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PREFACE

We are happy to launch the *Nepalese Journal of Agricultural Economics* (NJAE) with development as the dominant theme and incorporating issues such as agricultural growth, marketing, food security, and agricultural inputs on which authors from diverse backgrounds and experience contribute.

Almost by definition, the development of agricultural economics in Nepal incorporates the agricultural system in the Himalayan region, symbolized in this journal's cover page by the pictures of Mt. Everest and Nepali Yak. In that sense, the journal accords a high priority to high altitude agriculture and its interactions with the neighboring economies.

NJAE thus intends to serve as a common academic and research forum of thinkers in agriculture, forestry, fisheries, and allied economic activities in industry and trade from the point view of economics, rural sociology, environmental science, resource conservation, institutions, and inter-disciplinary synthesis, as a process of research-policy dialogue to expedite the modernization of agriculture and agrarian transformation by bringing together experiences and feedbacks from our fellow professional colleagues and other contributors.

My sincere appreciation goes to the Chief Editor, Mr. Y.B. Thapa, and Director for Publication, Information and Public Relations, Mr. Rudra Bahadur Shrestha as also to Dr. Kamal Raj Paudyal, Dr. Bishwa Bandhu Raj Singh, Dr. Devendra Gauchan, Dr. Ganesh Raj Joshi for putting their efforts to bring out the journal, and Mr. Anand Aditya for his editorial inputs. I thank the authors, members in the anonymous review panel, institutions and others whose help was essential in bringing out the journal papers in the present form.

We look forward to comments and suggestions from colleagues and fellow professionals.

Dr. Pushpa R. Mathema
President

September 11, 2011

EDITOR'S NOTE

The papers in this inaugural issue of the *Nepalese Journal of Agricultural Economics* (NJAE) which incorporates themes as diverse as agricultural resources, growth, investment, marketing of products and inputs, food security, and entitlements, need to be seen in the context of a widely held view that Nepal needs an output growth rate for agriculture, forestry, and fishery of about five percent to increase the people's per capita food consumption to support the manufacturing industries, contribute in net exports to foreign countries, and generate saving required for further growth. Such a plan also requires a host of supporting policies and programs over time.

The first paper takes up the determinants of agricultural growth by products over space and the measures to rectify the program orientation on roads, irrigation, agricultural credit, women literacy, and use of fertilizers. The positive impact of population growth rates, male literacy, improved seeds, and insecticides to increase agri-GDP growth rates shows room for improvement, and suggests the need to rectify the Agricultural Perspective Plan strategy on the priority outputs/ inputs to create an aggregate impact on food security, agro-industry, and trade.

The contribution on plant genetic diversity highlights the need to crease incentives among the farmers to grow superior aromatic landraces by introducing a flexible incentive system in Terai to maintain landraces on farm, and by raising awareness about the importance of landraces through improvement of the existing extension and research networks.

The paper on landownership issues concludes that, with an improvement on land policies and access of the poor to land resources, agriculture can be modernized to increase employment, reduce poverty, and ensure food security.

The fourth paper on groundwater markets suggests that the consolidation of farm size can encourage farmers to establish shallow tubewells which would reduce water demand from purchasers, lower water prices, and increase efficiency in the use of groundwater.

Yet another contribution is on public investment in rice research that shows substantial underinvestment in commodity and regions and recommends research funding in rice and agriculture research.

The next write-up on rice marketing practices and constraints is about the improvement in the efficiency of marketing system that could be obtained by pursuing the policies to facilitate the entry of more traders in the markets, improvements in marketing infrastructures, and reliable rapid dissemination of marketing information.

Integration of regional rice markets in Nepal and northern India is another theme which shows that the farmers' shares are lower than what we would expect the producers to receive in a perfectly competitive market. The major regional rice markets are weakly integrated across Nepal, but these are strongly integrated with the adjoining markets in India.

DAP and Urea fertilizer prices is another theme that takes up the issue of larger integration of fertilizer prices in Nepal with the world fertilizer prices and with the Indian fertilizer prices.

It points to the urgent need for market integration across the geographical and their wrapper integrators heterogeneity through physical infrastructure and market regulations, and questions the rationale for budgetary subsidy on fertilizer fertilizers.

Poverty–environment nexus is another theme for analysis that says a joint implementation of the poverty-environment strategies may be cost-effective for some environmental problems, but an independent implementation may be preferable in other cases.

The last contribution dwells on organic certification of coffees which reveals that group organic certification plays a positive role in smallholders' livelihoods and that participation in group organic certification increases farmers' welfare through increased income.

Among the book reviews included in this volume, the first one on liberalization of food grains markets in South Asia suggests two broad types of policy changes: on the domestic front, the primary role of government should be to invest in infrastructure that would promote agricultural production and deepen agriculture markets, moving away from subsidizing inputs and toward subsidizing general-purpose public goods such as agricultural research and extension services. Second, on the regional front, it recommends policy coordination among the countries in South Asia in view of the rising intra-regional trade in rice and wheat there. An effective food policy measure may have great potential for decreasing poverty and in enhancing growth in the South Asian region.

The review on rice in the global economy lays out a rich menu of the technological and institutional options for sustainably improving the rice systems and enhancing overall performance of the global rice economy.

The review on the theme of the Nepali Yak raises a number of interesting questions related to the economics of livestock in the high altitude agriculture and livelihood systems and suggests that, as incomes grow and people get better educated about human nutrition, the demands for livestock products such as meat and milk would grow faster.

By communicating on the issues of agro-economic relevance and through recommendations of professionals working in government agencies, private firms, and non-profit-making institutions across the countries, the journal hopes to generate knowledge to transform the nation's agrarian economy. The journal also lists some important areas that the forthcoming issues would address. We welcome and look forward to appraisals and support in our endeavor.

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Agricultural Growth: Lessons for Redesigning Principles

Y. B. Thapa[1]

Abstract

This study examines how to increase the agricultural growth rate (about three percent annually in the past), and make food production growth rates positive on a per capita basis, and looks at the agricultural growth patterns for six sub-sectors by district and the contributing factors. The weighted least square regression indicates the need to rectify mistakes in orientation on roads, irrigation, agricultural credit, women literacy, and use of fertilizers. The positive impact of population growth rates, male literacy, improved seeds, and insecticides to increase agri-GDP growth rates shows room for improvement and suggests correcting the Agricultural Perspective Plan strategy about the priority outputs/inputs for creating an aggregate impact on food security, agro-industry, and trade. These findings may be helpful to the new initiatives on agriculture development strategy and the nutrition security programs.

JEL Classification: O13, O33, Q18

Key Words: Agricultural and natural resources and primary products; Technological change, choices, and consequences; Agricultural policy and food policy

1. Introduction

The national income accounting in Nepal defines agriculture as including agriculture, forestry, and fishery. The growth of agri-GDP is very important for Nepal's development since a large proportion of the population is dependent on agriculture and a large part of non-agri GDP and trade is based on agriculture. Probably keeping this in view, the government launched the Agricultural Perspective Plan (APP) covering 20 years (1997/98 - 2016/17), which has been implemented under four periodic plans.[2]

The APP's target was to increase agricultural growth rates from the past (1964/65-94/95) trend of 3.97% or no-APP case of about 3.26% to 4.75 % annually (ref Figure 1). The APP showed a slight commodity bias in agricultural planning putting a higher emphasis on the high value agricultural commodities (HVAC) and less on staple foods (ref Table 1). APP thus slightly downplayed the importance of self-sufficiency in food grains which may be a questionable strategy. The APP growth accounting framework (GAF) estimated that of the total

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[2] These plans include the Ninth Five Year Plan (1997/98 - 2001/02), Tenth Five Year Plan (2002/03 - 2007/08), Three Year Interim Plan (2008/09 - 2010/11), and Three Year Plan (2011/12-14/15).

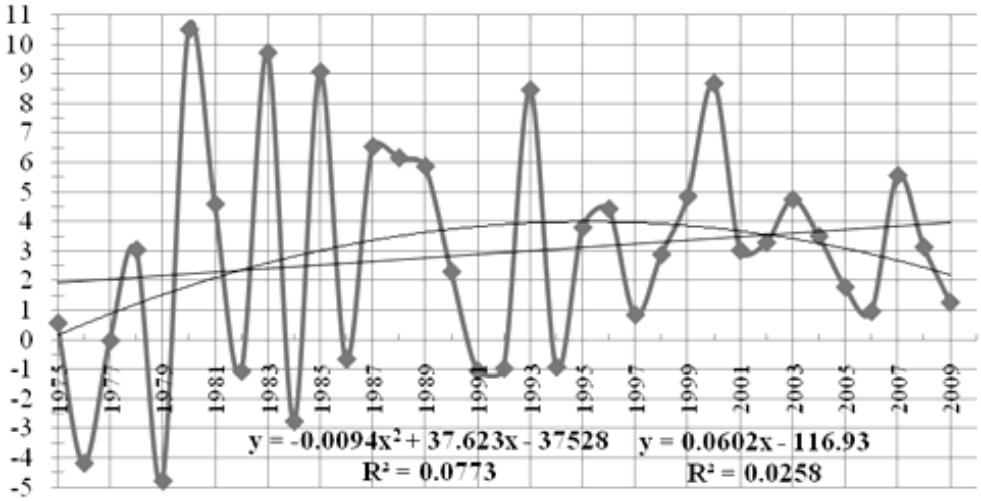
agri-GDP, crops would contribute 50% and the rest would come from livestock, forestry, and fishery. APP tried to increase agri-GDP with contributions from inputs to the extent of 57.6%, namely fertilizers 38.2%, variety 3.4%, and irrigation 16.01% (surface water 7.86%, groundwater 11.56%, and others 3.39%). Thus, the APP mainly targeted HVAC growth through seed-water-fertilizer technologies and trade for food security.

Table 1: APP Targets for Growth Rates, 1995/96- 2014/15 (% Annually)

Product	Crops	Fruits	Vegetable	Meat	Milk	Poultry	Forest	Fisheries	Nepal
%/ year	4.49	5.70	4.99	6.41	6.24	7.47	2.15	7.47	4.75

Notes: APP's growth targets are: Horticulture 5.29%/ year, and Livestock 5.32 %/year.
Source: APROSC/ JMA (June 1995).

Figure 1: Agri Growth in Nepal by Years (%/Year; 1994 Prices)



The directions of agricultural growth rates in Figure 1 during 1965-2009 are shown by the smooth linear or quadratic trends. The flat linear equation implies that these agricultural growth rates do not show any sign of secular increase/ decrease over the years. However, the quadratic equation indicates that the growth rates have tended to fall in recent years. Realizing the lackluster performance, the Three Year Plan (2011/12-14/15) has scaled back the agricultural growth target at 3.94% annually although it should have increased the target to make up the backlog of preceding plans.

In the context of slowdown in agriculture, it is essential to revisit the results and expectations about agricultural performance, and derive some lessons to correct past mistakes for the post-APP period. Accordingly, this study aims to address the agricultural growth rates-related concerns by looking at various sub-sectors at the district level. The district-level analysis is important because the *Local Self-Governance Act 1999* and the devolution plans put

agriculture development institutions under district supervision. More so in a federal country, the state/ local governments would be responsible for the progress in agriculture.

The factors affecting agricultural growth patterns by district would help in understanding the growth impediments, and accordingly in setting policies so that we can accelerate agricultural growth at the local, sub-national, and national levels. The study has thus three specific objectives: (1) examine agricultural growth patterns by major commodity groups by district; (2) examine how the major factors have contributed to agricultural growth; and (3) suggest policies for redesigning agricultural planning.

Various researchers have focused on a number of variables in examining agricultural growth. Malthus emphasized labor force growth. Schultz (1964), Stevens and Waele (2003), and Dass and Bhattacharya (nd) emphasize human capital for development of agriculture, and for its transformation to manufacturing and services, respectively. Schumpeter (1912) and World Bank (1989) consider financing a very important part of agri-growth. Yoshino and Nakahigashi (2000) stress the role of capital accumulation in public infrastructure for the growth of manufacturing and agriculture. USDA (nd) and Per Pinstru Anderson (2006) stress the role of research and technology in agriculture. The paper here aims to test the importance of all these determinants of agricultural growth.

The study uses econometric estimation. The major determinants for agricultural growth we examine here are infrastructure, capital (human and financial), labor supply, and technology-related variables. The findings suggest that the most important contributors to the rate of agricultural growth rates are population growth rates, male literacy, improved seeds, and medicine. The contributions of female literacy, road density, irrigation coverage, agricultural credit, and mineral fertilizers looked significant.

The study rejects the view on inclusiveness in agricultural growth rates and uniform contribution of various factors to agri-GDP growth rates in Nepalese agriculture under APP. Some of the adverse results may improve if their contribution to agricultural growth rates is applied at more disaggregated levels by sub-sector or even commodity. Their detailed analysis, however, is outside the scope of the present study.

The rest of the paper is organized as follows. Section 2 is a brief recapitulation of factors contributing to economic/ agricultural growth. Section 3 is about the nature of data, its measurements, and limitations. Section 4 is on models and results, which is about the growth trends and growth production functions. This is followed by Section 5 on conclusions and recommendations.

2. Data

The data used in the paper are a mix of time series and cross-section. The annual average agricultural growth rate is computed using continuous time series data by year from 1997 to 2009 from the Ministry of Agriculture and Co-operatives (MOAC). We have analyzed data in physical quantity terms, e.g., metric ton figures (inflation controlled physical volumes).

Agricultural commodities are grouped here by major six-subsectors: cereal grains, pulses and oilseeds, industrial crops, horticulture, tea, livestock products, fishery, and aggregate agri-GDP by district. We use two dependant variables, namely, annual average rates of growth of agri-GDP and cereal grains in regression analysis. Here, the cereal grains stand for paddy, maize, millet, and barley; industrial crops cover sugarcane, tobacco, and jute; horticultural products cover potato, vegetables, and fruits; and livestock products imply milk, meat, and eggs.

The paper uses several variables as determinants of agricultural growth. As outlined in the section above, it tests the role of labor force, human capital, rural infrastructure, and finance and agriculture technology (water, seed, insecticides, and mineral fertilizers).

The variable labor force was measured using compound population growth rate during 1991-2001 as a proxy for the magnitude of value-addition in agriculture and demand for survival. For human capital, here we used literacy rate by gender for the population of six years of age and above for the year 2001 as a proxy for the educational status of farm decision makers/ labor to assess information and its applications. We also controlled for gender disaggregation by applying male and female literacy rates separately. We used rural infrastructure by using two variables: (1) Road density which is defined as road length (km) per 100 square-kilometers for the year 2006 and irrigation coverage defined as a percentage of cultivated area in a year 2009/10. For finance, we included the agricultural credit as a percent of household with access in the year 2001. Since agricultural technology has a very important role to play in agri-growth, we measured it using three indicators on paddy for the year 2001: (1) percent of households using the improved seeds of paddy; (2) percent of households using insecticides in paddy; and (3) mineral fertilizers applied in paddy in terms of kilograms per hectare of applied area for the year 2001.

The road density data were derived from the Department of Roads, irrigation data from the Department of Irrigation and population size and literacy rates from *Population Census 2001*. Likewise, information on agricultural credit, improved seeds, insecticides, and mineral fertilizers was availed from the *National Sample Census of Agriculture 2001/02*.

3. Estimating Equation and Results

For products Y_i, period X by years, and district d, the growth rates are estimated using ordinary least squares linear regression trend line to the logarithmic annual values as given below.

$$\text{Log } Y_{id} = a_{oid} + b_{id} * X_{id} + e_{id}; \quad \ldots\ldots\ldots (1)$$

where "Y" is the value of the variable, "*e*" is the error term, and "*a*" and "*b*" are coefficients. As in World Bank, the annual compound growth rate (CGR), G_{id}, is given by:

$$G_{id} = \{\text{anti log } (b_{id})-1\} * 100; \; i, 1\ldots6, \text{ products; } d = 1,\ldots,75 \text{ districts, } \ldots (2)$$

The present study analyzes the factors affecting the agri-GDP growth rates by observing in the 75 districts at the aggregate levels and for cereal grains taken together. Thus, in the case of

the agri-GDP growth rates "g" by districts "d", this is a function of a number of factors "j" with weights "y" shown in the following equation:

$$\frac{g_{id}}{y_{id}} = a_{0id} + a_1 \frac{x_{id}^j}{y_{id}} + e_{id};\ \ i = 1,\ldots,6;\ d = 1,\ldots,75;\ \ j = 1,\ldots,8. \quad (3)$$

Note that in the above equation, the dependant variables of growth rates and indices of explanatory variables in districts are weighed by the size of the agri-GDP in the districts.[1] The weights "y" are agri-GDP growth-rates production function/ or sum of cereal grains for food grains growth-rate production function by districts. These weights are used to remedy for hetereoscedasticity-related problems.

The relative contributions of individual explanatory variables in variations in agricultural growth rates in percent are measured by equation (4) below:

$$G_{expl} = \frac{a_i}{\sum|a_i|} * Adj\ R^2 * 100 \quad (4)$$

Where,

G_{expl}: agricultural growth rates explained in percentage terms,
a_i: Coefficients of individual explanatory variables (ref Eq 3 above),
$\sum |a_i|$:Sum of absolute sizes of a_i, and
Adj R^2 is the adjusted value of coefficient of determinants.

Section 3.2, Table 3 provides results of Eq (3) & (4) in colums 2-3 and 4, respectively.

3.1 Results: Patterns of Agricultural Growth Rates

The growth rates of agri-GDP in total and for six-subsectors in districts during 1997/98-2009/10 are provided in Table 2 and Appendix 1. First, on the hypothesis about the fulfillment of APP targets during 1997/98-2009/10, the results show that agri-GDP growth rate has been 3.24 % annually, which is just around its long-term trend-value in the pre-APP phase. During the past 45 years, the agri-GDP growth rates for major periods were 1965/66-73/74: 2.33% annually; 1974/75-96/97: 4.72% annually; and 1997/98-2009/10: 4.63% annually[2] (ref Figure 1). Similarly, the quadratic trend shows that the agricultural growth rates started to fall soon after the APP was launched.

Table 2: Compound Growth of Agriculture by Commodities 1997/98-2009/10

Products	Cereal grains	Pulses & oilseeds	Technical crops	Fruits & Veg	Tea	Live-stock	Fish	Total Crops	Nepal
% / year	1.71	1.72	2.63	6.85	12.49	2.99	6.73	3.37	3.34

Note: Based on district-wise analysis; refer to Appendix-1 for agri-growth by districts.

Second, on the agricultural growth accounting by commodity-wise contribution, the APP's priority products such as horticulture, tea, and fishery show impressive growth rates of 6.85%,

[1] A description of weighted least-squares could be found in Gujarati's "*Econometrics*" and elsewhere.
[2] Agri-GDP growth rate during 1997/98-2009/10 from district-wise analysis is lower at 3.34 due to exclusion of products like forestry.

12.49%, and 6.73% annually, respectively. But the share of such commodities in total agri-GDP is barely 10% of the total, which is not a very significant amount.

Third, agricultural growth accounting has to be done among the more extensively produced food grains such as cereals, pulses, and oilseeds. APP had downplayed cereal grains, pulses, and oilseeds; their growth rates have remained low at 1.71% and 1.72% annually respectively. Thus, the food grain production growth rates are lower than the population growth rate in the country. The APP plan to rely on the import trade for staples for ensuring food security has not worked. The agricultural development plans need to emphasize the concept of "Grow your own foods" approach for the country, regions, and districts.

Fourth, it is worrisome that there has been decline in agricultural production in a significant number of sub-sectors and districts as follows.

i. Cereal grain production growth rates have been declining in 15 out of 75 districts (Panchathar, Terhathum, Bhojpur, Saptari, Siraha, Sindhuli, Kathmandu, Mahottari, Chitwan, Mustang, Rolpa, Bajura, Achham, Baitadi, and Dadeldhura),
ii. Pulses and oil seed production growth rates are declining in 18 out of the 75 districts.,
iii. Industrial crop production growth rates declined in 17 out of the 38 districts where these are grown,
iv. Horticulture production growth rates are declining in Mustang,
v. Livestock production growth rates are declining in 10 out of the 75 districts (Taplejung, Kathmandu, Mustang, Lamjung, Gulmi, Arghakhanchi, Dolpa, Rolpa, Darchula, and Baitadi), and
vi. Fish output growth rates are declining in 9 out of 47 reporting-districts (Sankhuwsabha, Panchathar, Illam, Kavre, Lalitpur, Kaski, Parbat, Gulmi, and Arghakhanchi).

Thus, the decline in agricultural growth rates to negative ranges may be considered as an evidence of institutional failure at the central, district, and community levels. Irrespective of the spirit of LSGA 1999, the decline in agricultural growth rates in districts reflects an inability to manage the market opportunities, factors of production, adaptation to climates changes such as rainfall, snowfalls, temperature, photoperiods, shifting seasonal patterns, etc.

Finally, the aggregate agricultural growth rates are positive for the total crop sector and total agriculture with a rate of 3.37% and 3.34% annually respectively. As the country has about three million farm households, some farmers would benefit from the above agricultural growth rates whereas other farmers would lose. This differential impact of agricultural performance is due to differences in the farmers' asset base, agricultural policy packages, and parameters of climate changes. The government and markets would be required to work out how to compensate the disadvantaged farmers, where such compensation is due to get all farmers on the board to a socially just agricultural progress.

As reported in the appendix, next we aim to describe what explains the agri-GDP growth rates among the districts with some explanatory variables. The result of weighted least-squares estimation is presented in Table 3. Since on the right hand side of the equation we have the agri-growth rates spanning 13 years (1997-2009) by district, we are looking for both time-series

and cross-sectional variations. However, on the explanatory variables side, as we have data for only one period, we would be looking at the cross-sectional variation only.

Table 3: Regression of Agri-GDP Growth Rates 1997/98-2009/10 on Explanatory Variables at Different Years in that Period

Explanatory Variable	Coefficient	Standards Error	Growth Rate Explained (%)
Constant	-0.0159	0.0129	
Population growth rate	0.4037	0.2044[c]	61.61
Male literacy rates	0.0560	0.0211[a]	8.55
Female literacy rate	-0.0724	0.0228[a]	11.05
Road density	0.0059	0.0142	0.90
Irrigated area	-0.0189	0.0073[b]	2.88
Agricultural credit use	0.0066	0.0177	1.01
Improved seeds use	0.0246	0.0074[a]	3.75
Insecticides use	0.0537	0.0082[a]	8.20
Mineral fertilizer use	-0.0036	0.0094	0.59
R^2	0.9871		98.53
Adj. R^2	0.9853		
F-value (n_1= 9, n_2=65)	552.94[a]		
Chi^2 (1)	0.13		
N	75		

Notes: (1) a = significant at 1% level, b = significant at 5% level, c = significant at 10% level.

(2) Each district includes one observation; population growth rate is percent per year during 1991-2001; male and female literacy rates are percent of male and female population 6 years and above for year 2001; road density is km/100 sq. km.; irrigated area is percent of cultivated area for year 2009/10, agricultural credit is percent of households having access to it for year 2001; improved seed use is percent of households using improved seeds for year 2001; insecticides use is percent of households using improved seeds for year 2001; and mineral fertilizer use is kg nitrogen, phosphorous and potash/ ha of applied-area in paddy for year 2001.

We discuss below the regression coefficients of explanatory variables individually, and as proportions of individual coefficients to the sums of all coefficients. First, the weighted population growth rates by districts during 1991-2001 have contributed significantly to the inter-district variations in agri-GDP growth rate with a coefficient of 0.4035. That is, if the population growth rates increase by one percent point in the districts, the agricultural growth rates there would increase by about 0.40 percent point. Based on the proportions to sum of all coefficients of the explanatory variables, the spatial variations in the population growth rates can explain 61.61% of similar spatial variations in annual agri-GDP growth rates between the districts. It probably signifies both the importance of labor force increase and demand for livelihood strategies (the Malthusian case). Conversely, if labor force in agriculture declines, agri-GDP, too, would decline.

On the human capital side, the weighted male literacy rate has significantly contributed to the variations in inter-district agricultural growth rates with a coefficient of 0.056 (i.e., 8.55 % of the sum of all coefficients). Generally, the coefficient of male literacy ought to have an even

larger contribution to agricultural growth rates because the literature shows that education has high rates of return to investment, and higher contribution to economic growth rates by improving the total factor productivity. Contrary to expectations, the spatial variations in weighted-female literacy rate significantly reduced inter-district variations in agricultural growth rates with a coefficient of negative 0.072 (i.e., -11.05% of the sum of all coefficients). Such result should be a serious issue in view of the present doctrinaire emphasis on 'educated women in agriculture'. Here, the literate female may have been averse to agricultural occupations or simply the rural women workforce may not have had access to education while the literate women may live in urban areas or rely on non-agricultural occupations (which bring higher rates of return).

The weighted density of roads by district does not appear to have correlation with the spatial variations in the agri-GDP growth rates. This finding calls into question the belief that road development leading to transport, trading, and markets would be important for agricultural growth. However, our line of thinking is that the road development activities may have not reached those places/ entrepreneurs that have higher potentials for agricultural growth.

A counter-intuitive result is that weighted-irrigation coverage variable by district has a significant coefficient of negative 0.0189 in relation to the spatial variations in the agri-GDP growth rates; it implies a 2.88% reduction in the agri-GDP growth rates annually. This adverse effect might be due to the re-allocation of irrigated lands to the non-agricultural purposes such as urban housing, roads, industry, and commerce; complementary inputs such as lack of fertilizers and quality seeds; disincentives in prices of inputs/ outputs; poor drainage conditions, the uncertainty about water in the canals and crop fields; vulnerability of irrigated field to floods and riverbank erosions; poor management of agencies and enterprises; or all of the above. Or the non-irrigated agriculture (such as the case of HVAC mentioned above) may have brought out more growth in agriculture. Perhaps, if the irrigation variables were not for the year 2009/10 toward the end of the study period (because of our desire to include the latest data sets) but for some early years, it could have made a difference there. In any case, our assumption is no-major spatial shifts in irrigation coverage during the study decade. Nevertheless, the negative coefficient is partly in line with the APP fears that the 'other' water resources activities would actually bring the agricultural growth rates down (noted in the introduction above). In a nutshell, there is a need to reorganize the irrigation-agriculture institutions and strategies for the use of existing resources more effectively than their mere physical expansion!

The coefficient of weighted-agricultural credit access for 2001 turned an insignificant regressor. The coefficients of weighted-improved seeds uses and of insecticides uses for 2001 have significantly contributed to the agricultural growth rates with their coefficients of 0.0246 and 0.0537 respectively. Thus, the spatial variations in these variables together explain 11.95 percent of spatial variations in agri-GDP growth rates. These coefficients emphasize the role of agricultural research and extension agencies to increase the agri-GDP growth rates. Further, these coefficients ought to be larger to boost up the agri-GDP growth rates because the APP thrust was on these factors. Recall that under green revolution, seeds and medicines have

increased the productivity of agriculture and contributed to the dynamics of agriculture and food security. The variations in application of weighted-mineral fertilizer for paddy production in kg per hectare (of the applied area) by district have unexpectedly turned insignificant in relation to the spatial variations in the agri-GDP growth rates. There may be questions about quality of fertilizers, lack of synergy with complementary inputs, problems in nutrient uptakes by crops. Hence, some opportunities do exist to manage the fertilizer sector for increasing agricultural growth rates.

In the foregoing discussion on regression results in Table 3, there might be some problem of multi-collinearity where it is difficult to segregate individual variable effects even if the model explains most of the spatial variations in the agricultural growth rates. The latent problem of multi-collinearity may not be very serious here because it has not impaired the test of significance of individual variables. With these cautions, the assessment on the individual factors as contributors to agricultural growth rates is upheld, and we suggest further investigation about the factors affecting agricultural growth rates both in terms of econometric tools and agricultural planning necessities from the communities, to districts, regions and, countries.

4. Conclusions and Recommendations

The present study has examined variations in agricultural growth rates (targets and achievements) across commodities for over a decade, and the dependence of the spatial variations in these agri-GDP growth rates on factors affecting all districts in the country. The major recommendations emanating from this study are grouped below as those relating to issues further investigations, and those related to the redesign of agricultural development policies and programs.

First, on the issue of further investigations, there will be opportunity to utilize the new data sets from the *Population Census 2011* and *National Sample Census of Agriculture 2011* for enhancing our understanding of the variations in agricultural growth rates in aggregate terms and by commodity groups at different levels of spatial aggregations. The analysis of agricultural growth accounting and factors affecting it needs to construct longitudinal panel datasets from the three census years for 1991, 2001, and 2011 by commodities at the inter-district level, and carry out their aggregation to higher levels by watershed/ climatic / or development regions. The indicative uses of information on agricultural technology (seeds, insecticides, and fertilizers) for paddy may be extended to other crops like maize, wheat, pulses, oilseeds etc. to explain the aggregate trends. Likewise, one may revise the irrigation variable from aggregate coverage to its crop-wise uses and efficacy. Thus, cases exist to revise the measurement of explanatory variables and create longitudinal panel data sets for understanding spatial and commodity-wise processes of agricultural growth rates in the country and at the sub-national levels.

Second, the agricultural growth rates by sub-sectors and commodities presented here can be the basis of planning for agricultural progress at the district/ local level, and the sum of local plans may result in plans at the watershed regions/agro-climatic belts and country levels. This requires a full devolution of agricultural and related supports one-more step forward from the LSGA 1999 to the local government. Such a devolution of institutions for agricultural planning and investments may provide a good basis for its accountability and monitoring to improve the performance of agriculture at the community level and upstream (refer to UN GA resolution mentioned above).

