The Consequences of Irrigation Inequality on Livelihood Erraticism among Rural Households in the Dry Zone of Sri Lanka

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Introduction

Irrigation is most important strategic factor in the development in the rural sector since it is playing a central role in income generation process in the dry-zone of Sri Lanka (Bhattarai, Sakthivadival, & Hussain, 2006).Water is becoming a scare resource in Sri Lanka as all other parts of the world due to increased use for irrigation, industry and domestic purposes (Henegedara, 2002). It is quite unlikely that the present irrigated area can be expanded in Sri Lanka, because water resources development is prohibitively expensive (International Water Management Institute, 2002). Hence, an economically efficient way of water utilization must be found for irrigation. Farmers in Sri Lanka generally enjoy free-of-charge irrigation facilities that are often provided by the government, although the law provides for collecting operational and maintenance charges (Hemaratne, Abeygunawardena, & Thilakarathna, 1996). In Sri Lanka, the free nature of irrigation water has created inefficient usage and demand for water is over and above the optimum requirements at zero prices (Bhattarai *et al*., 2002). When irrigation water is free, farmers use water until the marginal productivity of water is driven to zero (Seagraves & Easter, 1983). The inevitable consequences of this situation are wasteful utilization of existing irrigation facilities and damage to equity and equality objectives of irrigation water in large-scale irrigation schemes.

Problem Statement

Currently, irrigation inequalities are a common problem in irrigation management policies. These inequalities have been defined in several ways. There are two basic ways of experiencing inequality: one is in accessing the resource and another is in its use (Silva & Vidanapathirana, 1984). With respect to access, people upstream (head-end) have better access compared to those downstream (tail-end); with respect to use, farmers in high-water risk

areas receive a smaller quantity of water compared those to farmers in low-water risk areas (Chokkakula, 2009; Bhattarai *et al*., 2006). In both cases, further probing of the conditions that underpin or drive the differential experienced by people suggests that inequities and inequalities mutually construct and perpetuate each other: unequal access to resources generates inequity, and inequitable distribution of resource leads to inequality (Chokkakula, 2009; Nanayakkara, 2009). The ultimate outcome of these inequalities creates the dynamic of economic and social differentiation among local communities. However in Sri Lanka the available literature does not provide empirical evidence with regard to the consequences of irrigation inequality on livelihood variability of rural households in the dry-zone of Sri Lanka. This paper examines the impact of irrigation inequality on livelihood variability of small-scale rice growers in the dry zone of Sri Lanka.

Objectives of the Study

The general objective of this study is to examine the consequences of irrigation inequality on the dynamics of livelihood variability among small scale rice growers under major irrigation condition in the dry zone of Sri Lanka.

Methodology

Study Location

The *Huruluwawa* irrigation scheme was randomly selected for the study based on list of major irrigation schemes in Anuradhapura District. Since majority of major and minor irrigation schemes are located in Anuradhapura District, the study deliberately selected the Anuradhapura District form the dry-zone region. There are 4,261 farmer households cultivating paddy under this scheme (Department of Irrigation, 2012). In the wet season (*Maha Season*) around 10,400 acres of irrigable land was cultivated. However, during the dry season (*Yala Season*) cultivated irrigable land was reduced up to 4,272 acres due to shortage of water (Department of Irrigation, 2012). Under this scheme each farmer was given 1.2 ha of irrigable extent and 0.4 ha of high land when they have settled in the project. The distribution network consists of 39 km of main canals, 56 km of distributory canals and 183km of field canals (Department of Irrigation, 2012).

Analytical Tools

The livelihood variability of upstream and downstream households was mainly determined based on income inequality, asset accumulation inequality and their poverty level. The Gini Decomposition Index (GDI) has been used for income and asset inequality measurements since it is uniquely suited to studies most concerned with changing middle income categories of a population over time (Allison, 1978; Anand, 1983; Atkinson, 1970). In Sri Lankan, the most commonly applied poverty measurements by far are the headcount ratio and poverty gap index. Sen's poverty index is a combination of the Gini index, headcount ratio and poverty gap index, but previous literature has used it infrequently. This current study applied three measures for poverty measurement: (1) headcount ratio, (2) poverty gap index, and (3) Sen's poverty index.

