dimensional development interventions aimed at development of villages in their entirety rather than implementing piece-meal development plans in isolation.

Therefore, promoting diversification of household incomes and farming systems cannot be best achieved by pursuing road development in isolation. Nevertheless, a village centered holistic development approach will only augment household incomes and diversify the farming systems in which a paradigm shift in agricultural sector is a part and parcel. This study stresses the need for commitment by political forces and institutions, both state and private sector involved in and are responsible for rural development to ensure the above requirement fulfilled in development planning, implementation and funding processes. Programmes for income diversification (both agricultural and non-agricultural incomes) and commercialization and value addition to agricultural products should be essential parts of such village centered development plans.

It is needed to reiterate that though rural road development is essential for rural development as anticipated in the national development framework, the level of achievement in rural road development is inadequate. Therefore, the crucial role that the roads play in rural development should not be undermined and requires more attention than at present. It is not only in terms of investment, but also in terms of the increased level of attention to the points raised in this study. Thus the biggest challenge is to rehabilitate the unattended rural roads laid among the tracks of farming lands. As aimed at in this study, diversification of farming systems and agricultural income can best be achieved by pursuing RRD in an integrated way as

people seek required support to utilize the opportunities that rural roads may offer. Given the required assistance, the people can expand the livelihood opportunities and thereby increase the family income.

Finally, the authors are of the opinion that the level of rural road development in the country is still inadequate to assess its effects and impacts in agricultural terms, hence methodological changes may require capturing any widespread effects that could not be captured through the methodology followed in this attempt. Therefore, further research on assessing the effects and impacts of infrastructure development should be coupled with methodological improvements that suit the local context and the extent and the nature of road development. One suggestion is to assess the effects at larger administrative levels such as divisional level than at village level.

BIBLIOGRAPHY

Ahmed, Raisuddin and Hossain, Mnabub. (1990); *Development Impact of Rural Infrastructure in Bangladesh*. Research Report 83. International Food Policy Research Institute and Bangladesh Institute of Development Studies. 1990.

Hemamali Hettige. (2006); When do Rural Roads Benefits the Poor and How: An In-depth Analysis Based on Case Studies. Asian Development Bank.

Higgins, B., (1959); Economic Development. New York. Norton.

Hirshman, A., (1958); The Strategy of Economic Development. New Harem, Conn., U.S.A. Yale University Press.

http://www.academia.edu/198095/Rural Infrastructure and Economic Development, accessed on (03.10.2014)

http://www.adb.org (Accessed on 08.24.2011).

http://www.development.lk/project_detail-1a--75.html, Development.lk, Wonder of Asia, Media Centre for national Development of Sri Lanka. (Accessed on 09.20.2011)

http://med.gov.lk , Ministry of Economic Development, Regional Development. (Accessed on 09.20.2011).

http://www.moshl.gov.lk. (Accessed on 05.25.2014).

http://www.rural roads.org/en/poverty. (Accessed on 04.06.2013).

http://www.worldbank.org/en/news/feature, Sri Lanka Rural Roads Link Villages to Cities Improving Rural Economy, (Accessed on 01.28.2014)

Ministry of Finance and Planning (2010); *Sri Lanka Wonder of Asia*: *Mahinda Chinthana Way Forward*. The Development Framework of the Government of Sri Lanka. 2010.

Ministry of Finance and Planning (2012); Research Issues Forwarded to Hector Kobbekaduwa Agrarian Research and Training Institute.

Mosher, A., T. (1966); *Getting Agriculture Moving: Essentials for Development Modernization*. Fredrick A. Praeger Publishers. New York. Washington. London. 1966.

Posda, A. J. (1966); Transportation in '*Selected Readings to Accompany Getting Agriculture Moving: Essentials for Development Modernization*. Vol. II Ed. Raymond E. Borton. The Agricultural Development Council Inc. 630. Fifth Avenue, New York. N. Y. 10020.

Sri Lanka Southern Development Authority. (2010); *Jathika Sawiya Gama Neguma* Development Programme -2010, Hambantota District – Progress as at 2010.12.31.

Sri Lanka Council for Agricultural Research Policy (SLCARP). (2011); *National Priorities in Socio-Economic Research in Agriculture:* 2012-2016. National Committee on Socio-economics and Policy Analysis. SLCARP, Sri Lanka.

Sunday Observer. (2010.09.12); Gamaneguma to Boost Rural Economy.

Sunday Observer. (2011.02.13); Gamaneguma is for Inclusive Development.

World Development Report (2006); Equity and Development (2005) ed. Francisco H. G. Ferreira, Michael Walton. World Bank and Oxford University Press.