Third, the 'production function' approach to explain spatial variations in agri-GDP growth rates by district indicates that there is a need to rectify the lack of productivity in the expansion of roads, irrigation, agricultural credit, women literacy, and uses of fertilizers. We need to re-train the concerned agencies in these sectors for increasing their efficiency and impact on agricultural progress and its redistribution among stakeholders in the country. Meanwhile, the positive impact of population growth rates, male literacy, improved seeds, and insecticides to increase agri-GDP growth rates has room also for improvement in terms of farm productivity and subsequently agricultural growth rates. This is because of the fact that the agri-GDP growth rates continue to lag behind their targets and food security objectives such as the need for self-sufficiency in grains sectors (e.g., cereals, pulses, and oilseeds) at the national and sub-national levels.

There seems to be a mismatch in the APP strategy about the so-called priority outputs and priority inputs to bring about the aggregate impact in terms of food security, agro-industry, and international trade. This also needs to be corrected. The ongoing work of the Government with the Asian Development Bank on agriculture development strategy, that with UN FAO on food and nutrition security program, and the other related activities need to seriously take the above findings, issues, recommendations, and reasoning for improving agricultural performance in the ensuing decades.

Acknowledgement

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Appendix Table 1: Agricultural Growth Rates by Major Product Group and Distrct, 1997/98-2009/10

	District	Cereal Grain	Pulses & Oilseeds	Tech. Crops	Hotri-culture	Tea	Live-stocks	Fish	Total Crops	Total Agriculture
1	Taplejung	2.75	-0.85		5.24		-0.4		3.88	3.32
2	Sankhuava	2.79	4.4	-5.83	5.5		3.05	-0.81	3.86	3.76
3	Solukhumbu	8.89	2.86		11.27		2.58		10.75	10.01
4	Panchthar	-1.54	-0.86		5.2	9.61	4.49	-2.42	1.63	1.96
5	Illam	2.29	-4.22		5.43	6.37	1.48	-2.37	3.76	3.46
6	Terhathum	-1.08	6.26		9.18	11.66	4		3.57	3.64
7	Dhankuta	3.23	0.18	-3.75	8.1	33.13	5.66	1.25	5.29	5.31
8	Bhojpur	-0.83	-2.27		2.83		1.62	6.29	0.31	0.43
9	Khothang	3.33	7.35		17.22		0.69		9.16	8.06
10	Okhaldhunga	2.38	-1.01		8.74		0.37	4.7	4.94	4.24
11	Udayapur	3.85	6.66	-1.75	0.37		6.05	0.99	3.02	3.51
12	Jhapa	1.57	7.59	0.09	11.41	13.36	4.53	6.78	4.47	4.48
13	Morang	1.24	1.06	0.93	4.81		5.89	5.01	1.93	2.15
14	Sunsari	0.14	8.21	8.71	5.12		6.71	3.43	3.51	3.7
15	Saptari	-0.83	1.88	4.88	11.86		3.71	7.65	4.22	4.2
16	Siraha	-0.61	7.13	5.43	2.19		5.17	7.58	1.39	1.69
17	Dolakha	0.41	-1.45		4.28		2.69		2.51	2.53
18	Sindhupalchok	4.19	10.42		7.45		2.73	5.63	5.54	5.26
19	Rasuwa	1.74	10.91		2.19		0.78	2.01	2.19	2.04
20	Ramechhap	3.88	-3.86		2.89		2.95		3.29	3.25
21	Sindhuli	-1.76	4.14		3.78		2.23	1.52	0.33	0.56
22	Kavre	0.57	9.74	-19.01	9.52		10.52	-2.58	5.66	6.39
23	Bhaktapur	0.36	1		2.98		1.26	22.72	2.02	1.94
24	Lalitpur	1.1	2.62		8.98		6.49	-0.68	4.94	5.14
25	Kathmandu	-1.12	2.84		5.91		-0.71	0.64	1.99	1.54
26	Nuwakot	2.77	2.28	-1.07	7.78		1.98	3.18	4.18	3.83
27	Dhading	1.29	4.55	-10.46	3.52		0.87	5.04	1.79	1.65
28	Makwanpur	2.21	1.38	-0.66	2.14		5.6	9.84	2.11	2.57
29	Dhanusha	2.8	-2.37	4.06	5.63		2.91	5.05	3.65	3.62
30	Mahottari	-1.47	-1.56	3.84	5.51		4.16	5.2	2.18	2.29
31	Sarlahi	0.49	1.46	6.76	8.35		3.72	5.35	5.35	5.3
32	Rautahat	0.61	-0.76	2.8	9.92		4.56	3.53	3.11	3.15
33	Bara	2.3	4.61	-5.95	4.88		6.87	6.4	1.75	1.89
34	Parsa	3.4	2.44	-12.09	3.54		0.75	4.85	1.69	1.63
35	Chitwan	-0.1	-0.5	-1.85	9.3		2.6	6.8	2.78	2.76
36	Manang	1.67	18.96		5.18		3.17		4.8	4.76
37	Mustang	-0.002	20.87		-0.36		-0.1		0.35	0.33
38	Gorkha	2.48	3.37	-6.47	5.68		0.47	4.09	3.32	2.97

	District	Cereal Grain	Pulses & Oilseeds	Tech. Crops	Hotri-culture	Tea	Live-stocks	Fish	Total Crops	Total Agriculture
39	Lamjung	3.84	5.45	2.1	8.58		-0.86		5.48	4.71
40	Tanahu	3.21	0.34	6.84	5.42		4.94	2.33	3.82	4
41	Kaski	4.28	-0.3	0.24	6.44		1.4	-0.55	4.88	4.09
42	Parbat	2.57	2.72	0.12	1.21		1.53	-1.07	2.12	2.05
43	Syangja	5.83	4.23	-1.93	13.92		2.53	9.14	7.77	6.63
44	Palpa	1.06	8.15	-3.41	5.25		0.07	1.67	2.4	1.96
45	Myagdi	4.25	6.03	-2.45	7.2		2.86	0.33	5.27	4.91
46	Baglung	5.53	8.56		7.16		1.86	3.29	6.08	5.25
47	Gulmi	1.49	2.11	-4.97	2.64		-0.18	-3.5	1.63	1.37
48	Arghakhanchi	2.06	6.17		8.99		-0.83	-2.09	3.95	2.82
49	Nawalparasi	2.13	0.43	0.85	4.74		4.7	6.14	1.79	1.94
50	Rupandehi	3.08	3.46	-3.74	6.2		2.19	13.72	2.29	2.31
51	Kapilbastu	5.02	-0.65	1.23	7.54		3.13	9.52	3.39	3.38
52	Dolpa	5.15	-2.35		2.04		-0.36		3.19	2.91
53	Mugu	8.94	1.47		14.36		1.73		11.5	9.58
54	Humla	1.83	-2.17		2.19		0.49		2.17	1.99
55	Jumla	5.99	2.07		4.97		2.23		5.35	5.18
56	Kalikot	1.5	1.88		7.99		0.57		4.3	3.79
57	Rukum	0.04	2.62		5.76		0.41		2.18	1.99
58	Rolpa	-0.03	-0.83		5		-0.2		1.88	1.55
59	Pyuthan	0.39	0.8		4.81		2.02		1.67	1.72
60	Salyan	1.08	0.38		8.44		3.05		3.22	3.23
61	Jajarkot	0.52	5.95		5.21		2.69		1.89	2.04
62	Dailekh	4.24	2.88		12.34		1.98		7.46	6.57
63	Surkhet	1.37	2.08		6.36		1.82	9.99	2.75	2.67
64	Dang	0.61	1.6	30.05	5.82		2.19	10.46	2.28	2.29
65	Banke	1.16	0.18	16.94	4.14		4.61	12.95	2.11	2.32
66	Bardiya	3.08	0.71	25.92	5.65		7.93		5.51	5.69
67	Bajura	-1.01	0.19	19.46	4.02		0.89		1.31	1.21
68	Bajhang	3.41	5.24		5.78		1.58		4.32	3.74
69	Darchula	0.55	-2.04	-5.24	6.56		-0.91		2.56	1.91
70	Achham	-0.64	2.28		6.41		0.2		1.38	1.1
71	Doti	2.29	6.14		11.08		2.96		5.13	4.64
72	Baitadi	-0.22	1.92		4.74		-0.96		1.32	0.7
73	Dadeldhura	-1.23	0.57		3.82		4.35		0.22	1.1
74	Kailali	1.66	-0.86	-5.15	17.4		3.32	5.63	4.3	4.22
75	Kanchanpur	0.58	2.39	4.77	9.9		4.25	10.13	3.09	3.18
	Country	1.71	1.72	2.63	6.85	12.49	2.99	6.73	3.37	3.34

Source: Based on MOAC datasets.

Factors Affecting On-farm Conservation of Genetic Resources: A Case of Rice Landraces in Western Terai, Nepal

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Abstract

Nepal is considered as the center of genetic diversity for Asian rice. The conservation of these genetic resources is necessary to address the increasing demand for food as these can be used for future crop improvement because they possess novel alleles. This paper identifies the factors influencing the decision of farmers to allocate area for landraces by using a Tobit model. Majority of the farmers cultivate both the landraces and modern varieties simultaneously. Farmers, who have a larger number of working age members, participate in the market for sale of output and prefer tastes that result in higher area shares for landraces. However, the opportunity cost of maintaining the landraces is higher for the irrigated farms and educated farmers. Farmers would have incentives to grow the superior aromatic landraces if consumers are willing to pay a premium for their products because these foods have unique attributes. Public investments are needed in developing markets and related infrastructures. We need to introduce a flexible incentive system in Terai for maintaining landraces on farm, and for creating awareness about the importance of landraces by improving the existing extension and research networks.

JEL Classification: Q12, Q27, Q58

Key Words: Microanalysis of farm firms, Renewable resource and conservation, Government policy

1. Introduction

Landraces are crop genetic resources that have evolved continuously under the natural and farmer selection practices in the fields of farmers, and are progenitors of the modern crop varieties. Such landraces have been developed and diffused among farmers around the world (Harlan, 1972). In addition to the private value, which they generate for farmers growing these crops, landraces have social values because they are not only the source of novel alleles, but are also used by the breeders for crop improvement. In spite of their importance, however there has been a loss of these resources, which needs to be rectified.

The conventional explanation for the loss of crop diversity on farms is that such losses are demand-induced. Farmers no longer want to grow diverse sets of varieties, particularly landraces. As the farmers' crop production decisions have become integrated into market and have greater opportunities to access modern varieties, they sell surplus produces and purchase

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other products. So, farmers may prefer to specialize and plant a few high-yielding modern varieties of rice that provide them with higher incomes. Increasingly, small-scale farmers and their households participate in labor markets. In fact, this shift in occupation may be the most important link to the market, particularly against selling agricultural products (Taylor et al., 1999). The expanded participation of farm household members in the labor markets increases the opportunity cost of time. To maintain crop diversity, especially the landraces on their farms, farmers have to invest labor, management, and other inputs in this activity. In addition, they may have to forgo other opportunities. Such an increased intensification and commercialisation of crop production would increase the opportunity cost of maintaining landraces so much that the farmers may not be willing to maintain it.

Nepal is a center of genetic diversity for Asian rice. An estimate of 2,000 rice landraces is maintained in association with their wild and weedy relatives (Shrestha and Vaughan, 1989; Upadhyay and Gupta, 2000). These landraces have evolved in response to the wide variations in local conditions and play an important role in rural food security in the country, especially in the hill and mountain areas where modern technologies are usually available. In the Terai plains, landraces are adapted to specific niches where they out-compete the modern varieties (Gauchan, 2000). The depletion of genetic diversity in rice (and other major crop species) is apparent in the *Terai* and central hills of Nepal (Upadhyay and Sthapit, 1998). Joshi et al. (1998) reported on the declining cultivation of 43 rice landraces in the Pokhara valley (western hills) and its vicinity. Similarly, 140 rice varieties were in decline in nine hill districts of the Western Development Region (Vaidya, 1998). The National Agricultural Research Council (NARC, 1991) reported that genetic diversity has been maintained in the remote Karnali areas whereas the level of genetic erosion was highest in Kapilvastu and Banke districts in the *Terai* region.

Despite the existing uncertainties regarding the extent and loss of crop-genetic diversity, their conservation is also taking place. The *ex situ* conservation is still dominantly utilized; the *in situ* conservation has also entered the stage for conservation of intra-species diversity of crop genetic resources (Wale, 2003). Among the different *in situ* conservation options for crop genetic resources (CGRs), the on-farm management has recently received a considerable attention by the governments, NGOs, and international community. Despite a lot of discourse in its favor, there is no adequate contextual research done on how on-farm management can be made a feasible complement to the *ex situ* conservation. Because the on-farm management of CGRs cannot be undertaken in a vacuum, the farmers' crop-diversification motivation and the effect of their working environment on the level of their contribution to crop diversity have to be understood adequately for justified and efficient interventions.

Rice in Nepal occupies about 50 percent of the total area under food crops of 3.3 million hectares. Its contribution to the total agricultural GDP is about 17 percent. This crop alone contributes to about 50 percent of the total calorie intake of people. The area under landraces has declined from 60 percent in 1993/94 to about 15 percent in 2005/06 (MOAC 2006).

Compared to other ecological regions, this decline in landraces is higher in the *Terai* region where irrigation, roads, and market infrastructures are well developed.

The success of agricultural development and food production in the country is closely related to the potential of various crop varieties including rice to perform under various biotic and abiotic stresses. In order to address the country's increasing food production demand, there is a need to maintain the CGRs for their present and future potential uses. With this background, the main objective of this paper is to identify the factors that influence the decision of farmers to allocate area for the landraces. The overall hypothesis of the present paper is that farmers are not motivated to conserve genetic resources with their access to modern technologies and markets whereas the attributes and their preference encourage their conservation.

2. Methodology

2.1 Data Collection

The present study is based on a sample survey of 222 rice farmers from Banke and Nawalparasi districts in *Terai* region of Nepal. Farmers were selected from three rain fed villages of each district using the stratified random sampling procedure. The villages surveyed are Manikapur, Bethani, and Bageswori from Banke district (mid-western development region) and Kushma, Deurali, and Ramnagar villages from Nawalparasi district (western development region). The survey included collection of data on the number and types of rice varieties grown including the landraces, farmers' preference for attributes, and the associated socio-economic and demographic characteristics of farm households. The relevant data for the cropping year 2001/02 were collected by using a set of pre-tested questionnaires.

2.2 Empirical Estimation

The observed area shares for landraces are greater than, equal to zero and less than, or equal to one, but the predicted area shares may lie outside that interval. To correct this problem, two-limit Tobit procedure has been used. The model is represented below by using an index function approach.

$$y_i^* = \beta' X_i + e_i \quad (1)$$

$$y_i = 0 \quad \text{if } y_i^* \leq 0 \quad (2)$$

$$y_i = y_i^* \quad \text{if } y_i^* > 0 \quad (3)$$

where,

y_i, as a limited dependent variable, is the observed choice;

y_i^* is an underlying latent variable that indexes landraces cultivation;

X is the vector of different explanatory variables,

β' is a vector of parameters to be estimated; and

e_i is an error term.

The dependent variable is the proportion of the area under landraces. It is hypothesized that the farm households' characteristics, environmental and market factors, and preferences of farmers for consumption and production-related varietal attributes determine the area allocated among the landraces. This will enable the decision-makers to comprehend how the policy (through different incentive mechanisms) can have a better influence on the farmers' variety management behaviour. The explanatory variables used for estimation and their expected signs are presented in Appendix 1, while some descriptive statistics are presented in Appendix 2.

Previous studies have shown the effects of different farm and farmer specific variables on the adoption of agricultural technologies. Among them, the education of the decision maker farmer has a positive effect on the adoption of modern technology. This is because the more educated producers tend to adopt a new technology more quickly (Adesina and Seidi, 1995; Kebede et al., 1990). Also the farmers with better education are earlier adopters of modern technology and apply modern inputs more efficiently throughout the adoption process (Abdelmagid and Hassan, 1996). Hence, farmers' education is hypothesized to be negatively associated with cultivation of landraces. Birol et al. (2005) found that it is the older generation of farmers that grows landraces. Moreover, farmers are less likely to undertake landrace cultivation as their ability to work in labor-intensive farm production decreases at an advanced age. To test this hypothesis, the age and quadratic age variables are used.

Cultivation of landrace is a labor-intensive activity, and increases with the availability of working members in a household (Birol et al., 2005; Gauchan et al., 2005). So, the area under landraces may increase with a larger number of active members of households. Studies have also shown that farmers who participate in market (or sell their output) cultivate landraces (Birol et al., 2005; Gauchan et al., 2005). Other investigators report that the availability of irrigation is another important field-specific variable effecting the adoption of modern varieties (MVs) (David and Otsuka, 1994; Shakya and Flinn, 1985). Farmers with irrigated fields are more likely to adopt higher yielding MVs than those with rainfed fields. In less favorable agro-ecology, the irrigated share of home garden is related negatively to the prospects that a landrace would be grown (Birol et al., 2005). Hence, it is hypothesized that with the availability of assured irrigation, the area under landraces decreases. Farmers' preferences for the attributes of technology may have positive or negative effects on the adoption of seed-technology (landraces or MV). The direction of effects of attributes on landraces cultivation depends on the level of attributes embodied in the varieties.

The agro-ecological conditions of farm also play an important role in determining the area under different varieties. Farmers who have diverse soil and land types in their farms are expected to increase varietal diversity (including landraces). The hypothesized effect has been ambiguous.

3. Result and Discussion

3.1 Characteristics of Production System

The average farm size is much larger in Banke than in Nawalparasi. While rice is the dominant crop in both locations, the share of MV was higher in Banke than in Nawalparasi. The cropping intensity and proportion of irrigated area are higher in Nawalparasi than in Banke. On an average, about 20 percent of the rice area was under landraces (Table 1).

Table 1. General Characteristics of the Production System in the Study Area

Characteristics	District	
	Banke	Nawalparasi
Average Area owned per Household (ha)	2.3	1.1
Cropping Intensity (%)	151	185
Area under Rice (% of total cropped area)	53	52
Area under MV of Rice (%)	81	73
Area under Landraces of Rice (%)	19	27
Average Yield of MV (t/ha)	3	3
Average Yield of TV (t/ha)	1.6	2.3
Percentage Area Irrigated (including seasonal)	35	72

Source: Field survey.

3.2 Description of the Varieties Grown

It has been found, while valuating the number of named varieties grown by farmers, that the varietal diversity in the study area was apparently quite high. The sample farmers grew as many as 25 MVs and 19 landraces. Most of the farmers grew more than one rice variety in their farms, with a number of varieties ranging from one to nine. The incidence of farmers who grow two to three varieties is about 72 percent (Table 2).

Table 2: Farmers Growing One or More Varieties of Rice (Percent)

No. of Varieties	Percentage Distribution		
	Banke	Nawalparasi	Both
One	12.4	8.3	10.4
Two	40.7	41.3	41.0
Three	29.2	33.0	31.1
Four	12.4	12.8	12.5
Five and Above	5.3	4.6	5.0

Source: Field survey.

Also about 52 percent of the households grow both the modern varieties and landraces simultaneously. About 39 percent of the farmers grow only MVs whereas only about nine percent farmers grow only landraces. The results indicated that majority of the farmers still grow landraces (although in a small area) in combination with MVs (Appendix 3).

3.3 Description of Landraces

Landraces are being cultivated by the farmers for many years. In the survey area, the farmers had grown as many as 19 landraces. Among them, *Satha* is popular in Banke, which accounts for about 62 percent of the total landrace area. According to the farmers, this variety is directly seeded, and is also suitable to grow when there is late monsoon. Hence, it is most suitable for the rainfed area. In case of Nawalparasi, *Makarkodo* ranks number one occupying 34 percent of the total landrace area. This variety is most suitable for making fried rice (*Murahi/ Bhujiya*). *Shyamjira*, *Gauria,* and *Jhinuwa* are considered fine aromatic rice varieties. *Shyamjira* is cultivated in Banke whereas *Gauria* and *Jhinuwa* are cultivated in Nawalparasi (Table 3). According to the farmers, all of these races require a high amount of water, which means these races are more suitable for the lowland fields.

Table 3: Area Share of Popular Landraces in the Study Area (Percent)

Variety	Distribution by District					
	Banke		Nawalparasi		Both	
	No. of HHs.	Area (%)	No. of HHs.	Area (%)	No. of HHs.	Area (%)
Satha	58	61.5	0	0	59	31.1
Shyamjira	18	19.9	0	0	18	10.0
Tharuwa	5	5.8	0	0	5	2.9
Didwa	6	5.8	0	0	6	2.9
Padhani	0	0	10	6.3	10	3.2
Gauria	0	0	9	15.7	9	7.1
Jhinuwa	0	0	13	11.3	13	5.7
Anadi	1	0.3	11	12.2	12	6.5
Makarkodo	0	0	25	32.3	25	16.7
Lahure	0	0	9	11.6	9	5.8
Ramdev	0	0	4	6.6	4	2.9
Birju	0	0	2	4.1	2	1.8
Others	9	6.7	0	0	9	3.4
Total		100		100		100

Source: Field survey.

Table 4 shows the maturity days and years of cultivation of LRs in the surveyed area. Almost all of the varieties (except *Satha* and *Padhani*) are late maturing. As the name explains, *Satha* maturites relatively early in 75-90 days, has a religious and medicinal value and has been cultivated for about 50 years. Most of these varieties have good taste, some of them are aromatic too, and religious and cultural significance. Hence, these races have been cultivated for many years despite their low yields.

Table 4: Maturity Days and Years of Cultivation of Important Landraces in the Area

Variety	Characteristics by Maturity					
	Maturity Days			Years Cultivated		
	Min.	Max.	Mean	Min.	Max.	Mean
Satha	75	90	80	3	50	25
Shyamjira	160	165	163	17	40	30
Padhani	105	110	108	20	25	22
Gauria	135	155	141	2	5	4
Jhinuwa	140	160	150	2	30	16
Anadi	145	165	146	4	30	15
Makarkodo	135	150	140	3	5	5

Source: Field survey

3.4 Analysis of Area Share of Land Races

The result of Tobit model on the factors affecting landrace area share is presented in Table 5. The goodness of fit of the model is judged by the likelihood ratio (LR) test and pseudo R^2. The highly significant LR statistic implies that the independent factors, when taken together, influence the proportion of the area under landraces. Hensher and Johnson (1981) had commented that the values of Pseudo R^2 between 0.2 and 0.4 are considered to be extremely good fits, similar to 80-90 percent in the conventional analysis. The pseudo R^2 is 0.31 indicating that about 31 percent of the variations in the area share of the landraces are explained by the explanatory variables included in the present model.

Most of the results confirm *a priori* expectations. Among the agro-hydrological factors, the coefficient of percentage of the area irrigated (PERIRRIG) is negative and significant implying that the lower the proportion of year round irrigated area, the more likely that households will choose to cultivate landraces or have some area under landraces. This finding is consistent with that of Pham et al. (1999) where the balance between the long-duration high quality traditional cultivars and the short-duration modern cultivars had changed with the development of irrigation. The niche index (NICHES) is positive but not significant.

Among the household-related factors, the number of working age members in a household (WORKER) and the education level of household head (EDUCATION) are significant variables affecting the area under landraces. Higher the number of working age members in the household, higher the area share under landraces because landrace cultivation is considered as more labor-intensive. With increase in the level of education of household heads, the area share of landraces declines. This is true because the educated producers tend to adopt the modern production technologies including varieties more quickly; thus it reduces the area under landraces. The age of farmers (AGE) has no significant effect on landrace cultivation.

There is a strong correlation between the size of landholding and percentage of total production marketed (PERMARKT). Hence, to avoid multicollinearity, only PERMARKT has

been used. Farmers with a bigger size of landholding have grown a larger number of varieties including landraces to meet their special needs. They also sell production which increases with the size of landholding. It means that if farmers are participating in markets for the sale of their outputs, they like to grow more varieties of rice as per the demands in the market. This finding is consistent with that of Gauchan et al. (2003) who found that the farmers who sold rice produce in market were more likely to be growing both landraces and modern varieties than modern varieties or landraces alone.

Both the consumption attributes and farmers' preferences have a significant effect on the area share of landraces. With increase in farmers' preference for preparation of special products (POTHUSE) such as *chiura* and *murahi*, the area under landraces declined by about 0.17 percentage points. This is true except for *Makarkodo* and *Anadi.* Other varieties of landraces are perceived to be inferior by farmers for preparing these special products. With increase in taste preference attribute (PTASTE), the area share of landraces will be nine percentage points more than other varieties. Many landraces are superior to modern varieties in terms of taste. Hence, farmers' preference for taste has positively contributed to the area share of landraces.

Table 5: Estimated Landrace Area Share by Tobit Model

Variables	Marginal Effect	Standard Error
Constant	0.21923	0.21715
NICHES	0.4779	0.07500
PERIRRIG	0.19627***	0.05146
WORKER	0.01235**	0.00624
EDUCATION	-0.00644*	0.00394
AGE	-0.00974	0.00893
AGESQ	0.00009	0.00009
PERMARKT	0.00222***	0.00066
POTHUSE	-0.16654***	0.02983
PTASTE	0.09590**	0.03837
PPRODSTAB	0.06295	0.04450
OWNDUM	0.01464	0.03545
Likelihood Ratio	78.74***	
Pseudo R^2	0.31	

Note: ***, ** and * imply statistical significance at 1%, 5%, and 10% levels, respectively. Marginal effects refer to the partial derivatives of the expected value with respect to the vector of characteristics.

4. Conclusion and Recommendations

Rice production in the study area is getting commercialized gradually as about 70 percent of farmers sell their produce in the market. About 52 percent of the households continue to grow both the modern varieties and landraces simultaneously. Their demand for these types of varietal combinations is clearly shaped in part as a derived demand from markets, labor availability, and consumption preferences.

The availability of assured irrigation has demotivated farmers to grow landraces. It means that farmers might have looked for high yielding modern varieties. Similarly, the education level of household head has also contributed negatively to the landrace area share. This implies that irrigated farms and farmers with a higher education bear a higher opportunity cost in maintaining the landraces.

The diversity of agricultural genetic resources is important for both the present and future generations. Not all the landraces are of equal value to farming households uder the present uses. The landraces deficient in certain farmers' preferred attributes are not likely to be maintained on-farm. Market-based incentives are generally considered to be less costly than publicly funded conservation programs. The superior tastes of many landraces and the cultural significance of other varieties might serve as the basis for development of niche markets. Farmers would have incentives to grow superior aromatic landraces if urban consumers are willing to pay a premium for their products because these landraces have unique attributes. This would need investments from farmers in developing the infrastructures to support the formation of niche markets and to carry out the marketing promotion programs.

It has been reported that genetic erosion is taking place, especially in the *Terai* region of Nepal. There is a need for a flexible incentive system to maintain the crop genetic resources, especially the landraces at a social optimum, and to offset the negative effect of development interventions. The policy of creating awareness about the importance of landraces and rewarding farmers who maintain unique ones should be adopted. In conserving and developing landraces as indigenous phyto-genetic resources, it is important to mobilize the existing extension and research system, to encourage the farmers and to educate the consumers.

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Appendices

Appendix 1: Definition of Variables in the Tobit Model for Landrace Area Share

Variable	Definition	Measurement	Expected Sign
NICHES	Niche Index considering land and soil types	Index	unpredictable
PERIRRIG	Area irrigated (year round)	Percentage	negative
EDUCATION	Edn'l attainment of decision maker	No. of years of schooling	negative
WORKER	Number of workers in the household 15-59 years of age	Number	positive
AGE	Age of decision maker farmer	Years	positive
AGESQ	Age squared	-	negative
PERMARKT	Marketed quantity of rice	Percentage	positive
POTHUSE	Preference of farmer for preparing other special products from rice (other than boiled rice)	Binary: 1= if preference for other special product 0 = otherwise	unpredictable
PTASTE	Preference of farmer for taste attribute	Binary: 1= if the preference for taste attribute is important 0 = otherwise	positive
PPRODSTAB	Preference of farmer to maintain production stability	Binary: 1= if the preference for production stability 0 = otherwise	positive
OWNDUM	Ownership of the land	Binary: 1= if farmer is owner 0 = otherwise	unpredictable

Appendix 2: Descriptive Statistics of the Variables used in Tobit Model

Variable	Banke	Nawalparasi
Quantity of Rice Marketed (% of total production)	24.50	26.20
Households selling (%)	72.60	68.80
Workers in 15-59 years of age (Nos /household)	4.58	4.64
Age of the household head (years)	48.5	47.0
Education of Household head (Years of schooling)	4.0	3.8
Niche Index	0.51	0.41

Appendix 3: Rice Types and Farmers Market Participation in Banke & Nawalparasi Disticts

Description	Rice sellers (n = 157)	Non-Sellers (n = 65)	All Households (n = 222)
Growing traditional varieties only	7.6	12.3	9.0
Growing modern varieties only	34.4	50.8	39.2
Growing both traditional and modern varieties	58.0	36.9	51.8
Mean Among Farmers			
No. of traditional varieties grown	0.89	0.60	0.82
No. of modern varieties grown	1.96	1.45	1.81
No. of total varieties	2.85	2.05	2.63
Percentage of rice area in traditional varieties	24.3	20.1	23.0
Percentage of rice area in modern varieties	75.7	79.9	77.0
Education of household head (years of schooling)	4.5	2.6	3.9

Emerging from Landlessness, Poverty, and Food Insecurity Circles in Nepal: The Legislative Approach

Kailash N. Pyakuryal[1]

Abstract

Land is one of the most important sources of livelihood to more than three-fifths of Nepal's population. However, the past legacy of dual ownership, small average landholding, land fragmentation, skewed land distribution, landlessness, poverty, stagnant agriculture, and policies insensitive to improvement in agriculture and emancipation of the people have kept the poor marginalized. The poor have to struggle most for their survival. Most of them are the poorest of the poor with land as their only source of survival. However, it is this group that also falls among the landless people. A review of relevant literature was complemented with four case studies to make some inferences to generate workable recommendations. This study concludes that since agriculture still predominates the economy of the country, with an improvement on land policies and access of the poor to land resources, agriculture can be modernized to increase employment, reduce poverty, and ensure food security.