Key Findings

Income Analysis

According to income analysis, annual per capita net income in upstream farmers was 28 percent greater than that of the downstream farmers and such disparity has produced greater variation of farm income between two groups. According to empirical results, both groups received more than 60 percent of their annual income from farming activities. While upstream farmers earning capacity from farming were 25 percent lower than the downstream farmers.

Gini – Income Inequality Indices

Table 1: Gini -Inequality Indices for Sampled Households among Upstream and Downstream Farmers

Model	Paddy	OFC	Perennial	Livestock	Total-Farm	Employment	Business	Total-Non-farm	Total
Head	0.279 (0.020)	0.696 (0.025)	0.587 (0.037)	0.969 (0.000)	0.283 (0.017)	0.624 (0.024)	0.964 (0.018)	0.613 (0.027)	0.501 (0.014)
Tail	0.370 (0.017)	0.690 (0.034)	0.438 (0.022)	0.980 (0.00)	0.412 (0.028)	0.502 (0.027)	0.908 (0.024)	0.433 (0.026)	0.468 (0.019)
Pooled sample	0.658 (0.014)	0.698 (0.021)	0.530 (0.029)	0.976 (0.000)	0.656 (0.015)	0.572 (0.019)	0.945 (0.015)	0.538 (0.018)	0.512 (0.011)

Note: Based on net income Rs/HH/Year, Figures in the parentheses representing standard errors.

The per capita net income inequality indices of selected farmer households under two groups are presented in Table 1 above. The results show that income inequality indices in both models were high for numerous income sources. The main variable in this study, which is the net earnings from paddy, had the lowest Gini value (within the group) for the two groups. However, between the two groups the Gini value for paddy income was 0.658 reflected greater divergence of income from paddy farming among upstream verses downstream farmers. Further, income disparity between the groups was substantially high as measured Gini indices value was greater than 0.5 for entire income sources.

Decomposition of Income Inequality

Table 2: Overall Income Inequality by Income Sources -Pooled Sample.

Income Source	Coefficient of Concentration	Income Share	Relative Contribution	Absolute Contribution
Paddy	0.372	0.306	0.223	0.114
Other Field	0.698	0.206	0.281	0.144
Crops	0.571	0.055	0.061	0.031
Perennial	0.983	0.066	0.012	0.006
crops	0.466	0.384	0.349	0.179
Livestock	0.926	0.041	0.074	0.038
Employment				
Business				
Total	**-**	**1.000**	**1.000**	**0.512**

Overall Income Inequality by Sources–Pooled Sample

Table 2examined overall income inequality by income sources among head-enders and tail-enders. Farm and non-farm paid employment contributed 38.4 percent of the total income and accounted for 34.9 percent of the income

inequality between head-end and tail-end farmers. Paddy and other field crops jointly contributed 51.2 percent of the total income and accounted for 50.4 percent of total inequality among pooled sample. Besides, perennial crops and livestock together contributed to 12.1 percent to the total income and accounted for 7.3 percent of the total income inequality between head-end and tail-end farmers.

Poverty Measurements

Headcount Ratio

The selected poverty measurements are presented in Table 3. In the Sri Lankan context, the most commonly applied poverty measurement tool by far is the headcount index. Even though the country's overall poverty indices have declined during last three decades, the results from research sites on poverty indices show that the poverty level among rural irrigated farmers is still at a considerably high level. The situation was worst among tail-end farmers. Among the tail-end farmers, 17.1 percent households were still below the official poverty line. However, head-end farmers had better well-being compared to both the national level and sector level because they had only a 6.2 HCI.

Table 3: Poverty Measurements

Model	Head Count Index (%)	Poverty gap Index (%)	Sen's Poverty Index
Head-end[1]	6.2	1.5	0.017
Tail-end[1]	17.1	6.2	0.077
National Level[2]	8.9	1.7	0.019
Rural Sector[2]	9.4	1.8	0.020
North-central Province[2]	5.7	1	0.021

Note: 1 denotes author's computation based on field Survey in 2012, and 2 denote Department of Census and Statistics(DCS) measurement based on Household Income and Expenditure Survey 2009/2010. Author used the value of Official Poverty Line (OPL) in Anuradapura District (2013 March) which

was Rs. 3,585 real total expenditure per person per month as poverty line. The value of OPL in 2010 was Rs.3, 028 real total expenditure per person per month has used by DCS as poverty line.