Appendix I: Jathika Sawiya Gama Neguma Development Programme - 2010 - Hambantota District - Progress as at 2010.12.31

Programme	Sub Programme	Physical Target (No. or km)	No. of Beneficiaries	Estimated Cost (Rs.mn)	Allocation (Rs.mn)	Community Contribution (Rs.mn)	No. completed (No. or km)		
1. Spiritual Development	Community Health & Attitudinal Development	31	3075	987734.10	823111.75	164.622.35	30	0	1
	Sub Total	**31**	**3075**	**987734.10**	**823111.75**	**164.622.36**	**30**	**0**	**1**
2. Economic & Livelihood Development	Revolving Credit	3	162	246185.46	205154.55	41030.91	3	0	0
	Heavy Vehicle Driving	4	21		135150.00		0	0	4
	Cultivation of Red Lady	3		215736.00	179780.00	35956.00	0	2	1
	Pepper processing Centre	2	168		1222500.00		1	0	1
	Dairy Cattle Project	2		300000.00	300000.00	60000.00	0	0	2
	Tea Rehabilitation	2		216300.00	340009.00	36050.00	0	0	2
	Green village Programme	1	100	600000.00	500000.00	100000.00	1	0	0
	Cinnamon Rehabilitation	2		258120.00	247100.00	43020.00	0	0	2
	Sub Total	**19**	**451**	**1836341.46**	**3129693.55**	**316056.91**	**5**	**2**	**12**
3. Infrastructure Development	Agricultural Roads	37	7921	18746069.51	17161110.78	3177275.71	12	0	25
	Housing	15			610000.00		1	11	5
	Sanitary Facilities	9	300	662812.00	554010.00	108802.00	2	1	6
	Common Services (Libraries, Community Holes, Sports)	13	2125		2843791.44		0	0	13
	Culvets, Bridges, Channels &Anicuts	32	4904	12685340.29	11512319.06	2168871.82	5	1	26
	Lift Irrigation/Water Supply	8	230	3057152.90	2995555.92	515647.95	1	0	7
	Electricity Supply	3	1120		84230.00		0	1	2
	Other	6	175	529577.97	390581.40	207000.00	2	0	4
	Sub Total	**123**	**16775**	**35680952.67**	**36151598.6**	**6177597.48**	**23**	**14**	**88**

Source: Southern Development Authority, 2012

Appendix 2: Access Time to Markets by Prominent Mode of Travelling and Villages (in minutes)

Village	Walking Time to Preschool	Walking Time to Primary School	FC Time to Secondary School	MC Time to Hospital	2WT Time to Fertilizer Market	2WT Time to Seed Market	MC Time to Pesticide Market	2WT Time to Selling Paddy	2WT Time to Selling OFC	MC Time to Bank	MC Time to DS Office	Total Access Time
Hedawinna	30	30	12	17	40	40	7	40	40	17	17	297
Hathporuwa	40	40	30	20	45	15	5	15	15	20	20	270
Gotabayapura	30	50	30	15	25	20	10	20	20	10	10	250
Rubberwatta	30	40	40	5	60	20	4	20	20	4	4	251
Gotaimbaragama	20	20	10	25	60	60	25	60	60	25	45	435
Jandura	20	20	5	10	40	40	10	40	40	10	10	255

Note: FC: Foot Cycle, MC: Motor Cycle, 2WT: Two Wheel Tractor

Source: HARTI Survey Data, 2012

Appendix 3: Educational Level of Household Heads by Villages

Level of Education	VAI						Total
	7.5	9.0	9.8	15.8	16.4	29.3	
Can Read and Write	-	5	-	6	-	4	3
Grade 1-5	5	10	38	22	14	31	20
Grade 6 up to O/L	76	65	52	72	79	61	66
O/L + Tec. Trained	-	5	10	-	-	-	3
A/L	14	10	-	-	7	4	6
A/L + Tech. Trained	-	5	-	-	-	-	1
Basic Degree	5	-	-	-	-	-	1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Survey Data, 2012

EFFECTS OF RURAL ROAD DEVELOPMENT ON HOUSEHOLD AGRICULTURAL INCOME AND FARMING SYSTEMS IN HAMBANTOTA DISTRICT

RENUKA WEERAKKODY
SHARMINI K. KUMARA
S. EPASINGHE

Hector Kobbekaduwa Agrarian Research and Training Institute,
PO Box 1522,
Colombo,
Sri Lanka.
Tel. +94 11 2 6969 81
+94 11 2 6964 37
Fax. +94 11 2 6924 23
e-mail library@harti.lk
Web www.harti.gov.lk

PRICE : LKR 300/-

Department of Government Printing

National Digitization Project

National Science Foundation

Institute : National Science Foundation

1. Place of Scanning : Sanje (Private) Ltd, Hokandara
2. Date Scanned : 02/06/2017
3. Name of Digitizing Company : Sanje (Private) Ltd, No 435/16, Kottawa Rd, Hokandara North, Arangala, Hokandara
4. Scanning Officer

Name : Angelo Melvin Luwis

Signature : A. M. Luwis

Certification of Scanning

I hereby certify that the scanning of this document was carried out under my supervision, according to the norms and standards of digital scanning accurately, also keeping with the originality of the original document to be accepted in a court of law.

Certifying Officer

Designation : Information Officer

Name : Renuka Sugathadasa

Signature : R. P. Sugathadasa

Date : 02/06/2017

"This document/publication was digitized under National Digitization Project of the National Science Foundation, Sri Lanka"