JEL Classifications: D74, D78, K11, Q15, Q18

Key words**:** Conflict and conflict resolution, Positive analysis of policy making-implemenations, Property law, Landownership and tenure, Agricultural/ food food policy, and Regional migration/ labour markets

1. Introduction

Land is the main source of income for the majority of Nepalese people as well as their principal natural resource. Land entitlement gives prestige, dignity, and identity and is a secure form of property. Land forms a basis for the livelihood of the people, particularly the excluded groups like *Dalits*, women, and other highly marginalized groups. The concept of Dalit, is used here to refer to the vulnerable and poor groups who are put in the lowest rung of the status hierarchy (caste system). Historically, *Dalit* denotes lower and formerly untouchable caste referred to in the Old Legal Code of 1854 as a caste from whom water is not accepted and after whose touch sprinkling of holy water is required for sanctification (Dahal et al., 2002).

The access of Dalits, marginalized groups, and women to good land is becoming increasingly difficult. On one hand, increase in population has led to the increasing demand of agricultural land, but there is limited scope to increasing land availability. On the other hand, once land rights for the weaker and excluded sections are lost, they are difficult to re-establish because access to and control over resources is directly linked to power. Table 1 explains the

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land use patterns in Nepal, which shows one-fifth of the total areas is under cultivation, and food grains produced from this land are not enough for the population (MoAC, 2011).

Land distribution is skewed in Nepal. For example, 47 percent of landowning households own only 15 percent of the total cultivated land. The average size of holding of this group is less than 0.5 hectare, while the top five percent occupy more than 37 percent of land (CBS, 2006; UNDP, 2004). Inequality in land distribution as measured by the Gini Coefficient was 0.544 in 2001 (UNDP, 2004). The same report reveals that 24.5 percent of households were landless and 7 percent were semi-landless (owning less that 0.2 acres).

Table 1: Land Use Systems in Nepal

Land Use	Area in Ha	Percent
Agricultural land cultivated	3,091,000	21.0
Agricultural land uncultivated	1,030,000	7.0
Forest	5,828,000	39.6
Grassland	1,766,000	12.0
Water	383,000	2.6
Others	2,620,000	17.8
Total	14,718,000	100.0

Source: MoAC (2009).

2. Concepts and Methods

The present paper is based on synthesis of national land statistics, living standards surveys, a review of land tenure acts, land entitlement policies, and specific cases studies on the targeted-people upliftment programs. The arguments here are developed by combining the variables about institutional issues, market forces, and public choices in three stages as follows. First, landlessness/ land ownership is considered a function of the Birta, Kippat, Guthi, Raikar, Land Reform Act, Resettlements, Demography, and Markets, etc. Second, the poverty/income distribution is considered as a function of landownership, employment in agriculture or outside agriculture. Third, food insecurity/ peoples welfare is a function of income, government's food programs, and charities, etc.

The article is enriched with few case studies on the *Dalits* and the Tharus. *Dalits* and Tharus have been the victims of land tenure systems. Such groups have to struggle most for their survival. Most of them are poorest for whom land is the only source of survival. Yet they are also the groups who fall among the landless people. *Dalits* are the occupational caste at the bottom of caste hierarchy who are highly discriminated. Although untouchability is unconstitutional in Nepal, it is still practiced. *Dalits* are at the bottom of the human development index with 0.424 compared to the HDI for rest of Nepal's population at 0.509 (UNDP, 2009). Landlessness, food deficiency, and poverty are typical characteristics of Dalits (Dahal et al., 2002). Tharus, and indigenous ethnic groups practice farming as their main occupation, yet they do not have enough land to work. In Kanchanpur, Kailali, Banke, Bardia, Dang, and Surkhet of

Western Nepal, until recently there was Kamaiya system (bonded labor) among the Tharus. *Kamaiya* (mostly Tharu) is a bonded labor system used by landlords (mostly non-Tharu), which is a form of slavery. Kamaiya was recently abolished, and some liberated Kamaiyas were given small pieces of land as a support for their livelihood. But the Kamaiyas' conditions have not improved. Some have received a pieces of land (mostly 0.39 ha. or less per family), but most of them have still neither land nor shelter, and are living in squatter settlements. The situation necessitates social and economic policies that focus on land and agriculture as the base of the poverty alleviation and food security in the country.

Landlessness and land concentration are strong indicators of rural poverty. Landless households are those who have no land entitlement (or are devoid of land entitlement) with non holding land in their household. Likewise, poverty means being devoid of livelihood assets, and is also a psycho-social phenomen. The landless and poor people are thus devoid of anty asset entitlement. Rural poverty is also considered the concomitant of rural landlessness. The poverty rates of people having less that 0.2 ha and more than 2 ha in 2003/2004 were 39 and 24, respectively (CBS, 2006). There is a strong correlation between landholding and poverty (Wiley, Chapagain, and Sharma, 2008). The present scenario depicts the social ill and misery due to landlessness.

The study here aimed at exploring how much government intervention changed the plight of landless and poor small farm households. Extensive desk study was done to collect secondary data in related field using a wide range of materials such as books, statistical reports, annual reports, district and village development reports, district profiles, policy and plan documents, previous research findings, and other published materials and official records of INGOs/NGOs. The results of four case studies conducted in Kailali were also reviewed.

3. Landlessness

Land is one of the most important natural resources in the country, the source of livelihood of a vast majority of the Nepali people, as well as, an important contributor to the gross domestic product of the country. Of those who are landless, Dalits are the hardest hit group. In spite of the abolition of the Kamaiya system (bonded labor), several Tharu families are still Kamaiya directly or indirectly linked with their masters. Those who were liberated were not supported adequately and are living their life in vulnerable conditions.

The landless are the most underprivileged section of the Nepali society. Without land, the poor are deprived of the basic means of production in a rural economy. Moreover, the landless people are powerless with little or no access to credit, marketing systems, or other services and face social deprivation, poor health, illiteracy, and a high rate of child mortality. Insecurity is the stark reality of their lives (FAO, 1986).

There are various kinds of discrimination in land access for excluded groups with social barriers in the rooted feudal system shaped by customary beliefs and highly skewed power

relations. For example, women and indigenous communities produce food to ensure household and national food security and protect the environment and promote biodiversity. But they are usually denied land titles and depend on males. The same is true for the Dalits, who ploughed land and wage earned laborers at a time when there was plenty of land. They, too, were denied land ownership and control because of their caste, and the traditional division of labor. However, some progress has been achieved in this regard recently.

4. Status of Land Policies and Acts

Historically, the ruling classes had been using land and land-based resources such as forest and water as the principal sources of economic surplus. They exploited the peasantry through excessive expropriation of labor and land revenue, in particular, during the Rana regime during 1847-1951. After the overthrow of the Rana regime in 1951, the state made a number of interventions to reform land tenure (Chapagain, 2001). However, these interventions rarely solved the problems of landlessness and land tenure system. The power was still centered in the hands of landed aristocracy; the changes introduced by the state ended up mostly serving the privileged classes, perpetuating the status quo.

The most prevalent among the tenure systems are three types of tenure (Wiley et al., 2008). First is the *owner tenure* operated by owners themselves where the holder pays land tax to the state as per state regulations. Another is purely *rented land* in which the holder operates land owned by others under rental arrangements (ibid.). The most common is *adhiya* (sharing the produce) which means the produce is shared in equal proportions between the landowner and the tenant. There is also a *rented tenure* form in which both the landowner and the cultivator tend to exercise control over land, with a room for dual ownership. It is a *mixture of both owned and rented tenure*. A number of land policies initiated by the government in the past (see Wily et al., 2009 for details) left little impact on reducing land inequality or establishing the right of the tenants. Nevertheless, the Land Act 1964 is worth mentioning.

4.1 Land Act 1964 and Amendments

The Land Act 1964, started in 1964 to reduce inequality in the distribution of agricultural land, was the most comprehensive of all the past measures.

- It fixed ceilings on landholdings (25 bigha -16.93 ha- in Terai and inner Terai, 80 ropani -4.07 ha- in hills and mountains, and 50 ropani -2.54 ha- in Kathmandu Valley);
- Partially protected tenancy rights;
- Fixed rents at 50 percent of the principal crop grown in a year;
- Abolished birta system; and
- Introduced a compulsory savings scheme to generate investable capital in rural areas.

The Act was implemented in three phases between 1964 and 1966, and covering 16 districts in phase-1, 24 in phase-2, and 34 in phase-3. This allowed the landowners of second and third phase

districts to manipulate landholding and escape the ceilings. There were other loopholes, too, in the Act which favored the landowners. In retrospect, the state favored the landed gentry to protect their interests, at the same time projecting a populist image of the regime about the welfare of poor.

The objective to redistribute land to the landless and smallholder peasants appeared noble on the surface. However, the state could identify and redistribute only 1.5 percent (29,124 ha) of the total agricultural land, which is an insignificant achievement considering that about one-fourth of the farmers at that time were pure or mixed tenants (Zaman, 1973).

One key feature of this program was **Compulsory Saving Scheme**. All farmers were required to deposit a portion of their produce in the ward committees. The grains thus deposited were bought by the Nepal Food Corporation. Later cash deposits were also allowed, instead of kind. The resources thus generated were to be utilized in granting loans to the participating members to start income-generating activities. The scheme was to mature in five years after which farmers were promised full return for their deposits along with an annual five percent interest. Altogether, Rs 120 million was deposited during 1964-1969 under this scheme. The government used Rs 80 million in agricultural credit to the farmers and transferred Rs 40 million to the local entities. However, due to the corrupt practices, mostly by the elected authorities, this program could not go ahead and collapsed prematurely (SLRHC, 2010).

This Act has been amended six times; the fourth and fifth are the most important amendments. The fourth one was implemented in 1997 and is about a provision of apportioning 50% of the land hitherto cultivated by a tenant between the tenant and landowners, and provision of credit facilities to the tenant, should they be interested in buying the owners' share also. The Fifth Amendment came into effect in 2001 and reduced the ceilings while retaining the provision of the fourth amendment (Wily et al., 2010), Table 2.

Table 2: Land Ceiling prior to and after the Fifth Amendment of Lands Act 1964 (in ha)

Region	Before (per household)			After (per Adult)		
	Agri Land	Home-stead	Total	Agri Land	Home-stead	Total
Terai & Inner Terai	16.4	2.0	18.4	6.77	0.68	7.45
Kathmandu Valley	2.7	0.4	3.1	1.27	0.25	1.52
Hills & Mountains	4.1	0.8	4.9	3.56	0.25	0.81

Source: Ministry of Land Reform and Management (2006) cited in Wiley et al, 2008.

The Poverty Reduction Strategy Papers (PRSP) (Tenth Plan, 2002-2007) state the agricultural rural economy is greatly handicapped in terms of the quality of cultivated land and access to and use of inputs. The growth of agriculture at insignificant three percent annually is quite inadequate to meet the country's growing food demand and to trigger the process of economic transformation. It is noteworthy that the proportion of the economically active population depending on agriculture fell about 13 percentage points during 1971-2001 - from 94% to 80%. On the other hand, the share of agriculture in the GDP dropped more sharply from 72% to 34.1% during 1974/75-2009/2010 (MoF). During the 10th Plan (2002-2007), agriculture growth rate was

2.67 against a population growth rate of 2.8 percent. This shows that agricultural production is not sufficient to feed the growing population.

After the political change in 2006, the issue of land reform is again in focus. The Peace Accord of 2007 between the Seven Party Alliance and the Nepal Communist Party (Maoist) gave a high priority to land reform. The Interim Constitution emphasized Land Reform as an important agenda.

4.2 Land Agenda in Interim Constitution 2007

The *Interim Constitution of Nepal 2007* notes the provision for scientific land reform program in the context of various state measures. The constitution mentions state role to implement land reform program. Under the fundamental rights, the constitution protects the property rights of citizens who have to pay legal compensation for acquired land in the course of implementing scientific land reform program. Under the state's responsibilities, it also mentions the need to end feudalistic landownership by adopting a land reform policy, and to provide land to the economically and socially backward communities which includes the landless indivisuals, bonded laborers, shepherds, and tillers. Under the state policy, it has to develop the agriculture industry by launching a land reform program as well as a policy of positive discrimination for the landless, squatters, bonded laborers, and other deprived groups, and to provide land to the liberated bonded laborers.

In the Constituent Assembly, where the issue of land reform is being intensively debated, one group of parliamentary parties argue that land is a natural resource and therefore no individual can claim ownership whereas, the other groups of political parties argue it is a private property.

5. Poverty

Rural poverty is connected with rural landlessness. Despite all development programs and projects implemented and directed toward improving the situation of rural poor in the last few decades, the socio-economic and living conditions of the poor in most developing countries have remained dismal (Bongartz, 1993) and Nepal is no exception. During an eight-year period, the Nepal Living Standard Survey (NLSS) of 1995/95 and 2004/2005 reveals an increased income inequality evident in Gini co-efficient rise from 0.34 to 0.41 (TYIP, 2007). This is an indication that strategies adopted so far for alleviating rural poverty have not properly benefited the poor. A debate is on about the indicators of poverty between the approach of the World Bank NLSS based on expenditures, and the UNDP multi-dimensional indicators which uses a composite of about six indicators.

Experience suggest that the interventions by government and NGOs designed to combat poverty have, in general, failed mainly because they did not recognize that poverty is grounded

in the lack of access to resources resulting from an unequal distribution of assets, leading to insecurity, indebtedness, and powerlessness of the majority of rural households (Ahmed, 1987).

While the 10th Plan (2002-2007) aimed at an economic growth rate of 6.2 %, the growth attained was 3.4 % . The Far Western Region of Nepal has the highest poverty incidence. The Far and the Mid-Western Regions have a Human Development Index (HDI) of 0.4, which is far below the other regions (UNDP, 2004). The situation deteriorated further between 1996 and 2001 when the gap between these underdeveloped regions and the rest increased from 0.074 to 0.091.

The deteriorating conditions have pushed up urban migration adversely impacting on agricultural productivity. The *Interim Constitution of Nepal 2007* recognizes food security as one of the fundamental human rights. The World Food Conference 1996 also views food security as attained if each citizen has continual access (physical and economic) to adequate, fresh, and nutritious food. However, 39.9 % of the populations still do not get the minimum calorie requirement at the national level. This proportion is as: High Mountains 45.2%, Mid-hills 41.8%, and Terai 37.4%, the Eastern, Central and Western regions 37.2 to 39.9%, Mid-Western Region 44.3, and Far Western Region 44.9%, which exemplify the ecological and regional variations in terms of drought and stunting in availability of food. Among children under five years of age, food insecurity has caused stunted growth in 50.4%, has underweightage in 45.2 %, which tends to be higher in the case of girls.

6. Food Insecurity

Legal Provisions

Food security denotes a condition when people have access to sufficient, safe, and nutritious food whenever needed for an active and healthy life (FAO, 1996). The United States Department of Agriculture (USDA) states the household's food security as access by all members at all times to enough food for an active, healthy life. (Massimo Canali and Francesco Slaviero, 2010). This definition of food security suggests access, availability, and utilisation as the elements of food security. When such conditions do not prevail, the result is food insecurity. People are exposed to risks when any one or all of these conditions are absent, and they cannot cope with the negative impacts.

In Nepal, the landless and small farmers are more exposed to the risk of food insecurity as adequate compared to the rich and landed aristocracy. The people under poverty do not have enough land to farm as well as they do not have livelihood options to meet their food requirements. The main objective of farming activities/ agriculture is to satisfy households' food requirements. Agriculture is mostly rain-fed and subsistence-oriented though there are incidences of sporadic agriculture development. Food production usually does not meet food requirement in the country. In the year 2010, there was a food deficit of -329,972 MT against a total requirement of 52,977,444 MT. (MoAC, 2011). Agriculture is a broad-based sector which

engages two-thirds of the economically active population for livelihoods (CBS, 2008 as cited in Pyakuryal and Upreti, 2008).

Ghale (2011) refers to food factors such as food sufficiency, right to food, food security, and food sovereignty. The green revolution in agriculture made several countries (such as India) self-sufficient in food but it does not guarantee food availability. Right to food as a concept is guided by the principle of human rights. As citizens, all should have the right to enough food. However, in a country where other human rights are violated, the food right cannot be taken as granted. Food security, as has been explained earlier, does not encompass control on the land resource, which is an important source of food. Food sovereignty is related not only to the availability, access, and utilization of food but also to control on food producing resources by proper agrarian reforms.

Food sovereignty is also enshrined in the Interim Constitution of Nepal 2006. However, the existing agriculture policies, plans, and programs are much closer to the concept of food security.

Case Studies

Small farmers and landless households alike are food-insecure in Nepal. Both types of food insecurity such as transitory and chronic (Eicher and Staatz, 1990) prevail. The short-term inability to secure adequate food due to temporary shortfalls (say, due to flood or drought) in either production or income is a form of transitory food insecurity. Chronic food security refers to long-term inadequate food intake due to low productivity and incomes. This is supported by the following case studies conducted in Kailali in the Far-Western Region. All the four villages where mostly Dalits and Tharus resided were food-insecure villages.

These case studies were conducted by four students of Kathmandu University in the winter of 2007. The first one concludes that sharecropping as a primary livelihood option for poor farmers; brings scant motivation for optimum use of resources fear of eviction due to insecure tenancy right has negative implications for optimizing production; and the owner-tiller relation is exploitative making the share cropping system feudalistic in nature. In fact, even the food they produced was not enough for the whole year (Rai, 2008).

The second case study concludes that, though *Kamaiyas* are considered good at farm-based occupations, the ex-Kamaiyas of Sri Lanka village were mostly engaged in non-farm jobs. All of the Kamaiya households received 0.17 ha of land, not enough for survival. Some of the coping mechanisms they adopted were obtaining loans and temporary migration to India (Neupane, 2008).

The third case study concludes that production was not enough for subsistence and hence they depended on off-farm jobs (labor in Indian towns). Some had also taken to hotel business and faced occupational displacement (Adhikari, 2008).

Finally, the fourth study concludes that there is an inter-related problem of landlessness and food insecurity, because most of the people's landholdings were not sufficient for subsistence. Off-farm wage earning, traditional occupations, and loans were their survival strategies (Singh, 2008).

7. Discussion

Land has been one of the most important sources of livelihood for four-fifths of Nepal's population. However, the past legacy of dual ownership, small average landholding, land fragmentation, skewed distribution of landholdings, landlessness, poverty, and stagnant agriculture have increased marginalization of the poor people over the years.

Despite the planned socio-economic development efforts of half a century (1956-2014), no significant improvement is seen in the standard of living of rural people. Poverty is widespread and deep-rooted in rural Nepal with ever-increasing, continuing, and widening inequality. The rural poor lack the cultivable (arable) land which is the most important income generating asset in agrarian society. At present, landlessness has become one of the major problems of the country, especially in the Tarai (Sizur et al., 1984). Meanwhile, a debate is on about the relevant dimensions of poverty.

Poor performance of agriculture does not match the ever-growing population growth rate. In view of the absence of any other massive industries for employment generation, agrarian transformation may become the panacea of misery in the short to medium ranges. The study suggests that agriculture still predominates the economy of the country and, with improvement on land policies and access of poor to land resources, agriculture could be diversified and commercialized. This would also reduce poverty and ensure food security.

Given that poverty and food insecurity are closely interlinked with agriculture in the country, both in terms of occupation/main livelihood of the poor, and also in terms of the regions where poverty and food insecurity are manifest, agricultural development is the key to achieving food security and reducing poverty in Nepal. It is to be noted that the problem of food insecurity is a multi-dimensional problem that requires addressing issues related to the food availability, access, and utilization.

8. Recommendations

Most of the Plan documents of Nepal are donor-motivated and government-made. The progress on the plans is monitored, assessed, and published by the government with the help of donors. For example, in the PRSP/Tenth Plan, there is ample room to question the authenticity of data and the progress made. A strong monitoring and evaluation system in the National Planning Commission needs therefore to be established, supported by a strong and reliable dataset.

The review of the 10th Plan (Chapter 2, TYIP) rightly mentions, "The past experiences show that the objective of poverty alleviation might not be achieved even if the overall economic indicators remained positive". The Nepal Living Standard Survey (NLSS) 1995/96

and 2003/04 mention that the people living below the poverty line dropped from 42 to 31 percent of the population. However, the Gini Coefficient during the same period (8 years) increased from 0.34 to 0.41. TYIP 2008 further writes, "Expected improvements could not be realized in the economic and social conditions of Women, Dalits, Adibasi, Janjati, Madhesis, the Muslim Community, and the Residents of Karnali zone". This necessitates a need for implementation of a pro-poor land reform program which may reduce inequality and motivate farmers to produce more.

The constraints on Poverty Alleviation are hardly new: poor targeting of people under poverty, landlessness, skewed distribution of land, tenure, tenancy, and stagnant agriculture, as also economic, social, and political exclusion. The poor are divided and so are the Dalits, Ethnic/Caste groups, Marginal groups, and Women. As a consequence, they have always been exploited by the vested interest groups. A government strongly committed to positive discrimination for the poor and the disadvantaged could formulate land policies linked with the modernization of agriculture so that food security could be guaranteed.

There is an overwhelming representation of the non-poor in most of the political parties and support to such political parties by the Global Imperialists is another constraint on Poverty Alleviation in Nepal. A Nepali proverb says, "*Sabai bhanda saro dhunga, tyo bhanda saro nahunu*" which means "A stone is hard but scarcity is even harder". The poor are not only looked down upon, but they are also used as vote banks. Such attitudes need to be changed and the poor have to be properly re-integrated into the society.

In the absence of other employment opportunities in the medium to short run, agriculture will continue to play an important role in engaging the poor and the landless. The entitlement of land to the poor and the landless is a key to poverty alleviation. Land should be considered as a natural resource, and the small and marginal farmers and the landless peasants all should have access to and control on land. Policy should be oriented toward this end.

Pro-poor land reform would entitle land to the landless. When such farmers are organised into groups, associations, and federations, they may exert pressure on the government to formulate policies in their favor. When agricultural education, research, and extension are integrated through a well equipped agricultural university, a prosperous agriculture would guarantee food security, and a shared wellbeing of the people.

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Farmers' Participation in Groundwater Markets in Nepal's Terai

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Abstract

The study of demand and supply in the groundwater markets in Nepal and its policy implications is based on the primary data collected from 360 operators of shallow tubewells (STW) in 2002-03 in Terai. Of the total annual STW operations, about 70% time was used for own-crop irrigation, and nearly 30% was marketed. Average water purchase was 59 hours annually whereas the sale was 74 hours. Econometric analysis showed that the weighted parcel distance positively influenced the likelihood of farmer's participation on demand side, whereas the farm size, age, and education of decision maker and area under canal irrigation had a negative effect. On the supply side, the availability of electricity for pump operations had a positive and significant effect, whereas the net operated area and percentage area under vegetables had a negative influence. Farm size was most influential on the demand side, and the net operated area on the supply side. As a policy, the consolidation of farm size would encourage farmers to establish their own STW; it reduces water demand from the purchaser and lowers water prices; these would increase the efficient use of groundwater. Access to electricity for pumps lowers water extraction cost and ensures water availability at lower rates.

JEL Classification: Q2, Q5

Key Words: Groundwater, Market demand and supply, Shallow tubewell

1. Introduction

Groundwater (GW) is one of the important renewable natural resources that can be easily harnessed and controlled by the majority of the poor farm communities. It is said that GW irrigation is economically justified and provides the quickest way to raise productivity and employment in the agricultural sector. The GW market, which plays a key role in providing such opportunities to the farming communities, is one of the most promising institutional mechanisms to increase access to irrigation, which is both an input and a technology for achieving higher crop productivity.

According to NPC (2006), irrigated area comprises about 44% of the total cultivated area in Nepal. However, year-round irrigation is very limited to about 40% of the total irrigated area.

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About 80% of the total irrigable area of Nepal (1,766,000 ha) is located in Terai ecological belt, out of which, about 60% is irrigated. Of the total irrigated land, about 19% is under GW irrigation. The average size of cultivated land per household is very small. Because of this limited farm size most of the small farmers can neither afford to install a shallow tubewell (STW) nor operate and maintain it[1]. Small farmers unable to install their own tubewells can derive indirect benefits from a well by buying water from the neighboring better-off farmers. Water markets could become an important means to improve the access of small and marginal farmers to GW irrigation. Thus, GW market could increase agricultural production, particularly in areas with small and fragmented farm holdings.

The factors affecting private tubewell development and emergence of GW markets are very complex and interlinked. Many variables have played an important role to enhance farmers' participation in GW marketing from the demand as well as supply sides. Saleth (1991) also reported that climatic variables are highly significant with substantially greater contribution to the GW-buying decision than other variables.

Keeping in view the importance of GW irrigation in Nepal's context, this paper aims to evaluate farmers' participation in STW water markets, more specifically, to examine factors that determine farmers' participation in the demand and supply sectors of STW water markets in Terai Nepal.

2. Conceptual, Theoretical, and Analytical Framework

Conceptual Framework

Groundwater (GW) is a common property resource, but it becomes solely private as soon as it is captured by households and then it possesses a great market value. Water markets provide one of the most promising institutional mechanisms for increasing access to irrigation from GW. This applies particularly for tenants and small farmers in South Asia (Meinzen-Dick, 1996). Water market is very important in Nepal's agriculture which is more dependent on irrigation such as the GW in the Terai region. Such high importance of GW is mainly due to the lesser reliability of public canal irrigation systems compared to private tubewells. GW markets are not impersonal; that is, they are very competitive. Because of the high conveyance cost and transmission losses, GW transactions, generally, are limited to neighbors. With advancement in water conveyance system, it is now possible to transport water over longer distances and thus make the water markets more competitive. It ultimately encourages farmers to participate in GW markets. Initiatives such as small initial investment, short gestation period, and negligible environmental externalities of GW irrigation over large-scale canal irrigation schemes would encourage further development of STW irrigations in the country.

[1] A shallow well in Nepalese *Terai* is a well installed up to a depth of 60 m. To obtain discharge at this depth mechanically, a long pipe is bored deep into the ground, intercepting one or more water-bearing streams.

Theoretical Framework

Farmers' participation in GW markets can be described in terms of the demand and supply interactions. The demand for and supply of GW can be defined as the hours of water purchased/sold at a particular price and place. The demand for water decreases while its supply increases with price. The specific shapes of these curves would depend on the sizes of the respective elasticity coefficients. Farmers' participation in GW market can be analyzed by considering (i) the determinants of farmers' participation in GW market, and (ii) the determinants of GW demand and supply. In the first case, the dependent variable is dichotomous, which can be defined in terms of whether or not the farmer purchases water (demand side) and whether or not he sells water (supply side). In the second case, the dependent variable is continuous and can be defined in terms of the number of hours of tubewell-water purchased (demand side) or sold (supply side) in a year by a water purchaser/seller. In such a situation, one alternative is to model the two separate decisions by the farmers: (i) whether or not to participate in the water market; and (ii) the actual quantity of water to purchase or sell. This separation captures the maximum possible factors that would affect farmer's decision to participate in GW market, either from the demand or supply point of view. This particular study is limited only to find the determinants of farmers' participation in GW market using a probit regression of maximum likelihood estimates (MLE).

Probit regression is an alternative log-linear approach to handle categorically the dependent variables. The function used in probit model is the inverse of the standard normal cumulative distribution function. Probit regression assumes that a categorical dependent variable reflects an underlying quantitative variable and the probit model is based on the cumulative normal probability function is defined as follows:

$$P_{1/i} = F(\alpha + \beta X_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\alpha+\beta X_i} e^{-u^2/2} du \qquad (1)$$

Where,

$P_{1/i}$ = probability that the j^{th} respondent participates in GW market (demand side, if purchaser, and supply side, if seller)

F = cumulative normal probability function

U = standard normal deviation with mean zero and variance of one

α = constant factor

β = vector of unknown parameters; and

X_i = vector of independent variables included in the model

$P_{1/i}$ is the area under the standard normal curve between $-\infty$ and $(\alpha + \beta X_i)$. The greater the value of $(\alpha + \beta X_i)$, the more likely that the i^{th} individual will participate in the GW market. The linear probit model can be derived by taking the inverse (F^{-1}) of the cumulative normal probability function as follows:

$$F^{-1}(P_{1/i}) = (\alpha + \beta X_i) \qquad (2)$$

The probit on the left hand side of Equation 2 increases in value from $-\infty$ to $+\infty$ as $P_{1/i}$ increases from 0 to 1. This means that the distribution functions in the probit model are bounded between 0 and 1. This gives a realistic range for the estimated probabilities. The probit model of MLE estimate was used with its suitable specifications to handle the data characteristics, such as some observations of the dependent variable having a value of '0' for water non-purchaser and non-seller (lower limit) and some observations having a value of '1' for water purchasers and sellers (extreme limit).