Poverty Gap Index

The Poverty Gap Index (PGI) measures the extent to which individuals on average fall below the poverty line and is expressed as a percentage of the poverty line (Cowell, 1977). Further, it measures the intensity or depth of poverty: how poor the poor are (Anand, 1983). According to the survey results as shown in Table 3 above, in tail end farmers the PGI indices were greater than those of the national and regional level. Compared to national and regional estimates, the depth of poverty among tail-end farmers was much higher.

Conclusion

The study found that irrigation inequality among upstream and downstream farmers significantly impacted the divergence of livelihood implication among the two groups. Further the empirical data showed that the divergence of irrigation accessibility leads to poverty variation between upstream and downstream farmers among major irrigation schemes in the dry zone. As the study hypothesized, the annual net income significantly varied between upstream and downstream farmer households. The estimate Gini coefficient for total income inequality for the pooled sample was 0.512 and was 42 percent above the national level. The present study found evidence that more than 50 percent of inter income inequalities among pooled sample was drawn from farm income and evidence that tail-end farmers were relatively poorer than head-end farmers. The poverty level of downstream households was almost double compared to that of national level. Compared to national and regional estimates, the intensity of depth of poverty among downstream households were much higher. On average head end poor person was short by Rs.883 per month compared to the national poverty line. However, the tail-end poor are the poorest among the selected sample and to eliminate poverty, actions need to be taken to raise their per capita net income by Rs. 1,507 per month. Finally, the study found that, as the study hypothesized, there are significant interactions among rural poverty, irrigation accessibility and livelihood implication of settler farming community in the dry zone of Sri Lanka. Based on above discussion, it can be reasonably

concluded that equal irrigation accessibility plays a vital, desirable role in eradication of rural poverty as well as income inequality among farmer households in the dry zone of Sri Lanka.

Key Words: Income Disparity; Irrigation Inequality; Poverty Livelihood Variability.

References

Allison, P. (1978). Measures of Inequality. *American Sociological Review, 43*(6), 865-880.

Anand, S. (1983). *Inequality and Poverty in Malysia: Mesurement and Decomposition.* New York: Oxford University Press.

Atkinson, A. (1970). On the Mesurement of Income Inequality. *Journal of Economic Theory, 2*, 244-263.

Bhattarai, M., Sakthivadival, & Hussain, I. (2006). *Irrigation Impact on Income Inequalities and Poversty.* Colombo: International Water Management Institute (IWMI).

Bhattarai, M., Sakthivadivel, R., & Hussain, I. (2002). *Irrigation Impact on incme Inequality and Poverty Alleviation: Plicy issues and ptions for improved management of Irrigation Systems.* Colmbo,Sri Lanka: International Water Management Institute.

Chokkakula, S. (2009). *Interrogating Irrigation Inequalities: canal Irrigation Systems In Injil District, Herat.* Afghanistan research and Evaluation Unit - Case Study Series.

Cowell, F. (1977). *Measuring Inequality.* Philip Allen: Oxford University Press.

Department of Irrigation. (2012). *Baseline Statistics.* Colombo: Planning Devision, Department of Irrigation.

Hemaratne, P., Abeygunawardena, P., & Thilakarathna, M. (1996). *Income Inequalities and Diffrent Level of Water Availability in Irrigation Schemes:The Case f Minipe.* Bombuwela: Agricultural Economic Unit, Regional Agricultural Research centre.

Henegedara, G. (2002). Agricultural Policy Reform in the Paddy Setor in Sri Lanka: An Overview. *Sri Lanka Journal of Agriculture, 10*(1), 1-25.

International Water Management Institute. (2002). *Irrigtion Sector in Sri Lanka:Recent Investment Trands and the Development Path Ahead.* Colombo: International Water Management Institure (IWMI).

Nanayakkara, V. (2009). Sri Lanka's Water Poicy: Themes and Issues. *National Conference on Water,Food Security and Climate Change in Sri Lanka.03*, pp. 113-125. Colombo: International Water management Institute (IWMI).

Seagraves, J., & Easter, K. (1983). Pricing Irrigation Water in developing Countries. *Water Resources Bulletin, 19(4)*, 663-672.

Silva, M., & Vidanapathirana, A. (1984). Major Irrigation and Settlement Schemes in Sri Lanka: Some policy Issues in Operator and maintenance , Sri Lanka. *Journal of Agrarian Studies, 5*(2), 1-11.