The determinants of farmers' participation in GW market can be further explained by the demand and supply sides of the water market. The participation of actors could be either from the demand side (STW owners and non-owners) or the supply side (STW owners). For STW owners to be involved in the GW market, it is not always necessary to purchase or sell some quantity of water. Some of the actors may be non-purchasers and non-sellers as well. The question then arises: Why are water non-purchasers and non-sellers included in the demand and supply side analysis of groundwater market, if they are not purchasing and selling water? The answer is that, irrespective of water purchase or sale, they fulfill their water requirements from their own STWs. This can be considered as proxy for water purchase (demand analysis) and sale (supply analysis). But this is not true among the STW non-owners. They are non-sellers but they take part in the GW market by purchasing at least some quantity of irrigation water.

Analytical Framework

In testing the significance of the probit model where the parameters are estimated by the MLE procedure, the likelihood ratio (LR) is best suited. The LR must lie between 0 and 1. If the null hypothesis is true, we expect LR to be close to 1; if it is not true, then LR will be close to 0. In other words, we expect to reject the null hypothesis when LR is sufficiently small (Pindyck and Rubinfield, 1997).

A discrete choice probit regression is specified to estimate the effect of a set of explanatory variables about farmers' participation in GW market through the demand and supply side as (Appendix 1 for details) as follows:

$$\text{(i) } P_D = f(X_{ij}, D_{ij}, \varepsilon_j); \qquad \text{(ii) } P_S = f(X_{ij}, D_{ij}, \varepsilon_j)$$

Where,

P_D= farmer's participation on demand side of water market (dummy)

X_{ij}= factors affecting farmer's participation on the demand or supply side of water market

D_{ij}= dummies for specific characteristics

P_S= farmers participation on supply side of water market (dummy)

ε_j= error term

3. Data Collection and Analysis

This study was conducted in six Terai districts, namely Morang, Dhanusha, Parsa, Rupandehi, Banke, and Kanchanpur. One Village Development Committee/ Municipality from each category (highest and lowest STW density) was selected randomly. From each district, 30 STW owners and 30 non-owners were selected randomly to form a total sample size of 360 respondents (180 STW owners and 180 STW non-owners). The STW non-owner water-purchaser type of respondents comprised 50% of the total sample population, and another 50% by the STW owners (water purchaser 12.8%, non-purchaser 19.7%, water seller 1.4%, and non-seller 16.1%). To understand the determinants of farmers' participation on demand side of water markets, all 360 respondents were used in the analysis whereas on supply side, 180 STW owners were used. Of the total respondents, 129 (35.8%) were STW owners but non-purchasers. They were included in the analysis on the ground that, even if they are not purchasing water, they fulfilled their demand from their own STWs. Similarly, out of the 180 STW owners, a total of 63 respondents were not selling water, but they were included in the analysis because they fulfilled their needs from their own supplies.

Both primary and secondary data were used. The primary cross-section data were collected from randomly selected respondents through personal interviews using a set of pre-tested questionnaires and secondary data from relevant published and unpublished sources. Statistical analysis was carried-out by applying the principle of the MLE technique under a probit regression using the LIMDEP-7 computer software program.

4. Results and Discussion

4.1 Salient Features of STW Water Purchasers and Sellers

Taking the STW owner and non-owner samples together, the average farm size was found to be 2.2 ha (STW owners 2.8; non-owners 1.6 ha). Each family had an average of 3.4 land parcels (STW owners 3.7; non-owners 3.0) and average parcel size was observed to be 0.64 ha (STW owners 0.8 ha; non-owners 0.5 ha). Analysis showed that STW owners had a greater number of parcels per family and a larger parcel size than STW non-owners. This might be due to the larger landholdings of STW owners compared to the non-owners. Majority (51.1%) of the decision makers belonged to the 41-60 age group (STW owner 53.9%; non-owners 48.3%). About 6.7% of the household heads among the STW owners, and 11.9% among non-owners were illiterate.

The annual use of the owned STW for own-crop irrigation was nearly 110 hours, whereas the sale of STW facilities to others was about 48 hours. The annual water purchased by STW owners was nearly 13 hours but about 63 hours in the case of STW non-owners. The reason that STW owners needed fewer hours of water purchase was that their water requirements are fulfilled by their own STW and that only a few hours are needed from others, whereas the STW

non-owners rely fully on water sellers. Their annual water purchase was nearly 4.8 times higher than that of STW owners.

The average duration of water purchase was 58.9 hours annually, and the quantity of sale 74.4 hours per year. The flat rate average water purchase price (Rs 76.1 h^{-1}) was lower than the average sale price (Rs 84.1 h^{-1}) among the sample households. The higher sale price was mainly due to lessr number of water sellers. On an average, STW owner used about 13 hours ha^{-1} of the purchased STW irrigation water to meet their crop requirements. The STW non-owners used about 31 hours ha^{-1} of the purchased STW irrigation water. Overall, it can be inferred that the intensity of purchased STW water among STW non-owners was nearly 131% higher than those among STW owner water purchasers (ref Appendix tables 1 and 2).

4.2 Determinants of Farmers' Participation in GW Market

Demand side

The dependent variable was dichotomous and defined in terms of whether or not the respondent is a water purchaser (WTRPUR=1, if water purchaser; 0, otherwise). Farmers' participation on the demand side of water market model was tested with several combinations of the most frequently affective independent variables. Finally, the most influential independent variables impacting on the likelihood of participating on the demand–side of water market were identified as farm size (FARMSIZE), percentage area under rice (PRARRICE), number of land parcels (LNDPARCL), weighted land parcel distance (WGTDISTN), age of decision maker (AGEDMKR), education of decision maker (EDUDMKR), area under canal irrigation (ARCANL), and five site dummies ($SITED_{2\text{-}6}$)[1] (Appendix 1).

The index of LR, equivalent to a chi square value of 69.36 at 12 degrees of freedom, was found to be significant at 1% level. The sign and significance of the coefficients of the explanatory variables and the LR indicated that the probit model performed well in explaining the variations in response to farmers' participation on the demand side of water market. The significant LR implies that the explanatory variables, taken together, significantly influenced farmers' participation on the demand side of water market. The mean of dependent variable at the sample point was found to be 0.64. The results of MLE and partial probabilities of probit function for the likelihood of farmers' participation on the demand side of water market in the sample households are presented in Table 1.

The goodness of fit of the entire model was tested using pseudo R^2, and a value of 0.147 was obtained. This implies that 14.7% of the original variation of the dependent variable is explained by the model fitted. The unexplained variation might be the result of non-inclusion of some other factors that may influence farmers' decision to participate on the demand side of

[1] Site dummies six districts (n-1), one being control dummy.

water market. The model precisely predicted the farmers' participation on the demand side of water market status in 70.28% of all cases.

Among the regressor variables, farm size was significant at 1% level and weighted parcel distance and age of decision maker were significant at 5% level (Table 1). Variables such as education of decision maker and area under canal irrigation were found significant at 10% level. This implies these variables had significantly influenced farmer's decision to participate on the demand side of water market. Among the five site-specific dummies, Rupandehi and Kanchanpur were negatively significant at 5% and 10% respectively. This indicates that farmers' participation on the demand side of water market in these districts is lower as compared to that in Morang District (as a control case).

Farm size (FARMSIZE) had a strong negative effect on farmers' participation in GW market. Thus people with large farms do not like to purchase water from others because they are financially sound and able to install STW. They prefer to fulfill their water requirements by owning a STW rather than purchasing from others. In other words, farmers with small farm size were more likely to participate on the demand side of water market as compared to a large farm size group. This result is consistent with the findings of Saleth (1991) and Meinzen-Dick (1996) who also concluded that the negative coefficients associated with farm size implied that farmers with smaller farms are more likely to buy GW than those with large farms.

Weighted land parcel distance (WGTDISTN) had a significant positive effect on the likelihood of farmers' participation on the demand side of water market. This is because the distantly located scattered parcels give rise to larger weighted distance. If land parcels are distantly located and farmers seek to maximize benefits from GW irrigation, they would seek more water sellers around. In such cases, it is economical for them to irrigate by purchasing water instead of owning a STW. Thus, as parcel distance increases the probability of participating on the demand side of water market increases as water purchaser.

The age of the decision maker (AGEDMKR) had a significant negative effect on participation on the demand side of water market. Even with more experience in farming, older men do not like to take an active part on the demand side of water market compared to younger men. The younger households with less land were more likely to purchase GW than older households (Meizen-Dick, 1996).

The education level of decision maker (EDUDMKR) showed a negative effect on the probability of participation in GW market. Decision makers with better education and more years of schooling would be in a good position to have access to credit, subsidy, etc., which indirectly encourages them to own a STW, and thus fulfill the water requirement from their own facility instead of purchasing water from others.

Table 1: MLE and Probabilities of Probit Function for the Likelihood of Farmers' Participation on the Demand Side of Water Market, 2003

Variable	MLE Estimate		Marginal Effect[b]		Magnitude
	Coefficient[a]	Std. Error	Coefficient[a]	Std. Error	(ME*SD)
Constant	1.60***	0.61	0.58***	0.22	
FARMSIZE	-0.26***	0.06	-0.10***	0.02	-0.21
PRARRICE	0.01	0.01	0.004	0.003	0.04
LNDPARCL	-0.01	0.05	-0.003	0.02	-0.01
WGTDISTN	0.32**	0.13	0.05**	0.05	0.09
AGEDMKR	-0.02**	0.01	-0.01**	0.002	-0.14
EDUDMKR	-0.03*	0.02	-0.01*	0.01	-0.04
ARCANL	-0.01*	0.01	-0.004*	0.003	-0.05
SITED2	-0.40	0.27	-0.15	0.10	-0.06
SITED3	0.12	0.32	0.04	0.11	0.01
SITED4	-0.49*	0.27	-0.18*	0.10	-0.07
SITED5	-0.31	0.28	-0.11	0.11	-0.04
SITED6	-0.69**	0.28	-0.26**	0.11	-0.10
Log likelihood function (unrestricted)			-200.20		
Log likelihood function (restricted)			-234.88		
Farms correctly predicted			70.28%		
Likelihood ratio for Chi-Square			69.36***		
Goodness of fit (pseudo R^2)			0.147		
Mean predicted probability (P_i)			0.64		
Number of observations			360.00		

[a]***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

[b]Partial derivatives of probabilities with respect to vector of characteristics. They are computed at the mean of independent variables.

The area under canal irrigation (ARCANL) had a significant negative effect on farmer's participation in the GW market from the demand point of view farmers having access to canal irrigation are less likely to purchase GW and canal irrigation is cheaper than purchased STW water.

The marginal changes in farmers' participation on the demand side of water market can be explained by the marginal effect coefficient. The marginal effects are partial derivatives of probabilities with respect to the vector of independent variables and are computed at the means of the independent variables. The MLE estimates of probit regression presented in Table 1 are expressed in terms of the index level. The index values are difficult to interpret, unless they are transformed into probabilities. Thus the –0.26 MLE estimate of farm size indicates that a one-ha increase in land owned would lead to a decrease of a farmer's underlying index Z_i by 0.26 unit, *ceteris paribus*. Similarly, the 0.32 index coefficient of land parcel distance indicates that a one-unit increase in the weighted land parcel distance increases farmer's underlying index Z_i by 0.32 units, *ceteris paribus*. The same interpretation would hold true for the rest of variables.

The effect of each variable on the probability of participating on the demand side of water market could vary, depending on the level of each attribute variable. Therefore, marginal effects are useful to evaluate the effect of each explanatory variable on the probability of market participation (Table 1). The partial probability of farm size was estimated to be –0.10 impling that a one-ha increase in farm size will decrease the probability of farmer's participation on the demand side of water market by 0.10, *ceteris paribus*. The effects of other variables on the probability of farmers' participation on the demand side of water market can be interpreted similarly.

The product of marginal effect coefficient and their respective standard deviation can be used to judge the magnitude of effect of each independent variable on the dependent variable. Among the significant independent variables, the highest negative magnitude of effect on farmers' participation on the demand side of water market was observed with respect to the farm size variable (-0.21).

Supply Side

The dependent variable was dichotomous and defined as whether or not the respondent is a water seller (WTRSALE=1, if water seller; 0, otherwise). It was hypothesized that farmers' participation in GW market through supply side would depend on the net operated area (NETOPRAR), cropping intensity (CRPINT), percentage area under vegetables (PRARVEG), percentage area under wheat crop (PRARWHET), land parcels (LNDPARCL), weighted land parcel distance (WGTDISTN), education of decision maker (EDUDMKR), power source of pump set (POWERE), caste (CASTE), and five site- specific dummies for districts ($SITED_{2\text{-}6}$) (Appendix 1).

The index of LR, equivalent to chi square 28.26 at 14 degrees of freedom, was found to be significant at the 1% level. The sign and significance of the coefficients and LR indicated that the probit model performed well in explaining variations in response to the farmers' participation in the GW market from the supply point of view. The significant LR implies that the explanatory variables taken together influenced farmers' participation on the supply side of water market. The mean of dependent variable for the sample was 0.65. The results of MLE and partial probabilities of probit function for the likelihood of farmers' participation on the supply side of water market are presented in Table 2.

The goodness of fit of the model was tested using pseudo R^2, which gave a value of 0.121. This implies that 12.1% of the original variations in dependent variable is explained by the model. The unexplained variation might be the result of non-inclusion of some other factors, which influence farmer's decision to participate on the supply side of water market. The model precisely predicted farmers' participation on the supply side of water market status in 69.44% of all cases.

Among the independent variables, net operated area was significant at 5% level, and percentage area under vegetables and electric power source were significant at 10% (Table 2). Other variables such as cropping intensity, education of decision maker, and percentage area under wheat were not significant. Among the five site-specific dummies, the coefficient of districts Kanchanpur and Banke were negatively significant at 1 and 10% level respectively. Thus respondents in these districts were less likely to participate on the supply side of water market compared to Morang District (control case).

Table 2: MLE and Probabilities of Probit Function for the Likelihood of Farmers' Participation in the Supply Side of Water Market, 2003

Variable	MLE Estimate		Marginal Effect[b]		Magnitude
	Coefficient[a]	Std. error	Coefficient[a]	Std. Error	(ME*SD)
Constant	2.18*	1.20	0.79*	0.43	
NETOPRAR	-0.16**	0.07	-0.06**	0.03	-0.15
CRPINT	-0.003	0.005	-0.001	0.002	-0.02
PRARVEG	-0.03*	0.02	-0.01*	0.005	-0.09
PRARWHET	-0.01	0.01	-0.005	0.003	-0.07
LNDPARCL	0.07	0.08	0.02	0.03	0.03
WGTDISTN	0.01	0.16	0.005	0.06	0.003
EDUDMKR	-0.01	0.03	-0.002	0.01	-0.008
POWERE	1.13*	0.69	0.28***	0.10	0.06
CASTE	-0.02	0.22	-0.01	0.08	-0.005
SITED2	-0.19	0.41	-0.07	0.15	-0.03
SITED3	-0.58	0.43	-0.22	0.16	-0.08
SITED4	-0.47	0.41	-0.18	0.16	-0.07
SITED5	-0.70*	0.43	-0.27*	0.16	-0.10
SITED6	-1.07***	0.37	-0.41***	0.13	-0.15
Log likelihood function (unrestricted)			-102.41		
Log likelihood function (restricted)			-116.54		
Farms correctly predicted			69.44%		
Likelihood ratio for Chi-Square			28.26***		
Goodness of fit (pseudo R^2)			0.121		
Mean predicted probability (P_i)			0.65		
Number of observations			180		

[a]*** , **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.
[b]Partial derivatives of probabilities with respect to the vector of characteristics, computed at the mean of independent variables.

The net operated area (NETOPRAR) had a strong negative effect on farmers' participation in GW market by supplying water. As the net operated area of the water seller increases, their water requirements become high and would sell less. A rational water seller offers water to others only after fulfilling own requirements. There exists a strong negative relationship between increase in the net operated area and farmers' willingness to participate in the GW market by selling water.

The percentage area under vegetables (PRARVEG) had significant negative effect on farmers' participation in GW market by supplying water. Vegetables require more water than other crops. As the area under such crops increases, the water seller needs more water and

would prefer to sell less. This means the farmer is less likely to participate on the supply side of water market.

The source of power for pump sets was considered a dummy and defined in terms of whether the pump set is operated by electricity. The power source (POWERE) had a significant positive effect on farmers' participation in GW market by supplying water. This relationship could be explained by the fact that, if electricity is available for STW operation, people will run it for more hours compared to fuel-operated pump sets. Because electric energy is cheaper than diesel, there will be more demand from water purchasers as well. Hence, the STW owner is more likely to participate in the GW market by selling more water.

Coming to the marginal changes in farmers' participation on the supply side of GW market, the –0.16 MLE estimate of net operated area means that a one ha increase in net operated area would lead to a decrease in farmer's underlying index Z_i by 0.16 unit, *ceteris paribus*. The interpretation of the dummy variable is a little different. The estimated value of dummy variable for electric power source of pump set operation is 1.13, which means that a change in power source from fuel to electricity would increase the logarithm of odds (Z_i) that farmers will participate in the supply side of the water market by 1.13 units, *ceteris paribus*, and so on.

The effect of each independent variable on the probability of participating on the supply side of water market could vary, depending on the level of each attribute variable. The computed marginal effects are presented in Table 2. The partial probability of net operated area was estimated to be –0.06. This implies that a one ha increase in the net operated area of water seller will decrease the probability of participating on the supply side of water market by 0.06, *ceteris paribus*. The partial effect of power source was 0.28, which suggests that a change from fuel operation system to electricity would increase the probability of a water seller participating on the supply side of water market by 0.28, *ceteris paribus*, and so on.

The magnitude of effect of independent variables on farmers' participation on the supply side of GW market is presented in Table 2. Among the significant independent variables, the highest negative magnitude of effect on the dependent variable was observed with respect to the net operated area (–0.15).

5. Conclusion and Recommendations

The present study attempted an in-depth investigation of GW markets in Nepal with emphasis on collecting reliable and accurate data from sample respondents and from secondary sources. The study collected information from 13 VDCs (out of 395 VDCs) in six districts in Nepal. The survey methods and data reported by respondents based on recall may have its limitations over the real field situation. Hence, the applicability of the findings may be restricted to similar socio-economic conditions and research process. Overall, the study randomly collected primary data from 360 respondents (180 STW owners and 180 STW non-owners) in 2002-03. In terms

of GW marketing, the STW owners were categorized into water sellers-purchasers (46), sellers-nonpurchasers (71), non-sellers-purchasers (5), and nonsellers-nonpurchasers (58), whereas all STW non-owners were water purchasers. The annual operation of STW was 158 hours. A major proportion of the annual STW operation time was used for own-crop irrigations (70%), and nearly 30% of the time was marketed. Thus the findings are subject to changes in the composition of samples. The average annual water purchase was nearly 59.9 hours and sale was 74 hours. Annual water purchase by STW owners was lower compared to the STW non-owners.

The results of probit regression model revealed that the weighted parcel distance positively influenced the likelihood of farmer's participation on the demand side of water market, whereas the farm size, age, and education of decision-makers, and area under canal irrigation had a negative effect. In the case of supply side of water market, the availability of electricity for pump operation had a positive effect, and the net operated area and percentage area under vegetables negative influence. Among the explanatory variables, farm size was the most influential on the demand side, and net operated area on the supply side.

As a policy matter, farm size needs to be consolidated to encourage farmers to establish their own STW. This not only reduces water demand from the water purchaser, but also lowers water price and increases the efficient use of groundwater. It is also suggested to provide electricity access to pump operators which reduces the water extraction cost ensuring water availability at cheaper rates to the needy purchasers. These interventions could partly help in developing groundwater market and equity distribution of irrigation water.

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Appendices

Appendix 1: Determinants of farmers' participation in GW market. The empirical model of the effect of a set of explanatory variables on farmers' participation in GW market through demand and supply side was specified from the following relationships:

$$(WTRPUR)_j = \beta_0 + \beta_1(FARMSIZE)_j + \beta_2(PRARRICE)_j + \beta_3(LNDPARCL)_j + \beta_4(WGTDISTN)_j + \beta_5(AGEDMKR)_j + \beta_6(EDUDMKR)_j + \beta_7(ARCANL)_j + D_{(8\text{-}12)}(SITED_{2\text{-}6})_j + \varepsilon_j \quad (3)$$

$$(WTRSALE)_j = \beta_0 + \beta_1(NETOPRAR)_j + \beta_2(CRPINT)_j + \beta_3(PRARVEG)_j + \beta_4(PRARWHET)_j + \beta_5(EDUDMKR)_j + \beta_6(LNDPARCL)_j + \beta_7(WGTDISTN)_j + D_1(POWERE)j + D_2(CASTE)_j + D_{(3\text{-}7)}(SITED_{2\text{-}6})_j + \varepsilon_j \quad (4)$$

Where:

β_i = vectors of parameters to be estimated
D_i = vectors of parameters to be estimated for dummy variable
ε_j = error term
$(AGEDMKR)_j$ = age of decision maker (yr)
$(ARCANL)_j$ = area under canal irrigation of the j^{th} farmer (%)
$(CRPINT)_j$ = cropping intensity of the j^{th} farm (%)
$(EDUDMKR)_j$ = number of years of schooling of decisionmaker in the j^{th} farm (yr)
$(FARMSIZE)_j$ = landholding of the j^{th} farmer (ha)
$(LNDPARCL)_j$ = land parcels in the j^{th} farm (no.)
$(NETOPRAR)_j$ = net operated area of j^{th} farm (ha)
$(PRARRICE)_j$ = area under rice of the j^{th} farm (%)
$(PRARVEG)_j$ = area under vegetable crops of the j^{th} farm (%)
$(PRARWHET)_j$ = area under wheat crops of the j^{th} farm (%)
$(WGTDISTN)_j$ = weighted average parcel distance of the j^{th} farm (km)

Dummy Variables:

$(CASTE)_j$ = dummy for the caste of the jth farmer (CASTE =1, if the jth family belongs to upper castes Brahmin and Chhetri; 0, otherwise)
$(POWERE)_j$ = dummy for power source (POWERE =1, if pump set is electricity- operated; 0, otherwise)
$(SITED2)_j$ = dummy for Dhanusha district ($SITED_2$ =1, if the observation is from Dhanusha ; 0, otherwise);
$(SITED3)_j$ = dummy for Parsa district ($SITED_3$ =1, if the observation is from Parsa; 0, otherwise)
$(SITED4)_j$ = dummy for Rupandehi district ($SITED_4$ =1, if the observation is from Rupandehi; 0, otherwise)
$(SITED5)_j$ = dummy for Banke district ($SITED_5$ =1, if the observation is from Banke; 0, otherwise)
$(SITED6)_j$ = dummy for Kanchanpur district ($SITED_6$ =1, if the observation is from Kanchanpur; 0, otherwise)
$(WTRPUR)_j$ = dummy dependent variable for water purchaser (WTRPUR=1, if respondent is water purchaser; 0, otherwise) and
$(WTRSALE)_j$ = dummy dependent variable for water seller (WTRSALE=1, if respondent is water seller; 0, otherwise)

Appendix Table 1. Salient features of STW water purchasers in districts, Nepal, 2003

Feature	Unit	N=231		N=360	
		Mean	SD	Mean	SD
Farm size (FARMSIZE)	ha	1.77	1.27	2.22	2.09
Area under rice (PRARRICE)	%			47.23	11.04
Land parcel (LNDPARCL)	No.			3.38	1.69
Average parcel size	ha			0.64	
Weighted land parcel distance (WGTDISTN)	km	0.78	2.30	0.69	1.89
Age of household head (AGEDMKR)	yr	46.46	13.26	48	13.58
Education of decision-maker (EDUDMKR)	yr	5.01	4.11	5.31	4.16
Area under canal irrigation (ARCANL)	%			47.23	11.04
Site dummy (SITED2-4)	Dummy			0.17	0.37
Cropping intensity	%	196.29	28.42		
Water purchase	h yr^{-1}	58.89	21.10		
Water purchase price	Rs h^{-1}	76.13	26.63		

Appendix Table 2. Salient features of STW water sellers in districts, Nepal, 2003

Feature	Unit	N=117		N=180	
		Mean	SD	Mean	SD
Net operated area (NETOPRAR)	ha	2.36	1.68	2.65	2.51
Cropping intensity (CRPINT)	%	202.42	23.93	202.16	24.26
Area under vegetables (PRARVEG)	%			4.41	8.51
Area under wheat (PRARWHET)	%			28.50	13.83
Land parcel (LANDPARCL)	No.	3.74	1.71	3.70	1.69
Weighted land parcel distance (WGTDISTN)	km	0.54	0.76	0.56	0.68
Education of decisionmaker (EDUDMKR)	yr	5.44	4.06	5.48	4.18
Dummy for power source (POWERE)	1,0	0.07	0.25	0.05	0.22
Dummy for caste (CASTE)	1,0			0.61	0.49
STW operation	h yr^{-1}			158	
STW use for own crop irrigation	h yr^{-1}			109.8	
STW use for sale	h yr^{-1}			48.4	
Water sale	h yr^{-1}	74.40	68.63		
Water sale price	Rs h^{-1}	84.15	20.93		
Age of household head	yr	51.50	14.43		
Farm size	ha	2.48	1.71		

Patterns of Public Research Investment in Agriculture: The Case of Rice Research in Nepal

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Abstract

Public investment in agricultural research is essential for generating productivity growth and reducing rural poverty. However, recently the public sector investment in agricultural research has been slowing down in the developing world. This study analyses the patterns of public investment in agriculture research with an empirical study of rice, which is a principal food crop of Nepal. The resource allocation for rice research was approximated based on the full-time equivalent of researcher time spent on rice research. A simple congruence model modified by the expected rate of research progress and equity criteria was used to investigate the gap between the actual and normative research investment patterns. The results show a substantial underinvestment in rice research in general but more so in the Terai agro-ecological region. The use of modifiers such as the expected research progress and equity criteria amplified the extent of underinvestment in Terai. The paper provides options for addressing these imbalances in resource allocation and suggests raising the level of research funding in rice as well as overall agriculture research in Nepal.

JEL Classification: Q 160, Q 180, Q 280, Q300

Key words**:** Agricultural research, Congruence analysis, Public investment, Resource allocation, Rice research

1. Introduction

Public investment in agricultural research has contributed significantly to productivity growth and rural poverty reduction in many developing countries (World Bank, 2008; Fan *et al.*, 2007; Fan, 2008). Alston *et al.* (2000) provide evidence of a high rate of return from investment in agricultural research and development (R & D) from a Meta-analysis of 292 case studies conducted in several countries.

However, in recent years, the public-sector investment in agricultural research in developing world has been slowing down because of shifts in public policies and priorities toward structural reforms, environmental concerns, and human health (Alston and Pardey, 2006; Pardey *et al.*, 2006). Policy bias, market failure, and high opportunity cost of scarce resources in

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developing world are the most important reasons for such low investment (Alston *et al.,* 1998; Pardey *et al.*, 2006; Bezemer and Headey, 2008). Moreover, in the low income developing world, not only is the absolute magnitude of funding of resources declining but also the uncertainty and policy direction of this funding have changed over the years (Pardey *et al.*, 2006).

Agricultural expenditure as a percentage of Agricultural Gross Domestic Product (AGDP) measures government spending on agriculture relative to the size of sector. This measurement is very important because agriculture remains the largest sector of the economy in Nepal. Agriculture still accounts for one-third of GDP and employs two-thirds of the population in Nepal (MoF, 2009). The investment in agricultural research is essential to generate productivity growth and spur economic growth. However, underinvestment is a pervasive problem in agricultural research in the country. Estimates show that the current public agricultural research investment intensity[1] in the country is very low, about 0.20% of the AGDP (Gauchan and Pandey, 2011a) which has further declined in recent years.

At present, decisions on public investments in agricultural research and resource allocation across commodities are based mainly on the past spending patterns, donor interests, and political motivations, without adequate analysis of the potential impact of research on efficiency gains and poverty reduction across the regions and target group of farmers. There is thus a need for scientific, more explicit, and evidence-based processes for empirical analysis of public research investment patterns to inform and influence policy decisions on research investments. The purpose of this study is thus to contribute to a more informed decision-making process in agricultural research through an analysis of the allocation of resources across production environments, done by using a modified congruence approach.

The paper is organized as follows. The first section gives background information about public investment patterns in agricultural research in Nepal. This is followed by an empirical case study on rice research investment with a brief description of the importance of rice, agro-ecological environments, rice research organizations, and patterns of rice research expenditure in the country. The next section presents the methodology for assessing rice resource allocations. Then, the results of congruence analysis are discussed. Finally, conclusions and recommendations are given.

2. Public Investment Patterns in Aagricultural Research

Agricultural research in Nepal has historically been a public sector responsibility. Private sector agricultural research is nonexistent (Gauchan *et al*., 2003; Stads and Shrestha, 2006; NARC,

[1] Research intensity of investment is defined as the ratio of research investment to the value of agricultural production. This measure is preferred to absolute levels of expenditure to make the country's agricultural R&D efforts easily comparable within international contexts (Beintema and Stads, 2008).

2010). The current funding method for agricultural research is in the form of block grants provided through the Ministry of Agriculture and Cooperative (MoAC) to public research institutes such as Nepal Agricultural Research Council (NARC). The amount of grant allocated to research depends mainly on the past resource allocation, spending patterns, and total public allocation to agriculture with limited consideration research priorities, research productivity, or research planning in general (ITAD, 2005).

Since agricultural research has a long gestation period and its impact is not immediately observable to policymakers, the resource allocation pattern for agricultural research has historically been low, despite the government's declaration of priority given to the agricultural sector in various plans and policies (Yadav, 1987; Thapa, 1994; Upadhyay, 1996; ITAD, 2005; Sharma, 2009). The allocations of agricultural budget in relation to the share of AGDP have remained constant over the last one decade, whereas the total amount of agricultural funding fluctuated in different years during the period (Table 1). Estimates show that public allocation to agriculture[1] as a whole accounts for less than 3% of the national budget and 4% of the value of agricultural output, in spite of its importance in the national economy (Sharma, 2009; MoF, 2009). Furthermore, the trend of investment in agricultural research has declined in recent years both as a percentage of AGDP, and in real value terms. In 2000-01, the government allocated about 8% of its agricultural expenditures in research, which subsequently declined to around 4% in 2007-08. Similarly, the share of public research expenditures in AGDP allocated to NARC declined from 0.35% in 2001-02 to 0.16% in 2007-08. Thus, the current share of public research expenditures is very low relative to the investment of 0.6% on average in developing countries and 2.35% in developed countries (Beintema and Stads, 2008). The principal reason for such a drop in agricultural research spending in Nepal over the last eight years was the lack of major donor support for agricultural research after the phasing out of the World Bank-funded Agricultural Research and Extension Project in 2002 (Gauchan and Pandey, 2011a).

Table 1: Trend in Public Agriculture R&D Budget (% of AGDP current prices)

Year	AGDP (US$ billions)	Budget for agriculture (US$ million)	Agriculture budget as % of AGDP	Budget for agri-research (US$ million)	Research share in agriculture budget (%)	Research budget in AGDP (%)
2001-02	2.24	104	4.60	7.81	7.53	0.35
2002-03	2.34	82	3.50	4.23	5.18	0.18
2003-04	2.51	86	3.40	4.06	4.72	0.16
2004-05	2.69	92	3.40	4.21	4.58	0.16
2005-06	2.86	102	3.60	3.98	3.92	0.14
2006-07	3.06	124	4.10	4.79	3.86	0.16
2007-08	3.50	143	4.10	5.61	3.91	0.16

Source: Data derived from MoF (2009) and NARC (2009).

[1]Agriculture expenditures in Nepal reflect those allocated for agriculture, irrigation, and forestry. Agriculture specifically covers agricultural R& D for crops, horticulture, livestock, and fisheries, agricultural cooperatives, and seeds and fertilizers.

3. The Case Study of Rice

3. 1 Justification for Choosing Rice

Rice is chosen for this study because it is the principal food crop in the country and a major source of livelihood for two-thirds of the rural households, based on the number of families who cultivate paddy. It is currently grown on half of the total cropped area and accounts for more than half of the total food grain production in the country (MoAC, 2009). Rice accounts for one-fifth (20%) of the agri-GDP and supplies about 40% of the food calorie intake. The milled rice consumption is about 100 kg/ capita/ year (FAOSTAT, 2008).

During 1961-2008, rice production grew at a lower rate (1.8 % per annum) compared to the population growth rate of over 2 %/ annum (Gauchan and Pandey, 2011b). The sluggish growth in rice production is caused by the predominance of rain-fed areas that are frequently affected by inadequate and untimely rainfall. In addition, productivity growth is constrained by the limited development and adoption of new technologies, which would be suitable to the diverse production environments in the country. Consequently, a fairly large volume of rice is being imported from India during unfavorable years to meet the food security needs of the population, particularly in the remote hills and mountain districts, and the burgeoning urban populations.

3.2 Agro-Ecological Environments

Rice is grown in different ecological environments in Nepal from the lowland in Terai (50-300 meters average sea level or m asl) to the Hills (>300-1,500 m asl) and Mountains (>1,500-3,000 m asl). The share of rice area, production, and yield varies by these ecological regions (Table 2). Rice is largely produced in the Terai as it has a flat lowland topography and suitable climatic conditions. In the Hills and Mountains, rice is mainly grown in river valleys, foothills, hill terraces, and mountain slopes, up to as high as 3,000 m asl in Jumla valley (NARC, 1997). The Terai has the largest area (71%) and production share (73%), followed by the Hills (24%). The Mountain region accounts for a small proportion of area (4%) and production (3%) in the country, which is less than the share of populations in the later. Yield is also higher in the Terai (2.8 t/ha) than in the Hills (2.6 t/ha) and Mountains (2.0 t/ha). Considering the high production potential of rice in the Terai, the agricultural perspective plan (APP) 1997-2016 has given special priority to this region for enhancing the cereals foodgrains production and reducing poverty (JMA/APROSC, 1995).

Table 2: Rice Area and Yield by Ecological Region (Av for 2006/07–2008/09)

Ecological Region	Area		Production		Yield
	(000 ha)	Percent	(000 Mt)	Percent	(t/ha)
Mountain	63.7	4.21	124.9	3.0	1.96
Hills	382.1	25.22	1,005.1	24.1	2.63
Terai	1,068.8	70.56	3,037.8	72.9	2.83
Nepal	1,514.7	100.0	4,167.9	100.0	2.75

Source: MoAC (2009)

3.3. Organizations Involved in Rice Research

NARC is the sole public organization in Nepal that conducts rice research based on public financing in the country. Rice research is also done by LIBIRD (Local Initiatives for Biodiversity Research and Development) and FORWARD (Forum for Rural Welfare and Agricultural Reform for Development) through the funds and resources they obtained mainly from bilateral donors and international research agencies but not through public funding from Nepal. The Institute of Agriculture and Animal Sciences (IAAS)/ Tribhuvan University has mandate for mainly teaching, and research on rice is not a regular phenomenon through public funding.

Rice research in Nepal dates back to the early 1950s with the collection and evaluation of 930 rice germplasm accessions on the agricultural research farms of Parwarnipur and Khumaltar in Bara and Lalitpur districts, respectively (Mallik, 1981). However, a systematic coordinated rice research program on rice began only in 1972 with the establishment of the National Rice Improvement Program (NRIP) in Parwanipur, Bara District. The NARC central disciplinary divisions located in Kathmandu and regional agricultural research stations located in different ecological and development regions are mandated to implement their own rice research activities to assist in the national on-station and on-farm varietal testing process as well as to provide the technological information to farmers and other clients.

3.4 Patterns of Rice Research Investment

At present, there is no clear scientific process for the allocation of core research funds to rice research in the country. The allocation of resources for rice research depends on the total amount of the block grant that NARC receives annually from the government, and depending on the number and quality of the research proposals submitted by researchers within the organization. The proposals and budget proposed for rice research have to compete with other commodities and sectors. These proposals are screened internally through the annual program review. The current budget allocated to rice research is extremely low, which has also declined in real value terms in recent years (Table 3). For the period of 2001-08, about 2-6% (average of 4%) of the total operational[1] agricultural research budget was allocated for rice despite the vital share of rice output (20%) in AGDP. According to NARC, the allocation for rice in 2008-09 (in constant price) was 2.21% of the actual operational research budget, which was less than the budget allocated for fishery, commercial crops, and other commodities, which are nationally less important in the static sense (NARC, 2009).

Analysis of the recent data (2001-08) shows that rice research received about 13% of the total food crop research budget and 4% of the total agricultural research budget, which is not in

[1]The operational budget in agricultural research and rice research includes the actual amount allocated for core research activities after deducting from its staff salary, capital, and administrative expenditures.

keeping with the share of rice in half of the food crop output and 20% of the AGDP. An estimation of rice research intensity indicated that the current investment on rice research is only about 0.021% of the value of rice output. Furthermore, the share of rice research expenditures in the both total food crop and agricultural research expenditures has declined over the years. In real price, the share of operational research budget for rice is even lower, that is, about 2% of the total research budget in 2008. Moreover, this public spending declined from the 5.7% in 2001-02 to about 2% in 2008-09. Past evidences show that the proportionate share of rice research budget in total crop budget was higher in the early 1970s and 1980s than in the 1990s (Upadhyay, 1996).

Table 3: Budget for Rice Research and Total Agri-Research (constant US$)

Year	Budget for agricultural research (US$000)	Operational agricultural research budget (US$000)	Operational food crop research budget (US$000)	Operational rice research budget (US$000)	Rice research to operational agri-research budget (%)
2001-02	7,808	2,541	739	146	5.70
2002-03	4,073	1,222	306	50	4.10
2003-04	3,792	1,253	463	47	3.80
2004-05	3,769	1,273	498	66	5.21
2005-06	3,355	947	373	41	4.27
2006-07	3,773	1,182	417	51	4.34
2007-08	4,095	1,318	453	49	3.69
2008-09	4,668	1,200	334	27	2.21

Note: Real price is obtained by using GDP deflator for 2001 as a base year (IMF, 2009). The local currency NRs is converted to US$ using the US$1=NRs 74.0 for the study period.
Source: Data derived from NARC (2009).

The big gap between total agricultural research budget and actual operational agricultural research budget shows that a high proportion of resources are allocated to staff salary and administrative expenditures than to real research activities. This operational agricultural research budget is about 30% of the total budget allocated for agriculture in recent years (average of 2001-08). This shows that, within the limited budget, the expenditures allocated to and available for research in agriculture and in rice are very low.

4. Research Methods

4.1 Assessment of Rice Research Expenditures

This study employs analysis of the resources allocation for rice by ecological production environments (Terai, Hills, and Mountains) for the reference year 2008-09. We used a proxy measure for research expenditures, namely, the total scientific time invested in rice research on a full-time equivalent (FTE) basis, because the data on actual value of research expenditures on rice by ecological regions, discipline, and thematic areas are currently not available in Nepal.

The FTE estimates were obtained by a survey of rice researchers (n=37) involved in the main public research organization. The estimation of full time equivalents (FTEs) through surveys is a standard practice in the literature (Beintema and Stads, 2010) due to the lack of other alternative satisfactory ways of reliably estimating these inputs. The scientists were requested to consider their time invested in rice research only, not in management and other research activities[1].

4.2 Congruency Method

Economists use various economic methods and tools that are mainly founded on the application of the economic surplus approach for guiding the allocation of research resources (Byerlee and Morris, 1993; Alston *et al.,* 1998; Pandey and Pal, 2007). The approach demonstrated by Fuglie (2007) provides an example of a more complete economic surplus model and the data intensity needed to implement such an approach. These models obviously cannot be applied for Nepal because of the lack of relevant data. A simple, transparent, and commonly used procedure is based on the economic congruency rule, which generally implies that the importance of a commodity in agricultural research should be proportional to the importance of the commodity in the national economy. This rule maintains that the research resources should be allocated in proportion to their contribution to the value of production across production regions, ecosystems, and commodities, and among disciplines. Following Byerlee and Morris (1993) and Pandey and Pal (2007), congruency can be measured as

$$C = 1-\sum_i (R_i - V_i)^2,$$

Where,

C is the value of index,

R_i is the share of the ith region in the total rice research budget, and

V_i is the share of the ith region in the total value of rice output.

The greater the mismatch between the value of production and research expenditure shares, the lower the value of C (index). By definition, the value of C is between 0 and 1. This standard congruency analysis is based on the current share in the value of production of rice as the sole indicator of relative economic importance across the rice production environments in future.

Standard congruence analysis does not take into account the differential rate of future research progress, likely adoption rates, and likely differential impact on equity, and the environment across production environments (Byerlee and Morris, 1993; Alston *et al*., 1998; Pandey and Pal, 2007). To account for the future rate of research progress and incidence of poverty (equity), the simple congruence model was modified using two weighting procedures.

[1] Except for a few scientists who are exclusively assigned to a particular line of research in a commodity, most scientists in Nepal manage a portfolio of research and administrative tasks that can span several commodities or areas of work. Hence, estimates of time allocations are best obtained from the scientists themselves, which were later cross-validated with other sources of information.

The first one consisted of an efficiency criterion related to the expected payoffs to rice research expenditures, while the second one is an equity criterion related to expected distributional effects of technical change. As proposed by Alston *et al.* (1998), the scoring rules provide ways of incorporating suitable weights to the current value of production to account for these considerations. These weighted shares are used instead of the simple production shares to apply the congruency rule specified above. The two major considerations used to modify the simple congruence rule are outlined below.

Rate of expected research progress for rice: The expected rate of research progress is a commonly used modifier to the simple congruence rule (Byerlee and Morris, 1993; Pandey and Pal, 2007). Since the research progress is historically varied among the ecological regions (Hills, Mountains, Terai), a modification in the congruence analysis was made based on estimates of expected future progress in rice technology development in each of the ecological regions. The expected rate of future progress was based on the expert knowledge of scientific staff involved in research and research managers who would consider the current trends in productivity growth in different production environments, the technologies that are in the pipeline, and the relative potentials for productivity gains across production environments. The Terai region is more likely to show a higher rate of research progress because of its flat topography, abundance of groundwater resources, and potential for commercialization (ITAD, 2005; Gill, 1996; Upadhyay, 1996; JMA/APROSC, 1995). This region also has a higher potential for productivity gains in rice from the dry-season cropping. The mountain region has the lowest expected research progress because of its harsh climatic (low temperature), as well as physiographic (steep slopes) and market (inaccessibility) constraints. The expected yield gains relative to the current values were estimated through expert consultation as 30% for Terai, 20% for Hills, and 10% for Mountains. A group consensus estimate was used for analysis. A sensitivity analysis was conducted with respect to the estimates of expected yield gains to examine the robustness of results.

Incidence of poverty across ecological regions: Standard congruence analysis was also modified based on the equity considerations as poverty rates vary among the Hills, Mountains, and Terai regions. The living standards survey shows that the incidence of poverty is higher in the Hills and Mountains than in the Terai (CBS/NLSS, 2004). One of the major justifications for investing in research targeted at unfavorable environments (e.g. Hills and Mountains) is the higher incidence of poverty in these less favored environments (Byerlee and Morris, 1993; Palmer-Jones, 2000; IRRI, 2007). Therefore, the poverty consideration is included in the model by assigning a greater weight to the value of production for unfavorable production environments (e.g., Hills and Mountains). Official statistics on current poverty rates based on the NLSS of 2003-04 were used in the model. This shows that the poverty rate in the Mountains (35%) and the Hills (33%) is higher than in the Terai region (28%). Based on these reference data, the relative poverty weights of unity for Terai, 1.25 for Hills, and 1.20 for Mountains were used.

5. Findings

5.1 Allocation of Resources in Rice Research

Resources for public research in NARC for rice and other agricultural commodities are allocated based on proposals from researchers for working on a particular thematic area, discipline, production region, or ecosystem. The human resource capacity in rice research is currently limited, even though NARC has a fairly good number of researchers[1] in total (474). Data show that only 50 researchers are involved in rice research across the country either full- or part-time (Table 4). Out of the 50 researchers involved in rice research, only 10 were involved on a full-time basis. The rest (40 researchers) provide less than half of their time in rice research. Plant breeding and agronomy accounted for the highest proportion of FTE researchers.

NARC has a uniform level of research support across the regions and ecosystems even on a per FTE basis. Hence, the expenditures per unit of researcher time remain constant across the ecological regions. The analysis of budget expenditures allocated to rice research per FTE researcher was estimated to be about US$ 5,930 at current prices. This budget covered the current operational research costs, salary, research support staff, and administrative and capital costs. Staff salary accounted for a large share of total costs (51%) although the amount allocated for a researcher's salary is very small by regional and international standards. The resource allocated per scientist for rice research in a neighboring developing country (India) was estimated to be US$ 15,780 for eastern India and US$ 21,110 for the rest of India in FY 2000 (Pandey and Pal, 2007). This was much higher than the figure estimated for Nepal.

Table 4: Full-Time Equivalent Researchers and Expenditure (US$)

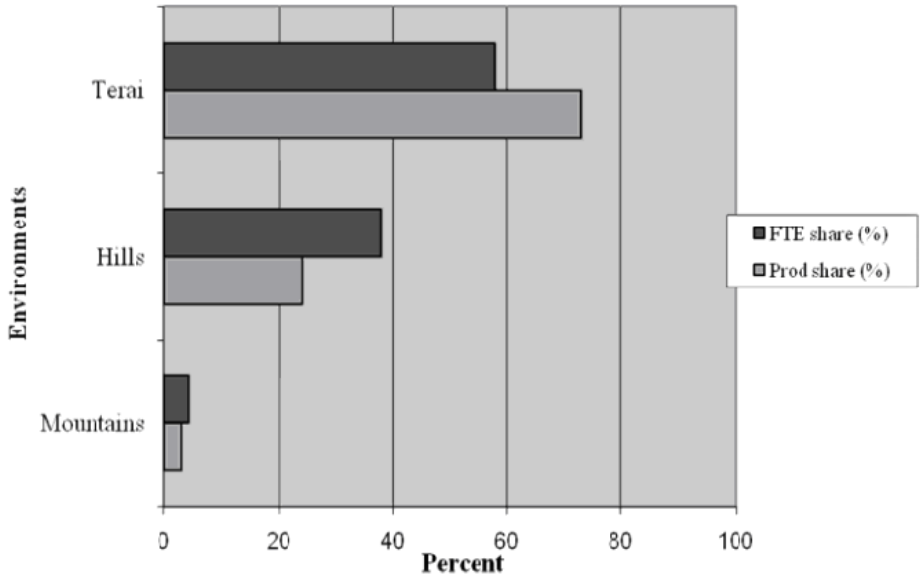
Research Time	Researchers involved in rice research (Nos)	Allocation of time in rice research (%)	US$ per Researcher
Full-time in rice research	10	100	-
Part-time in rice research	40	38.6	-
All	50	49.6	5,932

Note: US$1=NRs 74.0.

The current pattern of allocation of rice resources in terms of FTE indicates that the Terai region received fewer resources (58%) compared with its area and production share (73%) in the country (ref Fig 1). The Hill region received more resources (38%) than its share of production (24%). The Mountain region also received slightly higher resources in terms of production share, but it was almost comparable in terms of area share at the national level.

[1]Researchers in NARC comprise about 167 scientists and 307 technical officers in 2009 (NARC, 2009). In 2003, a total of 331 FTE researchers were working in NARC (Stads and Shrestha, 2006).

Fig 1. Share of rice production and FTE Resources



5.2 Results of Congruence Analysis

The results of congruence analysis across agro-ecological regions are presented in Table 5. The aggregate resource allocation reported here is based on FTE of researchers employed by NARC. A higher congruence value (95%) for the agro-ecological regions was obtained from the analysis of simple congruence rule. This shows that the FTE allocations in rice research among agro-ecological environments were pretty close to their respective actual (unadjusted) shares in the value of output produced. The analysis also showed that the Terai region was under-invested by 15 percentage points (it received 58% of its resources versus 73% of the production share). However, the Hill region received moderately higher resources (14% points) of the FTE allocation compared with its actual production share. The higher allocation of resources currently in the Hill region reflects the concentration of many disciplinary research programs and bulk of the scientists in the Kathmandu valley (Hill region) and a very low number of full-time rice scientists working in the Terai.

Congruence results are affected somewhat in the Terai and Hill regions by the use of a modifier for equity and potentials for research progress. When the effects of equity weights and the weights assigned for research progress were combined, this raised the congruence value to 97% from the original FTE value of 95%. However, when only the effect of research progress

was considered, the pattern of under-investment in the Terai was amplified, resulting in a lower congruence value of 95% and 17% point lower allocation of resources. The imbalance in research resource allocations to the Terai and Hills was reduced slightly when adjusted for equity. The investment pattern in rice research for the Mountains almost coincided with its value of total rice production. Therefore, the analyses based on adjusted weights indicate the need for a slight reallocation in favor of the Terai against the Hills.

Table 5: Production Shares and Allocation of Rice Research Resources

Production environment	Production share (%)	FTE share (%)	Adjusted for research progress & equity (%)	Adjusted for research progress only (%)	Adjusted for equity only (%)
Terai	72.90	57.92	70.24	74.61	68.62
Hills	24.12	37.90	26.82	22.79	28.39
Mountains	3.00	4.28	2.94	2.60	3.39
Congruence (%)		*95.49*	*97.23*	*94.90*	*97.94*

One of the options to improve the congruence estimates would be to reallocate some research resources from Hills to Terai. However, considering the very limited amount of resources currently allocated in the Hill region, it will not be very meaningful to shift and reallocate resources from one production region to another. It would be more desirable to increase the FTE and proportionate budget in the Terai region for correcting the current imbalances.

We also investigated the magnitude of the adjustment using "what if" scenario analyses. An increase from the current 14 FTE to 24 FTE (58% to 69%) researchers in the Terai would reduce the imbalances. The additional cost of this strategy would be only US$ 60,000 at the current prices. This is a small investment to correct the existing imbalance, but it should be noted that the current level of investment per FTE is still very low, about US$ 6,000. This is clearly insufficient given the share of rice in GDP.

To examine the robustness of our key findings, we conducted sensitivity analyses with respect to the key parameters, such as the expected rate of yield growth and equity weights across the production environments/ regions. Although this led to some changes in the numerical results, the main conclusion we reach is that the overall investment in rice research is too low in Nepal and that the total investment in rice research in Terai, which is the main rice bowl of the country, is lower relative to other agro ecological environments.

6. Conclusion

An optimum level of public investment in agricultural research is essential for generating productivity growth and reducing rural poverty. However, the recent trends indicate that public sector investments in agricultural research have been very low and are declining. Resource allocation in rice research in this paper is approximated by the full-time equivalent of researcher

time spent on rice research covering the three agro-ecological production environments. Results suggest that there is substantial under-investment in rice research (and agricultural research in general). In terms of region-wise allocations, Terai region has received lower priority than the Hills. The use of modifiers such as the expected research progress and equity criteria slightly altered these results, but the overall conclusion is: There is under-investment on rice in Terai relative to other agro-ecological regions. This finding also suggests that currently, limited scientific and economic principles are adopted in allocating research resources across the crops and agro-ecological zones.

Although an optimal public allocation of research resources across agro-ecological regions and commodities is important, it is even more important to raise the overall level of research funding for rice research, which has remained historically low and on a decline in recent years. Past and present trends in research expenditure patterns suggest that, historically, agricultural research in Nepal has received a low priority in spite of its major role in generating new technology to enhance and sustain productivity growth in agriculture and reduce poverty. There is always the presumption among policymakers and planners that agricultural technologies can be easily borrowed from outside countries, and transferred (Yadav, 1987). But even for borrowing and adapting technologies from outside, the technical capacity required is limited in Nepal. The National Rice Research Program (NRRP) currently suffers from very limited resources and insufficient technical capacity to conduct and coordinate research activities, and to strengthen ties with the national and international centers.

7. Recommendations

The current pattern of under investment on research calls for increased funding for public agricultural research in Nepal. As an internationally accepted norm, at least 1% of AGDP needs to be invested in agricultural research to spur agricultural growth in the country. Focus should be given for the allocation of relatively more resources to rice research and for the Terai agro-ecological region for reducing the current underinvestment bias. In addition, investments are needed also to develop technologies suited to higher temperature and more frequent extreme weather patterns, expected because of the global climate change.

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Rice Marketing Practices and Constraints in Nepal

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Abstract

This study aims to analyze rice marketing practices and constraints in Nepal using cros-section data collected in 2008. The results reveal that marketing channel is somewhat complex and lengthy due to the presence of several marketing intermediaries. This makes marketing process cumbersome and adds to the overall marketing cost. The major sources of marketing information are traders who have a leading role in price determination. Farm level price is constrained by the price controlling ability of these leading traders, while the wholesale and retail markets are influenced by the price of imported rice from India. Improvement in the efficiency of marketing system is possible through policies that facilitate entry of more traders in the market, improvements in marketing infrastructures (road network and storage facilities), and rapid dissemination of marketing information.

JEL Classification: D4, L1, Q1

Key Words: Rice marketing, marketing practices, marketing information, marketing constraints.

1. Introduction

A proper solution to the rice marketing constraints as suggested in this article would be very helpful for the benefit of producers, consumers, and rice promotion in Nepal. This is because rice is the major staple crop that accounts for more than 50 percent of the total food production in the country. The total production of rice was four million tones in the total area of 1.5 million hectares in 2009/10 (MOAC, 2010). The Terai belt (plain area) is agro-ecologically and climatically highly suitable for rice production. Specifically, Morang, Jhapa, Rupandehi, and Chitwan districts are on the top rank in terms of quantity of production and marketing activities, which influence the overall rice market in Nepal.

Inefficient marketing practices hurt both producers and consumers even though such practices may benefit traders to a certain extent in the short run. However, all the parties in the market lose in the long run due to overall marketing inefficiency. The price of rice mainly depends on the price of paddy as determined by local large millers and traders, and the prices in the bordering Indian markets (Singh, 1999). Paudyal and Singh (2008) cite instances when millers and wholesalers brought in low quality rice from the Indian market, mixed it with Nepali

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rice at a ratio of 75:25, packed these goods using the Nepali brand, and sold such mixed products in the local market at a higher price. Such behavioral patterns indicate substantial inefficiencies in the marketing system. An improved understanding of the nature of overall marketing system, and adequate identification of the key sources of inefficiencies and constraints on the evolution of a competitive system are needed for marketing reforms. The present study draws from the thesis works of the main author and additional information since then.

The main purpose of this study is to analyze marketing practices and the constraints encountered in rice marketing in Nepal. In that regard, this paper provides a descriptive analysis of the marketing intermediaries, marketing channel, and price determination in Nepal's rice markets. Some policy implications follow, based on the analysis.

2. Methodology

A cross-sectional sample of 300 marketing units comprising farmers (100), wholesalers[1] (100), and retailers (100) was used to collect information on the rice marketing systems in 2008. Semi-structured questionnaires were used to collect information from four districts (Jhapa, Morang, Chitwan, and Rupandehi). The sample respondents of farmers and retailers were selected from the identified wholesaler respondents by asking them to identify both suppliers and the purchasers. The flow of the product was traced forward and backward for selecting farmers and retailers randomly. Besides, a rapid marketing appraisal (RMA) and key informant interviews were carried out to explore the issues on problems, policies, and possible recommendations. Thus, policymakers, local leaders, government officials, and farmer/trader organizations participated in the RMA.

The price of paddy was adjusted by the average milling recovery (63.71) to get the prices in rice equivalent for making price comparison consistent. The farm prices of paddy collected from each respondent were adjusted by multiplying with a certain factor of an average head rice recovery percentage[2]. The number of respondents reported in the table was converted into percentage. In some cases, the total number of respondents reported is more than 100 because some respondents had multiple choices.

[1] In this study, 60 wholesaler respondents purchased rice from 100 farmer respondents and sold to 100 retailer respondents. Therefore, the number of wholesaler respondents was regarded as 100.

[2] Adjusted farm gate price of rice = (1/head rice recovery percentage)*farm gate price of paddy.

3. Result and Discussion

3.1 Marketing Intermediaries

Marketing intermediaries are defined as marketing agents who are involved from production onward up to the retail market level. The most common marketing intermediaries are paddy assembler, miller, wholesaler, and retailer. Additionally, there are other two major marketing agents such as Gola and stocker. A *Gola* is a big commission agent who has a big business network composed of assemblers, millers, and other traders in various different market hubs where transaction for paddy and rice marketing takes place. The gola controls the whole paddy and rice market by determining the price and disseminating marketing information inside and outside market centers. Stockers are marketing agents who stock paddy or rice for a certain period and supply it to other districts, particularly in the hills, mountains, and urban areas.

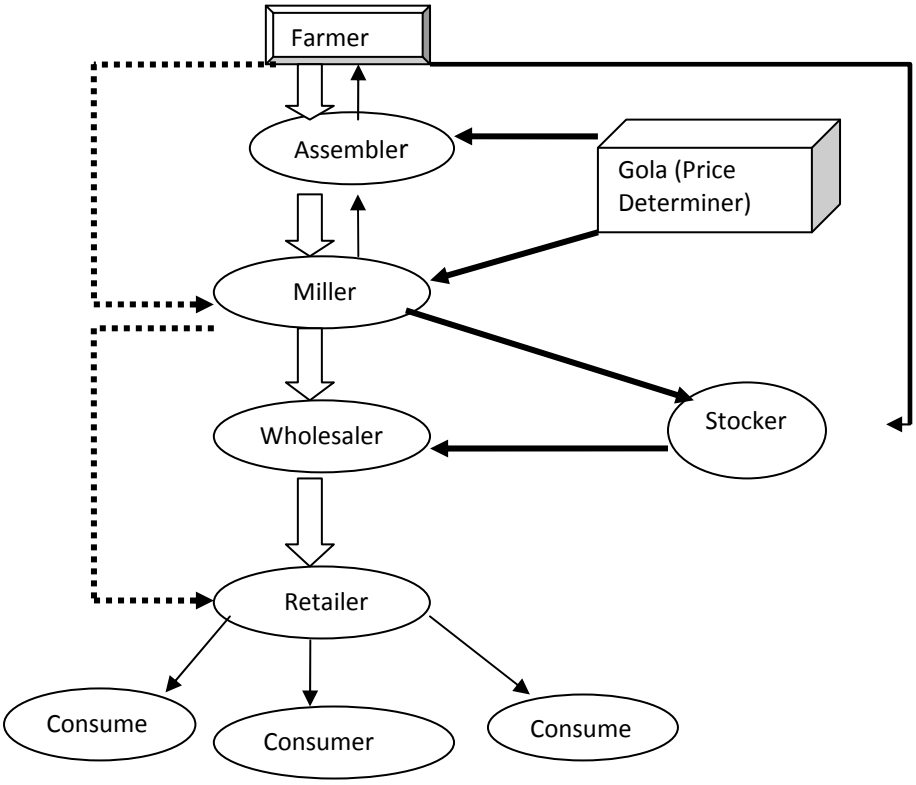
Milling is a major means of value addition through transformation of paddy to rice. The milling industry is owned and operated by the private sector and is not controlled in anyway by the government. There are two types of wholesalers; first, the millers who mill rice and supply it directly to retailers or consumers, and second, those who purchase milled rice from rice millers and sell it to retail markets. The retailer is the last agent in the channel in the marketing system for reaching the consumer. The retailer buys rice either from the wholesalers or the millers.

3.2 Marketing Channel

Marketing channel represents the linkages among marketing agents in the rice marketing chain from producer to consumer. Marketing channels differ in the selected districts. This is more complex in the eastern region than in other parts of the country because more marketing agents are involved, especially in the paddy marketing stage. There is also an indirect but significant role played by the *gola* in influencing the process of price determination. Figure 1 shows the common marketing channel for rice in Nepal for the four districts:

- Jhapa: Farmer – assembler – *gola* – miller – wholesaler – retailer – consumer
- Morang: Farmer – assembler – *gola* – miller – wholesaler – consumer
- Chitwan: Farmer – assembler – miller – wholesaler – consumer
- Rupandehi: Farmer – miller – retailer – consumer.

Fig 1: Common Rice Marketing Channel in Nepal, 2008/09



Thus, the marketing channel of rice in the western region is shorter than in the eastern region. The eastern region is the major area in terms of production and supply of paddy to all other major parts of the country and the quantity of rice handled by the marketing channel is substantial. Overtime, Biratnagar as the largest city in the eastern zone, has evolved as the regional marketing hub, which substantially influences the overall rice and paddy market in the country.

3.3 Marketing Information Services

Marketing information services consist of the provision of information on price, supply, and demand to the corresponding marketing agents like farmers, wholesalers, and retailers. This study considered three sources of information namely: traders, government institutions, and media. The government institutions included the District Agriculture Development Office (DADO), Agriculture Information and Communication Center (AICC), Agribusiness Promotion and Marketing Development Directorate (APMDD), and Kalimati Fruit and Vegetable Market Development Board (KFVMDB). Traders were included as they are major players in the overall

marketing of paddy and rice. They also provide marketing information to their suppliers and buyers. The other source of marketing information was the media such as radio, television, and publication who broadcast the prices of agricultural commodities for the benefit of all stakeholders. The generation and use of marketing information services were analyzed at the farmers' wholesalers', and retailers' levels of the markets.

Farmers' level: Results showed that more than 70 percent of the farmers use marketing information from traders, especially the marketing agent to whom the farmers supply their product. These are mostly the assemblers or millers. In Morang and Jhapa farmers depend on assemblers while in Chitwan and Rupandehi they obtain marketing information mainly from millers. Farmers use very minimal information disseminated by government institutions and media (Table 1). The policy implication here is that farmers need a regular, wider, and reliable source of price information to enable them for sourcing out alternative markets for products. Mass media like radio and government institutions would be very useful in exploring marketing information in other market centers.

Table 1: Distribution of Farmers by District and Source of Marketing Information, 2008

Source	Percentage of Farmers Reporting				
	Jhapa (n = 25)	Morang (n = 25)	Chitwan (n = 25)	Rupandehi (n = 25)	Pooled (n= 100)
Trader	72	76	64	80	73
Govt institutions	12	16	16	12	14
Media	16	8	20	8	13

Source: Field Survey, 2008.

Wholesale Level: At the wholesale level market, the most important sources of marketing information are other traders consisting of millers and wholesalers, government institutions, and media (Table 2). Dissemination of information on regular and reliable price from radio and other mass media can play an important role in helping the wholesalers to efficiently explore alternative markets for selling their products.

Table 2: Wholesalers' Sources of Marketing Information by District , 2008

Source	Percentage of Wholesalers Reporting				
	Jhapa (n=13)	Morang (n=17)	Chitwan (n=17)	Rupandehi (n=13)	Pooled (n=60)
Other traders	91	95	86	83	89
Gov institutions	5	4	8	7	6
Media	4	1	6	10	5

Source: Field Survey, 2008.

Retail Level: At the retailers' level, the source of marketing information is other traders, to be estimated over 80 percent in all districts. The source of marketing information in Chitwan more diversified where the other traders (76%) are the major source, followed by media (16%) and government institutions (8%). This diversification in source of information and hence competitiveness in Chitwan is higher than in the other three districts. One explanation could be higher rate of literacy (45.2%) and higher per capita income (NRs 1,403 per year).

Table 3: Distribution of Retailers by District and Source of Marketing Information, 2008

Source	Percentage of Retailers Reporting				
	Jhapa (n = 25)	Morang (n = 25)	Chitwan (n = 25)	Rupandehi (n = 25)	Pooled (n= 100)
Other traders	80	89	76	81	81
Gov institutions	6	3	8	9	7
Media	14	8	16	10	12

Source: Field Survey, 2008.

3.4 Price Determination

The interaction of demand and supply forces in the market at a given time determines the price of commodity. In the case of paddy, the common pricing practice is for the traders to give out loans to farmers during the planting season and agree on the price of paddy in advance. However, in the eastern region, the *gola* determines the price of paddy after consultation with certain traders (millers), and circulates this information to the assembler for procuring paddy from farmers. This study analyzed the role of marketing agents in determining the price of paddy and rice at all the three levels of marketing chain.

At the producer's level, some 77 percent of the farmer respondents said that the traders determine paddy price. At the wholesaler's level, more than 80 percent of the wholesaler respondents reported that price was determined by wholesalers themselves.

In the retail market, more than 65 percent of the retailer respondents reported that price was determined by retailers. Thus, the buyers have dominated sellers in the paddy market, but sellers have dominated buyers in the rice market. This indicates the dominant role of traders (miller/wholesaler) in determining the price of rice in the rice market.

3.5 Mode of Paddy Sale

The mode of selling paddy varies in the different places depending on the local production volume, accessibility, and competitiveness of traders and millers. When competition among traders is very stiff or when a large volume of paddy is to be sold, traders pick up paddy from farm. Majority of farmers (59%) deliver their marketable surplus of paddy to the primary assembly point at some designated places (Table 4). The trader (miller or assembler) then sends the tractor to the farmers' field or a primary assembly point for collecting paddy. Farmer respondents (27%) reported that farmers who have access to transportation facilities and are located near rice mills do deliver their product to the mills directly. Particularly in Rupandehi respondents (60%) delivered their paddy directly to rice mills.

Table 4: Mode of Paddy Sale by District 2008

Mode of Sale	Farmers Reporting (%)				
	Jhapa (n=25)	Morang (n=25)	Chitwan (n=25)	Rupandehi (n=25)	Pooled (n=100)
Paddy picked up from farm by trader	12	16	16	12	14
Delivery of paddy by farmer up to the primary assembly point	80	72	56	28	59
Delivery of paddy by farmer to mill	8	12	28	60	27
Total	100	100	100	100	100

Source: Field Survey, 2008.

3.6 Mode of Payment

The mode of payment in rice marketing depends largely on the goodwill between the marketing agents, agreement between sellers and buyers, and the immediate cash needs of farmers. The mode of payment was reported in three categories: cash, credit, and both. Cash was considered as immediate total payment by the buyers, credit as total delay payment, and both were considered as part of payment at the time of sale and the remaining payment after one or more than one month. At the farmers' level, more than 80 percent of the respondents sold their products on a cash basis in all the districts (Table 5) because farmers generally sell most of their products soon after harvest when the prices tend to be low. At the wholesale market level, trading is mostly based on both cash and credit. Table 5 shows the major modes of payment at the farmers', wholesalers', and retailers' levels.

Table 5: Mode of Payment to Farmers, Wholesalers, and Retailers in Districts, 2008

District	Percentage Reporting		
	Cash	Credit	Both
Farmers' level			
Jhapa (n = 25)	96	4	0
Morang (n = 25)	68	28	4
Chitwan (n = 25)	96	4	0
Rupandehi (n = 25)	72	24	4
Mean	83	15	2
Wholesalers' level			
Jhapa (n = 13)	54	0	46
Morang (n = 17)	41	6	53
Chitwan (n = 17)	29	12	59
Rupandehi (n = 13)	0	8	92
Mean	31	7	62
Retailers' level			
Jhapa (n = 25)	72	8	20
Morang (n = 25)	56	0	44
Chitwan (n = 25)	32	0	68
Rupandehi (n = 25)	64	0	36
Mean	56	2	42

Source: Field Survey, 2008.

3.7 Marketing Cost and Margin

The marketing cost and margin (and percentage marketing marging estimated here) for rice was estimated at three market levels, namely the farm to wholesale, wholesale to retail, and farm to retail (Table 6). The marketing cost and margin in the farm to wholesale market was higher than wholesale to retail market because more marketing services like assembling, transportation, storage, milling, packaging, and handling are involved in this stage of marketing chain. The average marketing margin in the farm to retail market was 45 percent higher than the marketing cost (Table 6). It suggests that the entrepreneurs' profit received by the middlemen, wholesalers or retailers could be unduly high.

Table 6: Marketing Cost and Margin by Market Levels in Districts 2008

District/Marketing Margin	Marketing Cost (Rs/Kg)	Marketing Margin (Rs/Kg)
Jhapa		
Farm to Wholesale	4.81	6.94
Wholesale to Retail	1.16	2.97
Farm to Retail	5.97	9.91
Morang		
Farm to Wholesale	4.89	7.27
Wholesale to Retail	1.45	3.39
Farm to Retail	6.34	10.66
Chitwan		
Farm to Wholesale	4.49	7.00
Wholesale to Retail	1.45	3.44
Farm to Retail	5.94	10.45
Rupandehi		
Farm to Wholesale	4.04	7.42
Wholesale to Retail	2.28	4.52
Farm to Retail	6.32	11.94
All Areas		
Farm to Wholesale	4.32	7.16
Wholesale to Retail	1.58	3.58
Farm to Retail	5.90	10.74

Source: Field Survey, 2008; Note: Exchange rate during survey was NRs70.0/ US$.

4. Constraints in Rice Marketing

The constraints encountered in rice marketing were assessed at the three market levels, such as farmers, wholesalers, and retailers are discussed below.

4.1 Farmer's Level

Farmers believe that the strong influence of traders in determining the price of paddy is a suppressing factor that lowers farm-gate price. This is particularly true in the eastern region where the *golas* exercise a substantial control on the rice market.

The low price of imported paddy from India is another constraint that distorts/ decreases farm gate prices of paddy. When the prices of local/ Nepali rice are higher, cheap rice from India tends to flow across the border which is porous. This effectively defines the ceiling price for the locally-produced price at the retail end.

Rice markets in Nepal are also characterized by substantial price fluctuations across the regions or months. In addition to supply shocks such as poor weather, price fluctuations are also caused by the trading practices of a limited number of traders, who exercise market power. Usually, the trader announces a low price for paddy during the harvesting season and high price when the product is out of stock at the farmers' level. The lack of sufficient storage facility at the farmers' level is one of the factors leading to price fluctuations by season.

Because of the inaccessibility of rural road network, farmers find it difficult to look for alternative markets. Hence, they are basically price takers in the local market. They have no choice but to sell their produce paddy at the price set by the traders. The constraints encountered by farmers are shown in Table 7.

Table 7: Marketing Constraints for Farmers by Districts 2008

Problems	Percentage of Farmers Reporting				
	Jhapa (n=25)	Morang (n=25)	Chitwan (n=25)	Rupandehi (n=25)	Pooled (n=100)
Low farm price of the product	28	40	36	36	35
Mechanism in price determination	56	60	40	40	49
Price of imported paddy from India	16	20	0	24	15
Wide price fluctuation	8	4	24	12	12
Total	108	124	100	112	111

Source: Field Survey, 2008.

4.2 Wholesalers' Level

The low and uncertain price of rice partly resulting from illegal imports from India is a problem for the wholesalers. In addition, adulteration is another constraint where wholesalers and millers bring in low quality rice from India and mix it with Nepali rice to receive higher profit for the Nepalese brand of rice. This should be the priority concern of the consumers.

The unstable peace and law and order condition affect the transportation services because of frequent strikes and, thus, contribute to increase in transportation costs. Different types of clubs, Village Development Committees, and District Development Committees unsystematically collect money as a tax from rice wholesalers. The following table shows the problems encountered by wholesalers in rice marketing.

Table 8. Marketing Constraints of Wholesalers by Districts, 2008

Problem	Percentage of Wholesalers Reporting				
	Jhapa (n=13)	Morang (n=17)	Chitwan (n=17)	Rupandehi (n=13)	Pooled (n=60)
Price Fluctuation	46	24	24	23	28
Quality / Mix	23	29	41	8	27
Tax and Donation	8	0	18	15	10
Price of Imported Rice	54	59	12	62	45
Peace and Order	15	6	12	8	10
Total	131	112	106	115	120

Source: Field Survey, 2008.

4.3 Retailers' Level

The constraints encountered by the retailers of rice are shown in Table 9. The major constraints are lack of quality standards, poor packaging materials used, and losses (in terms of both quantity and quality) due to poor transport and storage facilities.

- The rice imported from India is one of the major constraints as reported by 49 percent of the retailers. Respondents pointed out that the price of imported rice is generally cheaper compared to the domestically produced rice because of low quality. Additionally, under the Indian *Food Security Act*, rice is subsidized for poor consumers, but some of this cheap rice leaks to Nepal. Imported rice is easily accessible to the retailer through bicycles, while domestically produced rice has to be picked up from a rice mill or wholesale market by the buyer.
- The low quality of rice is another problem, which is caused by the mixing of stone, fermented rice, mixed with husk and dust into the rice to increase volume.
- In the retail market, retailers use small plastic bags as a packaging material which is very weak but expensive. At least two plastic bags are needed to pack one kilogram of rice that adds to the cost, and leads to increase in the market price.
- Rice retailers suffer from the loss of weight of rice (about 2 to 4 kg per 50 kg sack) compared to the quantity paid for.
- Rice wholesalers and millers also sell rice in small volumes (25 Kg or sometime less than 25 kg bags) just like the retailer. From their perspective, this is another constraint in the rice retail market. Most of the retailers pointed out that if the wholesalers and millers sell small volumes of rice, it is difficult to sustain the business of rice retailing.

Table 9: Marketing Constraints of Retailer Traders by District, 2008

Problem	Percentage of Retailers Reporting				
	Jhapa (n=25)	Morang (n=25)	Chitwan (n=25)	Rupandehi (n=25)	Pooled (n=100)
Quality / Mix	16	20	32	16	21
Packaging Material	12	8	24	8	13
Price of Imported Rice from India	64	56	12	64	49
Weight Loss	0	4	8	4	4
Price Fluctuation	12	8	24	20	16
Peace and Order	4	8	0	8	5
Total	108	104	100	120	108

Source: Field Survey, 2008.

5. Conclusions and Policy Implications

The involvement of many marketing intermediaries, especially at the different levels of assemblers and commission agents like *gola,* makes the marketing channel lengthier and complicated. This extension of marketing channel eventually lowers producer price and raises consumer price. One potential way to address the problem is establishment of farmers' cooperatives, which could not be studied in this paper but merits consideration due to government's emphasis on marketing cooperatives as complementary institutions. Such cooperatives presumably can promote collective marketing, storage management, and exploration of alternative markets. This could also help in improving marketing efficiency. It was suggested that the bare storage godowns owned by the government (Nepal Food Corporation) should be availed for use by farmers' cooperatives to store their paddy until the time price of paddy rises.

Rice traders have a dominant role in disseminating marketing information at all levels of markets. Relevant, accurate, and regular marketing information to farmers could be more useful for decision-making process benefitting all marketing intermediaries involved in the rice market. Various forms of media like radio, telephone, television, and print-media can help in disseminating marketing information on a regular basis. These mechanisms could help farmers to sell their products at higher prices, reduce marketing margin, and eventually reduce consumer prices.

Improvements in agricultural road network from farm to market are very crucial in boosting up market competition and reducing marketing costs of rice. Such road networks can be developed through the participatory development approach with the help of the local government, INGO/NGOs, cooperatives, and local communities.

Marketing agents incur high transportation costs, partly due to ad hoc taxes/fees collected by the Village Development Committees and District Development Committees and Municipalities. The government should strictly implement the rule of abolishing such ad hoc fees on the transportation of primary agricultural products. The government needs to put in

place strong monitoring mechanism for managing and controlling these kinds of ad hoc fees; enforcing food standards; disbanding market cartels; enforcing trade policies and regulations; and balancing the welfare of rice producers, traders, and consumers.

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Integration of Regional Rice Markets in Nepal

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Abstract

The rice marketing system, its linkages, and level of integration among the major regional markets in Nepal and the adjoining markets in India are analyzed in this paper. The Nepali rice market is mainly governed by private traders with millers playing a pivotal role. Producers get about 74 to 76 percent of mill-gate price and 68 to 70 percent of retail price in local market for medium quality common rice. In the case of graded and branded rice, farmers' shares in consumers' rupee range from 55 to 60 percent. These shares are lower than what producers would be expected to receive in a perfectly competitive market. Analysis shows that the major regional rice markets are weakly integrated across Nepal but strongly integrated with the adjoining markets in India. The implications of these findings for improving the efficiency of the rice marketing system are discussed.

JEL Classification: C32, Q13, Q18

Key Words: Agricultural policy, Agricultural markets, Marketing channel, Market integration, Vector error correction model

1. Introduction

Paddy is the most important cereal crop of Nepal from both the production and consumption perspectives. It is also an important marketed crop although the marketed surplus at the farm household level is limited as production takes place mostly in small farms. Nevertheless, these marketed surpluses are important for feeding consumers in large cities and rice deficit areas. The efficiency of the marketing system is thus important to ensure a smooth flow of rice from areas with marketed surplus to deficit areas. In addition, efficient transmission of price signals can improve the flexibility of rice production and marketing systems in the changing market situations.

The importance of rice markets in Nepal has also increased over time with urbanization, increased income through remittances, and extension of road network to the hills. These changes have resulted in increased reliance on markets for meeting consumption needs even in

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areas where rice is not an important crop. Despite these developments, the functioning of rice markets in Nepal is not well analyzed and understood currently.

This study aims to identify and analyze the rice marketing system and price behavior in Nepal. The specific objectives are: (i) to identify the rice marketing channels and stakeholders involved at various levels; (ii) to analyze the relationships of rice prices at different locations in Nepal and their adjoining markets in India; and (iii) to derive policy implications for improving the rice marketing system.

2. Material and Method

2.1 Data Sources

The monthly wholesale price data on coarse paddy for the country's four regional market hubs (Biratnagar, Birgunj, Bhairahawa, and Nepalgunj) and the Indian border markets adjoining the regional markets (Purniya, Mujaffarpur, Gorakhpur, and Baharaich, respectively) for a period of 55 months, from July/August 2002 to January/February 2008, were obtained from Nepal Rashtra Bank, Kathmandu. The weekly wholesale prices of paddy and rice of medium (Kanchhi) and fine (Mansuli) varieties in Biratnagar market for a period of 238 weeks, from April/May 2003 to March/April 2008, were obtained from the daily price records of Morang Merchants' Association (MMA), Biratnagar.

Primary information was collected through informal interactions and interviews with traders, millers, and brokers involved in rice trade and government officials in Morang, Sunsari, Rupandehi, and Banke districts in Terai, and Kathmandu, Dhankuta, and Tehrathum districts in the hills during February-March 2008. Information was also collected from the nearest major market points in India.

2.2 Market Integration Analysis

The vector error correction model (VECM) was estimated for evaluating price interrelations to infer on integration of (i) regional (spatial) markets for rice and (ii) different forms and types of rice. The spatial markets considered are the four regional market hubs of the country, viz., Biratnagar in the eastern region, Birgunj in the central region, Bhairahwa in the western region, and Nepalgunj in the mid-western region. Besides, the integration of these regional market centers with their respective bordering Indian market centers was also analyzed. As in Singh (1999), the VECM used for price analysis is discussed below. Consider a general VAR model (standard form) for n individual price series:

$$X_t = \sum_{i=1}^{k} A_i X_{t-i} + A_0 + \varepsilon_t, \qquad t = 1, \ldots\ldots, T \qquad (1)$$

Where,

X_t is n × 1 vector of the logarithm of prices at time t; X_t are integrated of order one;

A_0 is a (n × 1) vector of constants;

ε_t is a (n × 1) vector of independently and normally distributed disturbances with

$E(\varepsilon_t \times \varepsilon_t') = \Omega$; and

k is the lag length required to whiten the noise term ε_t.

Following Johansen (1988, 1991) and Johansen and Juselius (1990), the model can be transformed with variables in levels and in first differences by considering a reparameterization of (1) to yield VECM as

$$\Delta X_t = \Pi X_{t-1} + \Sigma \Gamma_i \Delta \sum_{i=1}^{k-1} X_{t-i} + A_0 + \varepsilon_t , \qquad (2)$$

Each of Γ_i is an n × n matrix of short-run response parameters. The coefficient matrix Π contains information about the stationarity of, and long-run relationships between, the variables in X_t. The rank of Π is viewed as the number of cointegrating (long-run) relations existing in X_t. If the rank of Π is r, where r ≤ n-1, then Π can be decomposed into n × r matrices, α and β, such that $\Pi = \alpha\beta'$. The matrix β is called the cointegrating matrix, and has the property that $\beta' X_t \sim I(0)$, while $X_t \sim I(1)$. If the hypothesis concerning cointegration holds, that is, if in Eq. (2) $\Pi = \alpha\beta'$, matrix $\beta' X_{t-1}$ constitutes a set of r error correction mechanisms. Matrix β consists of r linear cointegrating vectors, while α can be interpreted as a matrix of error correction parameters reflecting long-run responses, the speed of adjustment.

Once cointegration of the variable is found to hold, Equation (2) can be written with the error correction mechanism ($\beta' X_{t-1}$) as:

$$\Delta X_t = \alpha Z^{\#}_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + A_0 + \varepsilon_t , \qquad (3)$$

Where $Z^{\#}_{t-1} = \beta' X_{t-1}$

In equation (3), a large (small) value of α means that the system will respond to a deviation from the long-run equilibrium with a rapid (slow) adjustment. On the other hand, if α is zero, it implies that the corresponding variable does not respond to the disequilibrium error and, hence, may be weakly exogenous.

3. Rice Production and Trade

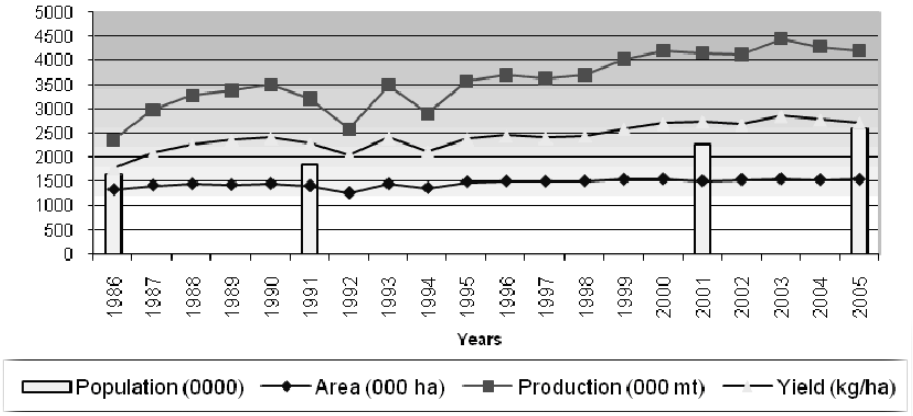
3.1 Production and Productivity

Paddy and rice-referring to un-milled and milled rice-is a traditional crop grown on almost all of the irrigated land in summer. With availability of suitable modern varieties, cultivation of paddy in spring (Chaite) and winter (Boro) is getting popular in the last two decades. Paddy area increased from 1.3 million ha in 1986 to 1.5 million ha in 2006, an increase of 16 percent in 20

years. During the same period, paddy yield increased by 53 percent resulting in 77 percent increase in total paddy production. Thus yield increase has been the main source of production growth. Trends in paddy area, production, and yield along with population are presented in Figure 1.

Almost three-fourths of paddy production takes place in the Terai, the granary of Nepal. Another 23 percent is produced in the Hills, where it is the second most important crop after maize. Less than three percent of the country's paddy is produced in Mountain districts, mainly on the river basins of lower parts of the belt. Productivity levels are lower as one goes from south (2.7 ton/ha in Terai) to north (2.0 ton/ha in Mountain).

Figure 1: Trend of Area, Production and Yield of Paddy in Nepal



3.2 Trade

Paddy enters market exchange even in the most remote parts of the country. About 30 percent of the paddy produced in Terai enters market. In the case of Hills and Mountains, only 13 percent and 6 percent respectively, of paddy production is sold (Table 1). Surplus paddy production in Terai is processed into rice and channeled either to the adjoining hills or the distant urban market centers like Kathmandu and Pokhara. Limited quantities of paddy/rice produced in the Hills and Mountain districts are sold in local market/Haats to buy consumption items.

Table1: Proportion of Farmers Selling Paddy and Proportion of Total Paddy Sold (%)

Region	Farmers that sold paddy	Paddy production sold
Mountain	10	6
Hills	21	13
Terai	58	30
Average	40	27

Source: ANZDEC, 2002.

Nepal has not been exporting rice in the recent past except in 2004/05, when the value of rice export was NRs 23 million (0.12% of total export). Import of rice is recorded every year, mostly from India. Based on the data published by the Ministry of Agriculture and Cooperatives (MOAC, 2007) and Nepal Rastra Bank (NRB, 2006), the value of rice import accounted for around two percent of the total value of import in the recent past. Actual figures, however, might be much more than this as the bulk of trade takes place between India and Nepal informally through porous borders. Rice import in eastern parts of Nepal is mainly in the form of paddy and mainly in the form of milled rice in the western parts.

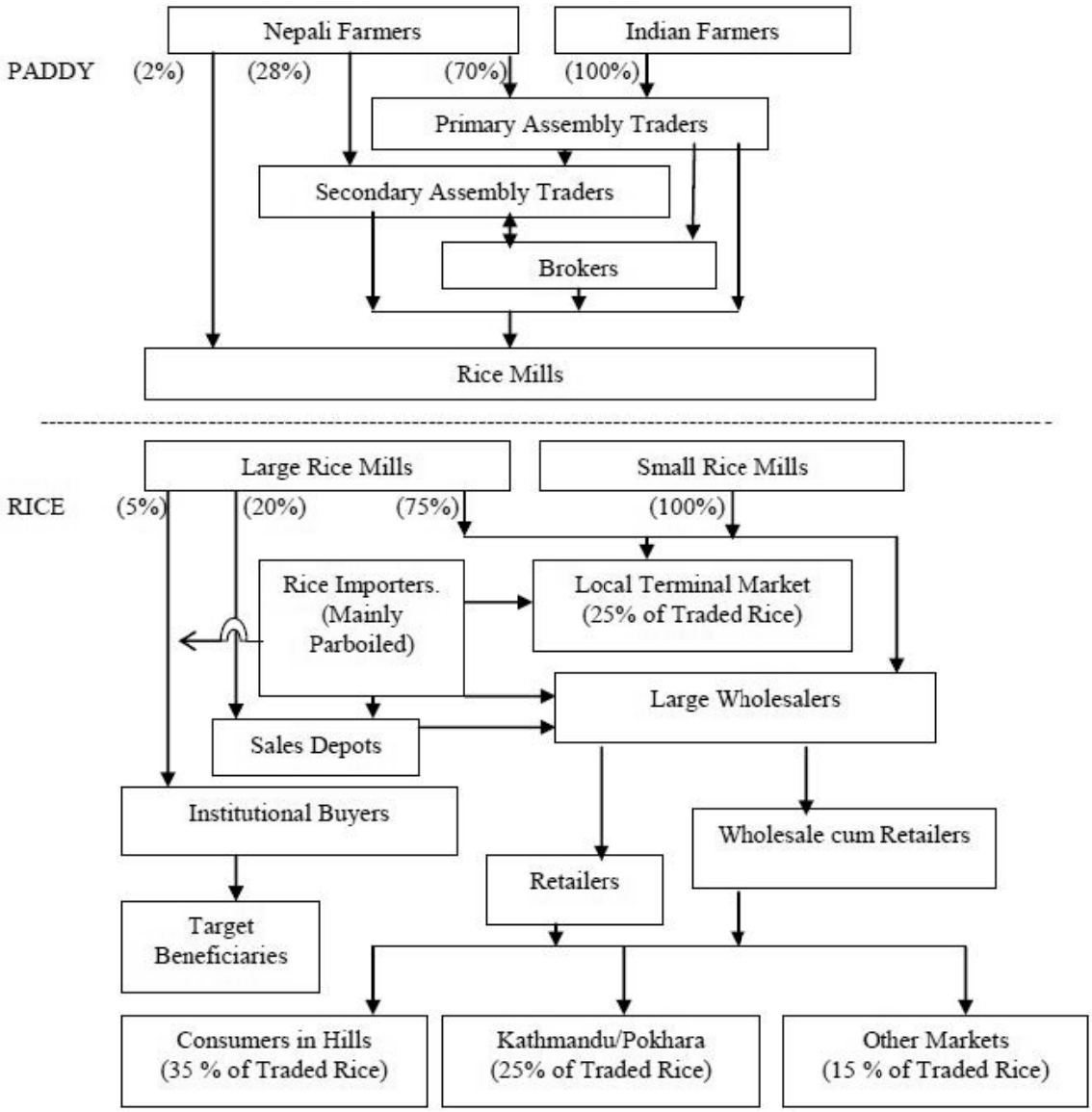
Nepal has been receiving food aid from different countries in the past. The quantity of such food aid ranged from 4 to 29 thousand tonnes per annum in the last one decade out of which, rice constituted more than half. Food aid in kind is normally delivered to Nepal Food Corporation (NFC), which in turn takes the responsibility of distributing these in the food deficit areas based on the quota determined by the government.

3.3 Rice Marketing Practices

Several marketing intermediaries are involved in paddy trading in addition to the farmers selling directly to rice mills or traders individually. Among them are traders involved in buying in the village (*Fariya*) and those based at strategic locations (*Kantawala*)[1]. About 90 percent of paddy marketed in Nepalgunj, 95 percent in Bhairahawa, and 98 percent in Biratnagar passes through those traders. Rest of the marketed paddy passes directly from farmers to the millers. Almost the entire paddy entering Nepal from the bordering villages in India is traded through *Fariya*. Rice millers are the major actors in paddy marketing, as the entire paddy has to pass through them for processing (Figure 2).

[1] Fariya is primary assembly trader and Kantawala is secondary assembly trader.

Figure 2: Marketing Channels for Paddy/Rice and Their Relative Shares in Biratnagar

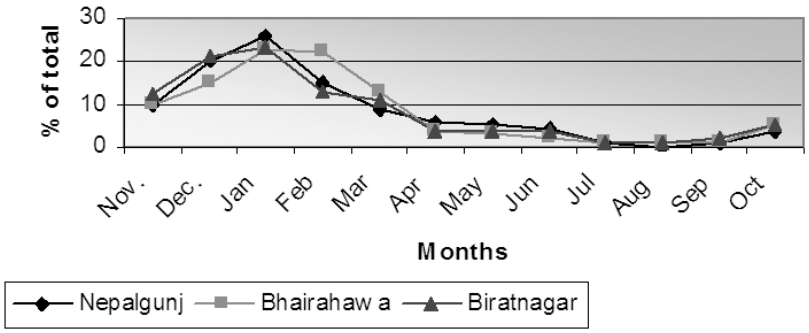


3.4 Seasonal Patterns

Farmers start selling paddy as soon as harvesting/threshing is done. The smaller farmers sell their products first as they need cash to pay debt and celebrate festivals such as *Dashain* and *Tihar* that coincide with the main paddy harvesting season. The larger farmers who are not hard pressed for cash and own storage facility prefer to wait for the prices to rise.

The main-season paddy starts to arrive in the market in November. The main season paddy arrives earlier in the market in Biratnagar than in Nepalgunj because early Monsoon in the east allows early planting (Figure 3). Better irrigation facilities also allow earlier crop establishment there.

Figure 3: Market arrival of coarse paddy



3.5 Pattern of Paddy/Rice Flow

Some regional configuration has been established in paddy marketing such that most of the paddy marketed enters the nearest regional market. In this regard, Nepalgunj in the mid and far-western regions, Bhairahawa in the western region, Birgunj in the central region, and Biratnagar in the eastern region are the major regional rice markets. About 13-35 percent of the paddy produced in Banke, Bardia, and Kailali, 13-22 percent produced in Nawalparasi, Rupandehi and Kapilvastu, and 22-24 percent produced in Morang and Sunsari is supplied to Nepalgunj, Bhairahawa, and Biratnagar markets respectively (Table 2).

Table 2: Major Paddy Supplier Districts of Terai Markets

Nepalgunj		Bhairahawa		Biratnagar	
Major supplier district	% of paddy production supplied	Major supplier district	% of paddy production supplied	Major supplier district	% of paddy production supplied
Banke	13	Kapilvastu	14	Morang	22
Bardia	35	Rupandehi	22	Sunsari	24
Kailali	15	Nawalparasi	13	-	-

A large part of the rice traded in the major Terai markets gets its way to the adjoining Hills, part of which also moves to the Mountains. Kathmandu and Pokhara are among the important terminal rice markets. The proportion of rice sold to the different destinations is summarized in Table 3.

Table 3: Total Traded Rice Supplied from Terai Markets (%)

Supplied to	Supplied from		
	Nepalgunj	Bhairahawa	Biratnagar
Local Markets	17	20	25
Adjoining Hills	60	30	35
Kathmandu, Pokhara	13	35	25
Others	10	15	15

Bhairahawa is the major transit point for fine and superfine rice imported from India most of which moves to the bigger markets such as Kathmandu and Pokhara. Biratnagar is one of the major suppliers of Mansuli and Basmati (fine rice) to Kathmandu. It was reported that 80-90 percent of the fine rice traded in Biratnagar gets its way to Kathmandu and Pokhara, but only two percent of *Kanchhi* (medium rice) goes to those markets.

3.6 Marketing Costs, Margins, and Prices

Based on the most common channel of trading, it is estimated that farmers receive 74 to 76 percent of the mill-gate price of rice and its by-products. Milling and other costs constitute two to three percent and 11 to 13 percent respectively. About 10 to 11 percent goes to miller and traders as their profit margins. The share of farmers in mill-gate price was higher in Bhairahawa than in Biratnagar, while this was recorded lowest in Nepalgunj (Table 4).

Table 4: Costs and Margins of Trading one Tonne of Paddy in Terai Markets

Description	Nepalgunj (Coarse Paddy)		Bhairahawa (Coarse Paddy)		Biratnagar (Medium Paddy)	
	Price & Cost (NRs)[a/]	% of mill-gate price	Prices & cost (NRs)	% of Mill-Gate Price	Price & Cost (NRs)	% of Mill-Gate Price
Farm Gate Price of Paddy	10,500	73.7	11,000	76.0	12,500	75.8
Net Margins to Millers/Traders	1,450	10.2	1,500	10.4	1,840	11.2
Milling Costs	460	3.2	390	2.7	390	2.4
Other Costs	1,840	12.9	1,580	10.9	1,770	10.7
Total	14,250	100	14,470	100.	16,500	100.
Mill Gate Price of						
Rice (non-graded)	12,580	88.3	12,670	87.6	14,620	88.6
By-products	1,670	11.7	1,800	12.4	1,880	11.4
Total	14,250	100	14,470	100	16,500	100

[a/] *One Nepali Rupee (NRs) was roughly equivalent to 1.4 US Cents in 2007/08.*

Average share of farmers in consumers' Rupee in the local terminal market was 68 to 70 percent, lower compared to the farmers' share in consumers' Rupee in Andhra Pradesh (73 to 77%) and Tamilnadu, (75%) in India (Khatana et al., 2005). Further analysis shows that farmers in the Terai receive about 63 percent of what a consumer living in the mid-Hill market pays for

medium quality non-graded rice[1]. In the case of graded and branded rice, farmers' share in consumers' Rupee ranges from 55 to 60 percent depending upon the location of the production pocket and terminal market.

Results of a survey conducted in February 2008 in Kathmandu and Lalitpur show that about 20 varieties of rice are sold in those markets. High price differences were observed among different brands, packing styles, and certain specifications such as Cholesterol-free, One year-old, Two years-old, Superfine, Special premium, Idly, Curry, Pulau, Classic etc. Prices also differed from shop to shop for the same variety and packing styles.

Most of the fine quality rice sold in Kathmandu is graded and branded. Table 5, which makes comparison of the rice prices in Terai and Kathmandu market together with the estimated costs involved in transfer between those markets, shows that the rice price in Kathmandu was higher than the total cost by 14 percent in the second week of February 2008. The differences could be attributed to a reasonable net-margin of the traders and the premium for grading and branding.

Table 5: Wholesale Prices in Terai and Kathmandu Markets during Second Week of February 2008(NRs/kg)

Price and Cost Item	Mansuli from Biratnagar	Sawa from Bhairahawa	Remarks
Wholesale Price in Terai Market	23.50	24.65	Normal rice
Transportation Cost	2.05	1.55	
Other Costs	0.60	0.40	
Additional Cost of Preparing Graded Rice (15%)	3.55	3.70	
Total Cost	29.70	30.30	
Wholesale Price in Kathmandu	33.90	34.80	Branded rice
Difference (Premium for Grading/Branding)	4.20	4.50	

3.7 Market Competitiveness

Despite the presence of a large number of buyers and sellers in the primary markets, the market prices differ substantially by location, supply channel, and time of sale. Lack of reliable and timely availability of the marketing and price-related information weakens the producers' bargaining power to get competitive prices. Traders and millers pass price information mainly within their own supply channels leading to inefficient price transmission across the markets. Non-existence of regulated grain market places (*Mandi*) also makes it difficult for producers to find an appropriate place/person to sell their products at the best available prices.

Different qualities of rice are often mixed and packed in different sizes and shape bags to suit the target markets/customers. As there is no standard to be complied with , the distortions

[1] Retail prices of rice at Tehrathum and mill-gate prices of by-products are added to estimate the shares.

on price creeps in. Branding and vertical integration practiced by the large rice mills may also have affected competitiveness.

4. Integration of Rice Markets

The integration of Nepali rice markets has been evaluated through investigations on (i) spatial integration of the rice market system comprising four regional markets and (ii) integration of the rice market in its form and type (paddy and rice of *Mansuli* and *Kanchhi* varieties).

4.1 Integration of Regional Markets

The cointegration test for price series among the four market centers showed that there is only one cointegrating equation, or stable long-run relationship, linking the market system in paddy prices. The estimates of the VECM (Table 6) provide the interrelationships in the market system in terms of the response of change in prices of each of the market centers to deviation from the established long-run relationship, the error correction term, $Z^{\#}_{t-1}$, and the lagged short-run (one month) price responses.

Table 6: Estimates of VECM for Monthly Prices of Paddy in Regional Markets (July/August 2002 to January/February 2008)

Regressor	Biratnagar $\Delta X_{1,t}$	Birgunj $\Delta X_{2,t}$	Bhairahwa $\Delta X_{3,t}$	Nepalgunj $\Delta X_{4,t}$
$Z^{\#}_{t-1}$	-756**	0.515**	-0.026	-0.025
$\Delta X_{1,t-1}$	0.337	0.132	0.059	0.258*
$\Delta X_{2,t-1}$	0.009	0.081	0.032	0.001
$\Delta X_{2,t-1}$	0.312	0.524**	0.129	0.379*
$\Delta X_{2,t-1}$	0.203	-0.392**	-0.112	-0.370*
Constant	0.000	0.001	0.008	0.004

*The asterisks ** and * denote significance at 1 percent and 5 percent level, respectively.*

The estimates of coefficient of error correction term ($Z^{\#}_{t-1}$), i.e., the speed of adjustment coefficients, are found to be statistically significant at one percent level in the case of Biratnagar and Birgunj, and not significant in the case of Bhairahwa and Nepalgunj. The results revealed that the prices in Biratnagar and Birgunj market centers respond to deviations from the long-run equilibrium relationships in the market system, whereas the prices in Bhairahwa and Nepalgunj do not.

The long-run and short-run parameter estimates indicate the regional market system to be weakly integrated, and that there could be some impediments in the efficient working of the rice market system in the country.

4.2 Integration of Regional Markets with Adjoining Indian Markets

Nepal has an open border system with India and the regional market centers in Terai are closely linked to the adjoining Indian border market centers in trade. The estimates of VECMs in Table 7 provide an assessment of the nature of integration of the sub-market systems in paddy prices for the pairs of regional market centers in Nepal and India.

The estimate of coefficient of the error correction term ($Z^{\#}_{t-1}$) for Biratnagar (-0.73) is statistically significant at one percent, but the same for Purniya (-0.12) is not, and none of the short-run adjustment lags is significant (Table 7a). This shows that Purniya prices are weakly exogenous and Biratnagar prices adjust to deviations from the long-run price relations established between the prices in two market centers. Such deviations are quickly corrected without any lag. It further shows that in the sub-market system, Purniya is the dominant market to which the prices of paddy in Biratnagar respond quickly.

In the case of Bhairahawa market, the results indicate that Gorakhpur prices are weakly exogenous and Bhairahawa prices adjust to deviations from the long-run price relations established between prices in the two market centers, and that such deviations are quickly corrected without any lag (Table 7c). Similarly, the Indian market of Baharaich is found to be the dominant market to which paddy prices in Nepalgunj respond quickly (Table 7d).

On the contrary, the results also indicate that the prices of paddy in the Indian market of Mujaffarpur adjust to any deviation from long-run price relation with Birgunj (Table 7b). One possible reason is that the Birgunj regional market being closest to Kathmandu, the county's main consumption market, the prices there are likely to be closely linked to the prices in Kathmandu. This strong linkage of Birgunj with Kathmandu causes prices in Mujaffarpur to respond to deviations from the long-run price relation established with Birgunj.

Table 7: Estimates of VECM for Monthly Prices of Paddy in Nepalese and Indian Markets (July/August 2002 to January/February 2008)

a. Biratnagar and Its Adjoining Indian Market Purnia		
Regressor	Biratnagar	Purniya
	$\Delta X_{1,t}$	$\Delta X_{11,t}$
$Z^{\#}_{t-1}$	-0.732**	-0.119
$\Delta X_{1,t-1}$	0.099	0.188
$\Delta X_{11,t-1}$	0.153	-0.136
Constant	0.004	0.007
b. Birgunj and Its Adjoining Indian Market Mujaffarpur		
Regressor	Birgunj	Mujaffarpur
	$\Delta X_{2,t}$	$\Delta X_{21,t}$
$Z^{\#}_{t-1}$	0.126	0.605**
$\Delta X_{2,t-1}$	-0.190	-0.236
$\Delta X_{21,t-1}$	0.362**	0.313
Constant	0.003	0.004

c. Bhairahwa and Its Adjoining Indian Market Gorakhpur		
Regressor	Bhairahawa	Gorakhpur
	$\Delta X_{3,t}$	$\Delta X_{31,t}$
$Z^{\#}_{t-1}$	-0.465*	0.187
$\Delta X_{3,t-1}$	0.296	0.217
$\Delta X_{31,t-1}$	-0.203	-0.111
Constant	0.008	0.006
d. Nepalgunj and Its Adjoining Indian Market Baharaich		
Regressor	Nepalgunj	Baharaich
	$\Delta X_{4,t}$	$\Delta X_{41,t}$
$Z^{\#}_{t-1}$	-0.353**	0.020
$\Delta X_{4,t-1}$	0.071	0.066
$\Delta X_{41,t-1}$	-0.205	-0.176

*The asterisks ** and * denote significance at 1 percent and 5 percent level respectively.*

The results show that the regional market centers in the country are well integrated with their adjoining Indian markets. Integration of the country's market system with the markets in India demands close monitoring of the developments in market and price situations there. This is important to see that the policies and practices in the country are better tuned to maximize the positive impacts of the open-border regime with India and at the same time minimize the adverse impacts.

4.3 Integration of Rice Market in Form and Quality

The parameters estimated in Table 8 provide the long-run response relations and two periods (weeks) short-run adjustment lags among different points in the regional rice market of Biratnagar, differentiated by the forms (paddy and rice) and types (*Kanchhi* and *Mansuli* varieties). Estimates suggest that the various market points in the rice market system of Biratnagar are integrated with *Kanchhi* paddy as the dominant market point to which prices at other points (viz., *Mansuli* paddy, *Mansuli* rice, and *Kanchhi* rice) adjust in the long-run. However, the short-run lags in the case of both *Mansuli* rice and *Kanchhi* rice indicate some impediments to the efficient working of the rice market system.

Table 8: Estimates of VECM for Weekly Prices of Mansuli and Kanchhi Varieties in Biratnagar (Apr/May 2003 to Mar/Apr 2008)

Regressor	Mansuli Rice	Kanchhi Rice	Mansuli Paddy	Kanchhi Paddy
	$\Delta X_{1,t}$	$\Delta X_{2,t}$	$\Delta X_{3,t}$	$\Delta X_{4,t}$
$Z^{\#}_{1,t-1}$	-0.237**	0.085	0.109	0.120
$Z^{\#}_{2,t-1}$	0.229**	-0.384**	-0.077	-0.009
$Z^{\#}_{3,t-1}$	0.058	-0.024	-0.249**	-0.098
$\Delta X_{1,t-1}$	-0.031	-0.012	-0.041	-0.066
$\Delta X_{1,t-2}$	-0.116	-0.026	-0.080	0.012
$\Delta X_{2,t-1}$	-0.075	0.130	0.228	0.236

Regressor	Mansuli Rice	Kanchhi Rice	Mansuli Paddy	Kanchhi Paddy
	$\Delta X_{1,t}$	$\Delta X_{2,t}$	$\Delta X_{3,t}$	$\Delta X_{4,t}$
$\Delta X_{2,t-2}$	-0.039	0.070	-0.026	-0.005
$\Delta X_{3,t-1}$	-0.033	-0.182**	-0.001	-0.085
$\Delta X_{3,t-2}$	0.125*	-0.035	0.115	0.043
$\Delta X_{4,t-1}$	0.055	0.045	-0.092	-0.005
$\Delta X_{4,t-2}$	-0.027	-0.114	-0.123	-0.060
Constant	0.002	0.002	0.001	0.001

The asterisks ** and * denote significance at 1 percent and 5 percent level respectively.

Market integration of paddy and rice in the regional market shows that the paddy market is well integrated. Meanwhile, there is indication of some barriers in workings of the market for rice. It seems that the increased production of graded rice and vertical integration being practiced by the large rice mills could have affected the operations of the market and marketing system for rice in the country.

5. Conclusion and Implications

The present marketing organizations in the country have been developed for the convenience of the traders rather than farmers. While the traders are aware of prices prevailing in the major trading places as well as demand/supply situation through their informal channel, such information is not available to the farmers. Therefore, some provision should be made for regular dissemination of the market-related information and a proper market monitoring mechanism should be developed.

The paddy prices go through their seasonal peaks and troughs. Non-existence of proper drying and storage facilities in the villages and urgency of cash for other activities compel the farmers, especially the small and medium farmers, to sell paddy soon after harvest, when the farm gate prices are at their lowest. This reduces the producers' share in the consumers' Rupees spent on the final product. Additional investment in rural infrastructure, fine-tuning of the land reform and land use policies, and agriculture diversification are some of the means to improve the situation.

The findings of this study indicate that the Nepali regional markets for rice are weakly integrated. This integration results in a slow transmission of price across the marketing channels. Integration of those markets could be strengthened through the improvement of market infrastructure, information network, and removing the barriers in the smooth and free flow of commodities among the markets.

The forgoing evaluation of integration of Nepali regional rice market centers with their adjoining Indian border market centers shows that the Indian market centers are mostly the dominant markets to which prices on the Nepali side adjust quickly. Open borders between these two countries and the integration of Nepalese markets with the adjoining border markets

in India suggest that policies and practices prevailing in India should be duly considered in developing Nepal's marketing, trade, and price policies.

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Impact of Rising Global Fertilizer Prices on the Nepalese Agriculture Sector

Sridhar Thapa[1]

Abstract

This paper examines the extent to which the domestic and international (world and India) prices of two types of fertilizers DAP and ureas are integrated. Moreover, it looks at the relationship between crop output and fertilizer prices. Results using monthly price series show that Nepali fertilizer prices are more integrated with the world fertilizer prices, but have weak relations with Indian fertilizer prices. Thus, the coefficient of DAP price transmission (0.33) shows that Nepal has higher integration with the world market prices as compared to the coefficient of urea price transmissions (0.06) with the market in India. Findings from the yearly data show that crop output is likely to reduce due to rise in potash price with an elasticity coefficient of (-) 0.19. Nevertheless, the overall findings show that the total quantity consumed of fertilizers is increasing despite rise in their prices, leading to higher crop output over time. Different responses of the international fertilizer prices in the domestic market including in the crop output could be a result of poor market integration in the region, particularly with India due to the absence of market clearing fertilizer prices, and geographical heterogeneity. It could have policy implication for the fertilizer market in Nepal. Policy needs to address the issue of market integration through investment in the infrastructure, and better market regulations, and the rationale to provide subsidy for fertilizers.

JEL Classification: Q11, Q12, Q19

Keywords: fertilizer price, price transmission, crop production, Nepal

1. Introduction

Fertilizer prices in combination with food prices in the world market have continued to rise since the beginning of 2006, raising many issues concerning its impact on the agricultural sector, particularly in the less developed and developing countries where the majority of people depend on this sector for their livelihood. Moreover, fertilizers are essential commodities and subject to matter of concern for an agrarian country like Nepal because of their contribution in crop yields. In Nepal, higher yield in agriculture is inevitable for increasing economic growth due to its sizeable share in the GDP and high correlation with the growth of national income. In addition to this, fertilizer is the most important purchased input for most farmers in Nepal. Agriculture Perspective Plan (APP), which is a key strategy to alleviate poverty and enhance food security, was assumed to contribute 64-75 percent of the total envisaged agricultural

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growth target. Moreover, the Agriculture Sector Performance Review (ASPR) report shows that the demand for chemical fertilizers in Nepal has increased by an estimation of 18.2 percent annually (ANZEC, 2002). The gains from using chemical fertilizers are therefore threatened in many low-income countries such as Nepal by soaring fertilizer prices, together with the shortage of chemical fertilizers at the time of crop plantation and growing. It is also a fact that soaring fertilizer price is one of many factors that contribute to the rise in food prices threatening to push poor people into malnutrition. An understanding of the impact of soaring fertilizer prices is thus likely to be important for policy implications in Nepal.

As the paper intends to shed light on the impact of soaring fertilizer prices in Nepal, the fertilizer policy, including supply and distribution mechanism, do matter for smooth functioning of fertilizer markets. In spite of the beginning of fertilizer supply and distribution in the early fifties by some private suppliers and then by the National Trading Limited, the institutional set-up for fertilizer supply and distribution started only after the establishment of the Agriculture Input Corporation (AIC) under the Ministry of Agriculture in 1966. The government had given the sole responsibility to AIC for procurement and distribution of fertilizers in Nepal, where prices were determined by the government. In 1973/74, as a part of revising the fertilizer market, the government decided to provide price and transportation subsidy in selected districts in the Hill and Mid-Hills to encourage farmers to use fertilizers and discourage outflow of fertilizers to India. However, it was widely recognized that AIC failed to fulfill the growing demand of fertilizers due to irregularities in procurement and distribution. To address this problem, the government decided to deregulate fertilizer markets by removing subsidy and allowing private sectors in supply and distribution in 1997. The deregulation of fertilizers left a positive impact on the overall supply situation after the involvement of private sectors, but that, too, did not ensure the quality of fertilizers which was the major issue after the fertilizer market liberalization (Shrestha, 2010). The government of Nepal has again introduced the fertilizer subsidy in the Hill and Mountain regions after a food crisis in 2007/08 that severely impacted the poor and vulnerable populations. The fertilizer policy regime together with the institutional set-up of fertilizer market is still a matter of discussion among the policy makers and scholars.

Literature shows that the growing global demand for fertilizers, as a result of increasing demand for food to meet the increasing population in the world, has played a large part to put pressure on fertilizer prices (Trostle, 2008). For instance, FAO (2008) forecasts 2 percent per year increase in the global fertilizer consumption between 2008 and 2012, equivalent to an increment of 19.3 million fertilizer nutrient tonnes where fertilizer demand in the South Asian region has risen to more than 23 percent in aggregate. Such an increasing demand for fertilizers is partly due to rapid economic growth and increasing demand for food. This increasing trend of fertilizer demand in the global market, especially in South Asia, could leave a significant impact on the prices of fertilizers that further influence the adoption and production pattern of the country. It is mentioned in the literature that poor price transmission, caused by domestic market constraints, could also influence agricultural production (FAO, 2008). On the other hand, better transmission of the global prices in the domestic markets may reduce the volatility,

which often helps farmers to cope risks in a better way. Therefore, analysis of the transmission of international fertilizer prices in domestic market could give an insight into the fertilizer markets in Nepal, and how the volatility of fertilizer prices affects in the agricultural sector of the country. More specifically, the objective of this study is to analyze how and to what extend the fertilizer (DAP and urea) prices pass through the domestic markets, and its impact on the crop output in Nepal.

This paper is organized as follows: After providing an introductory part in Section 1, Section 2 provides an overview of the theoretical framework of the study. Section 3 highlights the method applied to analyze the impact of soaring fertilizer prices in the agricultural sector. Section 4 presents data sources and some descriptive statistics and Section 5 gives the findings from econometric analysis. Section 6 concludes the study.

2. Theoretical Framework

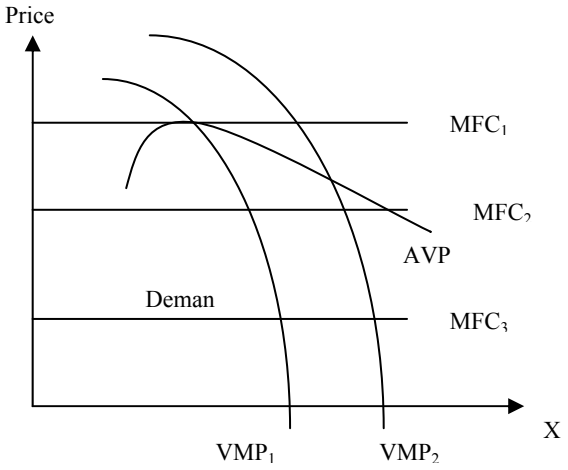
The relationship between international and domestic prices can be referred to as the effect of prices in one market on prices in another market, often measured in terms of the transmission elasticity that indicates the percentage change in the price in one market given a one percent change in another market. It is assumed that in a competitive market, price difference from one market in another is the incentive that the arbitrager often supplies from the low price market to the high price market. It is also a fact that the transmission of commodity prices from one market to another market is often applicable for homogeneous product, including other assumptions, such as: (a) all are price takers rather than price givers; (b) all have perfect information about prices and commodities; and (c) there are no other trade taxes or other policy barriers to trade, including transaction costs. However, in real life, such assumptions may not hold, and may lead to a reduction or even lower- down the transmission of prices from one market to another market.

Moreover, the relationship between the prices of factor inputs such as fertilizers and agricultural output may depend on various factors: price of crops, price of fertilizer, and parameters of production function that describe the technical transformation of inputs into output (i.e., fertilizer response function) (Debertin, 1986). However, in the conventional economic theory, the price of fertilizers is often determined by the intersection of the fertilizer demand and fertilizer supply functions that determine consumption levels (Kelly, 2006). In developing countries, fertilizers' economic potential determined by the prevailing fertilizer responses and prices is usually much larger than the actual use (Desai, 2002).

This paper focuses on the demand side of the equation, where the demand for fertilizer is often referred to as a "derived" demand, revealing that the fertilizer demand is determined largely by the final demand for the crop produced. In other words, the farmer wants to maximize profit at the point where the value of marginal product (VMP = Marginal physical product output price) should equal the marginal factor cost (MFC = Cost of adding the last unit of output). This notion can be explained more clearly with the help of a graph. In Figure 1, the price of fertilizers is presented on the y-axis and the quantity of input on the x-axis. As the

MFC declines, the profit maximizing quantity for input demanded increases. Moreover, the VMP curve shifts upward from VMP_1 to VMP_2 as the output price increases or technological change occurs (i.e., making fertilizer more productive) and that further leads to the demand for inputs because of increasing output prices. This theoretical framework suggests that the major cause of the shift in fertilizer demand curve is increase in output prices or technological change[1].

Figure 1: Demand for Inputs for the Production Process



The fertilizer demand curve is based on the assumption of perfect market conditions: (i) farmers maximize profit from fertilizer use; (ii) they have perfect information about markets; and (iii) there are no input and liquidity constraints. However, in the less developed countries like Nepal, other factors such as risk considerations and resource constraints may influence decisions on fertilizer use.

3. Method and Econometric Specifications

The study intends to analyze the impact of soaring fertilizer prices on Nepalese agriculture providing more emphasis on the transmission of the world and Indian fertilizer prices in Nepal and the impact of fertilizer price volatility on the crop output, particularly in cereal crops such as paddy, wheat, and maize, which are the major staple crops in Nepal. In order to address these issues, the paper first applies a model in which the fertilizer prices of Indian market and world market are the explanatory variables for the dependent variable of Nepalese fertilizer price. It is often discussed at the policy level, the Nepalese market is more influenced by the Indian market in comparison to the world market due to Nepal's de facto economic integration with India,

[1] The idea for this graph is drawn from Kelly (2006).

combined with a long open-border, and preferential trade agreement with India. Therefore, the inclusion of Indian market prices in the model seems plausible to analyze the impact of Indian fertilizer prices on the domestic markets. More specifically, the functional form used for price transmission follows as:

$$P_{1t\_np} = \alpha + \beta P_{2t\_ind} + \gamma P_{3t\_w} + \varepsilon \quad (1)$$

Where, $P1t_{\_np}$ and P_{2t_ind} are the monthly average fertilizer prices of Nepal's Terai markets and Indian markets adjacent to Nepalese border. $P_{3t\_w\ is}$ the fertilizer price in the world Markets[1].

β and γ are the parameters to be estimated, α is the constant, and ε is an error term with zero mean. This equation allows us to estimate to what extent the fertilizer price of Nepal is affected by the world and Indian fertilizer prices. In addition to the impact of international fertilizer prices on the domestic fertilizer markets, the study also examines the impact of domestic input prices (i.e., DAP, urea and, potash) on crop output in the country. The functional form of this estimate is given as:

$$Q_{it\_np} = \varphi + \phi X_{it\_np} + \mu \quad (2)$$

Q_{it_np} is the quantity output of the crops such as paddy rice, wheat, and maize in Nepal at period t and X_{it_np} is the fertilizer input price (DAP, urea and potash) of period t. φ is the parameter, ϕ is the constant term, and μ is the error term with mean zero.

The classical linear regression model assumes that given any value of the explanatory variables, the disturbances are uncorrelated with zero mean, and constant variance, implying that under these general assumptions, ordinary least squares (OLS) estimators are considered as optimal. However, in time series data, the problem of serial or auto correlation often raises while estimating OLS. In the presence of autocorrelation, parameter estimates are unbiased but are not efficient, leading to standard errors downward biased in the case of positive serial correlation and also increasing the probability of type I error. Hence, the estimators are no more BLUE (Best Linear Unbiased Estimators).

In the case of the presence of serial correlation in the model, the fundamental insight is to transform the regression model with Autoregressive (1) or AR (1) disturbances into a regression model that satisfies the conditions of the classical OLS theory[2]. In other words, in the model, instead of regressing dependent variable on explanatory variables, we must run the quasi first-difference for both the dependent and independent variables. Many statistical soft wares such as STATA can easily estimate the quasi-first difference to correct the problem of autocorrelation in the original OLS.

[1] The monthly prices of fertilizers for Nepal is the average price of four markets from Terai districts (Biratnagar, Birgunj, Bhairahawa, and Nepalgunj), while the Indian market covers the average price of four markets (Purnia, Muzaffarpur, Gorakhpur, and Baharaich). For world market, DAP price is drawn from Kiev, Ukraine and Urea price from US Gulf price.

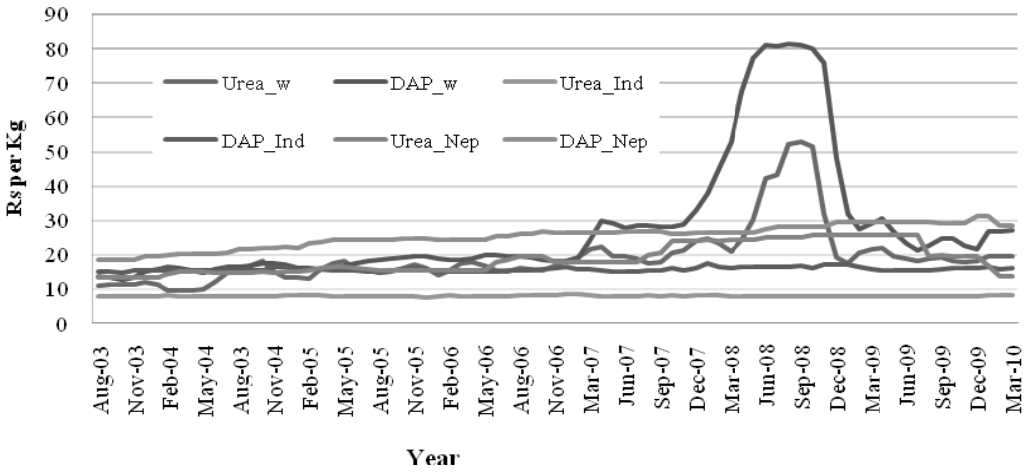
[2] For details, see Wooldridge (2003).

4. Data and Descriptive Statistics

This study is basically carried out from publically available data sources, such as FAO, IMF, World Bank, UN statistics, and the data from Nepal Rastra Bank (i.e., the Central Bank of Nepal), Agribusiness Promotion and Marketing Development Directorate (ABPMDD) under the Department of Agriculture, Ministry of Agriculture and Cooperative, and the Central Bureau of Statistics, Nepal.

To undertake transmission analysis, the study includes monthly fertilizer (urea and DAP) prices of world, India, and Nepal from August 2003 to March 2010. Figure 2 displays the price trends of fertilizers in Nepalese, Indian, and world markets. Price trend is high, especially in the world market in 2008, and then falls sharply. In Nepal, there is an upward movement of fertilizer prices, while prices are relatively stable in India over the same period.

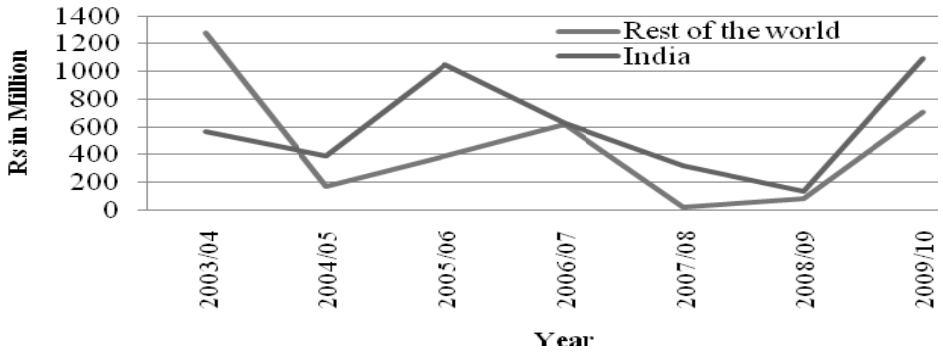
Figure 2: Fertilizer Prices



Nepal has to rely on foreign countries to meet the demand for fertilizers. Apart from the trade with the rest of world, Nepal imports a huge amount of fertilizers from India.

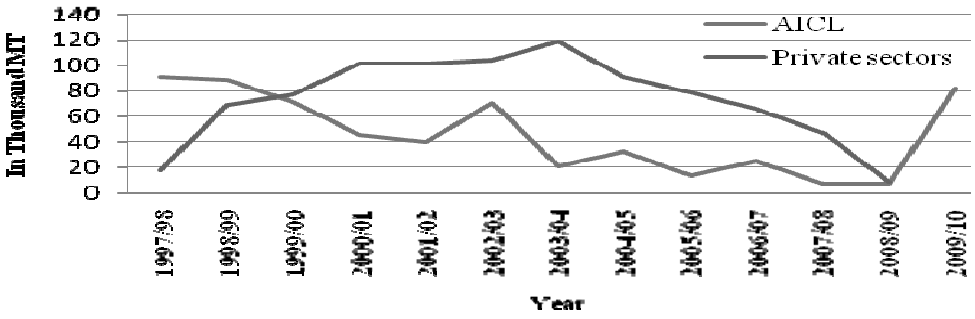
Figure 3, which display the trends in fertilizers exports from both India and the rest of world, shows the export from India overtaking from the rest of world since 2004/05. As fertilizer price in India is subsidized, Nepal imports fertilizers from the Indian fertilizer suppliers/producers based on import parity price (IPP), which is higher than for the fertilizers available in the India market.

Figure 3: Fertilizer Import in Nepal



In spite of fertilizer price volatility, Nepal often faces the problem of fertilizer distribution at the time of plantation and growing due to poor road networks. To avoid the problem, Nepal adopted the fertilizer-sector liberalization program since 1997, a major policy breakthrough in the fertilizer market, which enhanced smooth distribution of fertilizers to some extent despite issues such as the quality of fertilizers supplied by the private sector. This fact can be seen from Figure 4, which presents the supply of fertilizers from the Agricultural Input Company Limited (AICL, an undertaking of the Government of Nepal) and private sector. As is seen in Figure 4, the supply of fertilizers from the private sector is sharply increasing since the adoption of fertilizer sector reform in 1997. The quantity of fertilizer supply from the private sectors is higher than AICL until 2007/08. Private sectors have discounted the involvement in the supply and distribution of fertilizers after the government's reintroduction of subsidy on fertilizers since FY 2008/09. However, the impact of reintroduction of fertilizer subsidy on farm output is yet to be analyzed.

Figure 4: Sale of Fertilizers in Nepal



This study applies both the monthly and yearly time series data. Monthly data cover the figures from August 2003 to March 2010, while yearly data include them from 1990 to 2010. The descriptive statistics on variables used in the analysis show that the average price of DAP (27.85) in the world market is relatively higher than in Nepal (25.35) and India (15.66).

Likewise, the trends in Nepalese urea price are close or closer to the world prices in comparison to Indian urea prices. However, there are higher price fluctuations shown by the standard deviation in Nepal compared to the prices of world markets, but the average prices of Indian markets are below the Nepali and World markets. The average production of paddy rice is 2,079,892 MT; wheat is 922,941 MT; and maize is 103,930 MT, while the yearly average prices of DAP, urea, and potash are 18,091, 10,001 and 10,819 rupees per MT respectively.

5. Econometric Results

Table 1 presents the transmission of Indian and world fertilizer prices to Nepalese fertilizer prices. To analyze fertilizer price transmission, the model applies linear regression equations for both the prices of DAP and urea using monthly price data from August 2003 to March 2010. The analysis first tested the problem of autocorrelation, which often occurs in time-series data by applying the Darwin-Watson Test when the rho (ρ) value was found to be greater than zero, implying that there is autocorrelation in the model. There are several techniques to overcome autocorrelation or correlation in time series. A Newey-West Estimator is often used to correct the effects of correlation in the error terms applied to time series. This technique is traditionally used to account for serial correlation of unknown form in the residuals of time series data. Newey-West standard errors are robust to both arbitrary autocorrelation and arbitrary heteroskedasticity (Wooldridge, 2003). The study applies the Newey-West Estimates and also tests 3, 6, and 12 month lags, which are common in monthly time series data to decide which lag performs better (ibid.). The results show better performance of lag 6 and therefore the results are reported in lag length 6 in Table 1.

F-statistics for both prices of DAP and urea are significant at the 99 percent confidence level, implying that the explanatory variables selected for the model have a better fit to the data set and the model explains a lot more variability in the dependent variable. The findings show that Nepalese fertilizer prices are more likely to transmit with world fertilizer prices. For instance, the coefficient (0.33) of DAP with Nepali DAP prices shows that one Rupee change in world price is likely to induce change in Nepali DAP price by 33 percent (i.e., 33 paisa), while only 6 percent of the urea price is likely to be influenced by the world urea prices. However, the coefficients of Indian fertilizer prices are not significant at any required level, showing no impact in this data set. This result is a bit surprising for the case of Nepal. Since Nepal has a de facto economy dependence on India, the change in fertilizer prices is more likely to have an impact on Nepalese prices. Such an unexpected result could be an outcome of the subsidy in fertilizer prices in India. For instance, Nepal imports chemical fertilizers from India on the basis of import parity price[1] (IPP), based on open market price, while the fertilizer price available in India is a subsidized one. In addition, Nepali fertilizer, which is purchased on IPP

[1] As per the documents and discussion with the staff of Nepal Agricultural Input Company Limited.

basis, may not pass through the Indian fertilizer price, heavily subsidized by the Indian government. It is also a fact that the informal/unrecorded imports of fertilizers often overshadow the formal trade and price relationship between two countries. The estimation of fertilizers used in Nepal from India through informal channels accounts for about 65 percent (ANZDEC, 2002). In other words, the open porous border with a large share of informal/unrecorded trade of fertilizers may limit the effect on the transmission of prices to domestic markets (Cudjoe, Breisinger, and Diao, 2009). It is thus obvious that Indian fertilizer prices controlled and subsidized by the government do not pass through the Nepali uncontrolled fertilizer market, at least during the period of fertilizer price deregulation.

Table 1: Regression Equations of the World and Indian Fertilizer Price Transmission to Nepal

Variable	DAP	Urea
Indian	-0.68	0.71
	(1.32)	(1.07)
World	0.33***	0.06**
	(5.54)	(2.62)
Constant	17.92***	12.61
	(3.92)	(1.23)
F-statistics	15.4***	8.71***
No. of observations	79	79

Note: The values of t-statistics are given in the parentheses. ***, **, and * are 1%, 5%, and 10% level of significances respectively.

The study further analyzes the impact of fertilizer prices such as DAP, urea, and potash on crop output, particularly paddy rice, maize, and wheat. For this purpose, the study estimates the crop output as a function of fertilizer prices of DAP, urea, and potash using national average data from 1989 to 2009. The estimates first run some diagnosis tests, since the data are in time series. The results of Durbin-Watson Test show the presence of autocorrelation. The study applies Newey-West Estimators that often are used to overcome the problem of autocorrelation and serial correlation in the time series data set. The results of Newey-West Estimators are presented in Table 2, showing that as F-Statistics are significant, and the variables are better fitted for the models and data set.

Table 2: Regression Results of Crop Output with Fertilizer Prices (DAP, Urea, and Potash)

Variable	Log of DAP	Log of Urea	Log of Potash	Constant	F-Statistics	No. of Observations
Log of Paddy rice	0.06	0.32***	-0.12	12.12***	14.19***	21
	(0.45)	(3.97)	(0.9)	(18.97)		
Log of Wheat	0.07***	0.47***	-0.19**	8.57***	100.01***	21
	(3.05)	(10.29)	(2.31)	(17.76)		
Log of Maize	0.23	0.2*	-0.12	10.89***	14.13***	21
	(1.15)	(1.94)	(0.85)	(15.74)		

Note: The values of t-statistics are given in the parentheses. ***, **, and* are 1%, 5%, and 10% level of significances respectively.

The coefficients of urea are significant and positive at 99 percent confidence level, implying that crop output is more likely to increase with an increase in the price of urea for paddy rice, wheat, and maize. Highest impacts of urea prices are observed in wheat, followed by paddy rice, and maize. DAP price is significant with a positive sign, revealing a nominal impact on wheat production with price rise, while the rise in the potash price is likely to reduce total output of wheat, but not paddy rice, and maize. The results of urea, DAP, and potash can be analyzed in terms of both demand side and supply side of the theory. On the demand side, an increase in fertilizer may reduce the demand for fertilizers and decrease the consumption of fertilizers in crops reducing the output. This may lead to a negative relationship between fertilizer price and crop output (e.g., potash in this exercise). However, on the supply side, increase in fertilizer prices can enhance fertilizer supply. Despite an increase in fertilizer prices, farmers may increase fertilizer use due to an increase in the commodity prices that may stimulate farm investment. The relationship between crop output and fertilizer prices may be positive due to the indirect effect of increasing output prices (e.g., urea, and DAP in the regression results). In other words, the use of fertilizers in some potential areas may be economically profitable even at higher fertilizer prices, as suggested by Heisey and Mwangi (1996).

Ambiguity in the sign of coefficients of the urea and DAP price with respect to crop output seems to be an effect of increase in the quantity consumed of fertilizers even with an increase in the fertilizer prices. Table 3 shows an annual increase in fertilizer consumption by 10 percent for paddy, 20 percent for maize, and 6 percent for wheat from 1991/92 to 2001/02. Despite an increase in fertilizer prices, the quantity consumed of fertilizer did not fall over the period, which could lead to the higher crop output. This can also be seen from the positive average elasticity of crop output with respect to the fertilizer used (Table 3). Moreover, the result of positive relationship could be an outcome of poor fertilizer market integration with India. Such results may imply that the fertilize price changes in Nepal are less likely to have an impact on fertilizer consumption in Nepal due to higher share of the informal import in Nepal relative to the domestic supply from the rest of sources, which need to be separately addressed. As a result, the fertilizer policy subsidy often becomes ineffective due to not having clear fertilizer market mechanism with India.

Table 3: Fertilizer Application Rates by Crops

Crop	Total Cropped Area (in Thousand Ha)		Crop Output (in Thousand MT)		Mineral/Chemical Fertilizer Used (in Thousand MT)		Change (%/year)	Average Elasticity
	1991/92	2001/02	1991/92	2001/02	1991/92	2001/02		
Paddy	1,412	1,517	3,223	4,164	67	135	10	0.29
Maize	754	826	1204.7	1,511	13	39	20	0.13
Wheat	671	667	762	1,258	45	72	6	1.09

Source: CBS (1993, 2004): Nepal Sample Census of Agriculture (1991/92, and 2001/02); MOAC (2008/09).

Moreover, the results could be the effect of the unavailability of fertilizers at the time of planting and growing rather than the effect of fertilizer prices, where acquiring fertilizers in an appropriate time may be more influential than the price of fertilizers. However, as mentioned in the theoretical framework, there may be many factors that influencing farmers' decision to adopt fertilizers, such as resource availability, prices, and availability of fertilizers at the time of planting and demand for crops in the markets. The findings from these models conclude that higher impact is shown by the crop output prices compared to fertilizer input prices. Moreover, the timely availability of the fertilizers could also be a major concern for farmers rather than fertilizer prices at the time they need, as suggested by the ASPR report.

6. Conclusion

Surge in the fertilizer price during the past couple of years has raised many questions pertaining to its impact on the agrarian economy where a majority of the people depends on this sector for their livelihood. Rise in fertilizer price could doubly harm the impoverished economy of Nepal which needs to increase its agricultural production and productivity to meet the demands of the increasing population and improve the livelihood of rural people.

The study, which tried to analyze the impact of soaring fertilizer prices on the agricultural production in Nepal, shows high volatility of world fertilizer prices and an upward trend of Nepali fertilizer prices, while Indian fertilizer prices are relatively stable over the period. DAP prices are found to be higher and relatively more volatile than urea prices. For econometric analysis, the study first explored the transmission of global and Indian fertilizer prices to Nepal and then estimated the impact of rising fertilizer prices on crop output in Nepal using monthly data for price transmission and yearly data for crop output. The findings show that world fertilizer prices pass through Nepalese fertilizer prices, where the impact as shown by the transmission coefficient is found to be higher in the price of DAP in comparison to urea price. The coefficients of Indian fertilizer prices are not significant, perhaps due to the government control policy on fertilizer markets in India combined with an open porous border that often limits the effects on price transmission. The analysis also shows a positive relationship between crop output and urea price, probably due to increase in the quantity consumed of fertilizer as well as increase in quantity output over the period. DAP price seems to leave a positive nominal impact on wheat production, but not on paddy rice, and maize production. However, the negative relationship between potash and crop output, particularly wheat, shows a stronger effect of input prices rather than output prices. Since this study is confined only to crop-specific output data due to limitations of fertilizer specific consumption data since the liberalization of fertilizer market in 1997, the finding needs to be further refined once the data from the National Agricultural sample Census 2011 become available.

The results show different responses of international prices to the domestic markets as well as the crop output. The variations in the response of Nepal to the changes in the prices of

fertilizers in the international markets could be a result of many factors such as: poor fertilizer market integration (particularly with India) higher share of informal market compared to formal trade, poor road networks, and geographical heterogeneity. The fertilizer policy must address clearly the issue of fertilizer market clearing prices with India, otherwise there is no rationale to provide subsidy on fertilizers. Moreover, Nepalese government should focus on better market integration through investment in infrastructure and better market regulations. Moreover, higher investment in agricultural research and development could also help to increase production and minimize the impact of possible food crises on the poor and vulnerable people.

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Diagnosis of Poverty-Environment Nexus in the Context of Development in Nepal

Dinesh C Devkota[1]

Abstract

This paper investigates the poverty-environment nexus at the national level in Nepal. Poverty and environmental deterioration are among the greatest challenges faced in the developing world including Nepal today. These are interlinked and they reinforce each other in a downward spiral, and the increasing population exacerbates both. However, the relationship is complex, highly influenced by the socio-economic factors of a country or region. The poverty-environment nexus can be explained through two inter-linked processes. First, environmental degradation reinforces incidence of poverty by reducing the availability of natural resources and making the poor vulnerable to natural disasters. Second, poverty forces people to degrade the environment through over-exploitation, in the absence of other alternatives. Joint implementation of poverty and environment strategies may be cost-effective for some environmental problems, but independent implementation may be preferable in many cases as well.

JEL Classification:

Key Words: Environmental degradation, poverty, pollution, natural resource, linkage

1. Introduction

The notion that there is a relationship between poverty and environmental degradation is of long standing, yet the idea is being constantly re-discovered and re-invented. Thomas Malthus indirectly suggested that the poor are more likely to engage in environmentally injurious behaviour because they are incapable of thinking beyond the next meal. This idea was further embraced by colonial powers in Africa and Asia who frequently identified poor local peasants as the key cause of soil degradation, wasteful burning practices, and deforestation (see, for example, Baker, 1983; Fairhead and Leach, 1996). Poverty, in the early twentieth century, was often bundled in with ignorance, race, and tradition - all factors that contributed to poor resource management in the eyes of colonial administrators. The poverty-environmental degradation idea has taken on a renewed vigour since the rise of the sustainable development concept in the late 1980s (Lele, 1991; Bryant, 1997). Within the context of this discourse, poverty and environmental degradation has been described as a two-way interactive process. "Poverty is a major cause and effect of global environmental problems", stated the influential Brundtland Commission (WCED, 1987) in a sentence that captures widely held beliefs: Poor people are

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often seen as compelled to exploit their surrounding for short-term survival, and are assumed to be the ones most exposed to natural resource degradation. Despite these intuitively plausible statements, the debate on the characteristics of poverty-environment interaction has been likened to a puzzle (World Bank, 1997), which has several pieces, and identifies some crucial links and features, but still lacks a holistic view (World Bank, 1999). A series of UN-sponsored conferences since the early 1990s (Rio, Cairo, Copenhagen, Beijing, Istanbul, and Johannesburg) have elaborated the notion of sustainable development, each often reiterating the conventional wisdom regarding poverty-environment interactions (Gray and Moseley, 2005). To tackle this challenge, the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) joined hands and launched the Poverty-Environment Initiative (PEI) in 2005 and significantly scaled up the momentum in 2007. The PEI country program in Nepal, signed in 2010 and intended to run until 2012, is a global UN programme that helps countries to integrate poverty-environment linkages into their national and sub-national development planning, from policymaking to budgeting, implementation, and monitoring.

There is an obvious connection between environment and poverty which can hardly be over-emphasized. The more visible environmental problems are mostly seen in the case of exhaustive resources, which are in constant danger of depletion from excessive use, particularly in a developing country such as Nepal. At the same time, loss of many environmental resources can indeed make some people destitute even when the economy is growing. Therefore, common and mutually interlinked issues of poverty eradication and environmental protection are the major concerns of many developing and developed countries. While everyone recognizes the connection between poverty and environment, the nature of these relationships is very complex and location-specific (UNDP, 2008).

Recently, there has been increasing recognition that the linkages between poverty and the environment are complex, and are strongly influenced by the local demographic, institutional, and cultural factors. In some circumstances, a positive relationship between poverty and environmental degradation has been identified, lending support to the hypothesis that poor producers will systematically degrade the resources on which they depend if they have no alternatives. In other cases, it appears that over-exploitation of natural resources (such as forests) is more likely the result of actions of relatively wealthy interests engaged in the pursuit of commerce. Much depends upon the strength of local institutions engaged in environmental and resource management, and the extent to which they represent the interests of poorer groups (www.prem-online.org).

Environment comprises both the living (biodiversity) and non-living components of the natural world, and the interactions between them, that together support life on earth. Environment provides goods (natural resources) and services (ecosystem functions) used for food production, harvesting of wild products, energy, and raw materials. Environment is also a recipient and partial recycler of waste products from the economy and an important source of recreation, beauty, spiritual values, and other amenities (DFID, EU, UNDP and World Bank,

2002). Environmental problems such as unsafe water, poor housing, lack of sanitation, and natural disasters have not arisen from excessive degree of development; rather they reflect the inadequacy of development. Thus, while the rich countries may look upon development as the cause of environmental destruction, the poor countries cannot but look upon development as the cure or the means of remedying the basic environment problems. In this sense, therefore, the concern with environment in the developing world is but an aspect of the commitment to development. The goals of environment and the goals of development are facets of the same problem (UNESCO, 1981). In this context, this paper attempts to analyse the poverty-environment nexus in the context of development in Nepal.

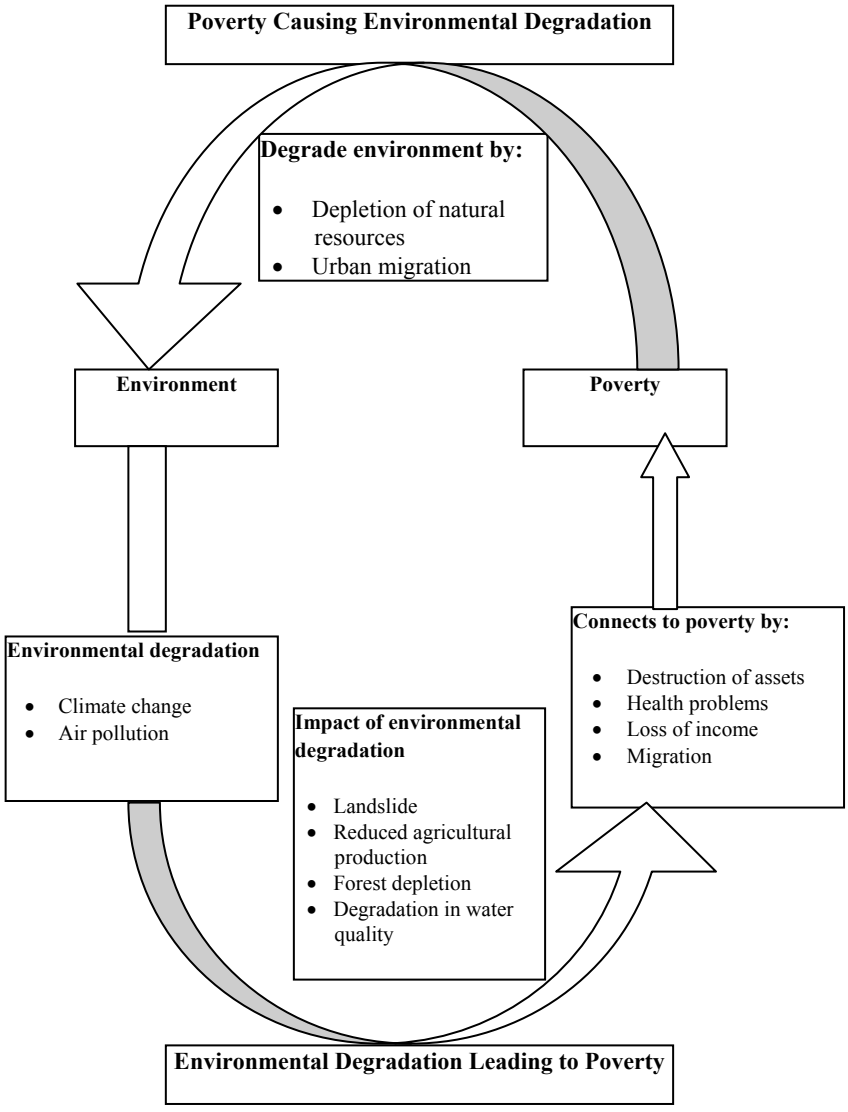
2. Poverty: Conceptual Diversions and Alternative Definitions

The way in which we define and conceptualize poverty influences poverty-environment analysis. Northern conceptions of poverty, defined in terms of monetary wealth and income (GDP/GNP per capita being the most frequently reported statistics), are fairly limited in many developing country contexts where a high proportion of production and transfers often takes place outside the formal economy and where there are significant regional and inter-societal differences (e.g., Hagberg, 2001). In many rural contexts, for example, rather than cash savings and earnings, wealth is often reflected in cattle holdings, the quality of agricultural implements, housing materials, labor resources, access to land, and the ability of the households to produce food. This conception of poverty has also changed recently, with more attention given to the non-market aspects of deprivation. For example, the World Bank has developed a three-part analysis of poverty that includes not only economic opportunity but also relative vulnerability to risk (security), and influence or access to the levers of power, i.e., voice/empowerment (www.prem-online.org). A more nuanced conceptualization of rural poverty is outlined by Reardon and Vosti (1995), who categorize poverty in terms of 'livelihood assets', including human, built and financial capital, as well as natural and social capital, all of which contribute to human well-being. Another dimension of poverty is encapsulated in Amartya Sen's entitlement concept, used to refer to a person's legitimate claims to available food (Sen, 1981; Dreze and Sen, 1989). Entitlements, according to Sen, are claims on resources that can be converted to food, ranging from crops in the ground, to cash on hand for food purchases, to social relations that may provide food in times of need. Lack of entitlement, that is, the ability to access resources, means that people can go hungry even though food resources may be abundant. Leach, Mearns, and Scoones (1999) have extended the concept of entitlement to environmental resources, 'exploring how differently positioned social actors command environmental goods and services that are instrumental to their well-being'. The discussion above suggests that poverty defined as a lack of income or cash savings is highly problematic in many contexts. Poverty is more about an inability to meet basic needs over time. As such, any definition of poverty must be context-specific because the mix of assets and entitlements needed to meet the basic needs varies from place to place.

3. Conceptual Framework for Poverty and Environment Nexus

Poverty-environment nexus can be explained through two inter-linked processes as shown in Figure 1. In the first case, environmental degradation reinforces the incidence of poverty by reducing the availability of natural resources and making the poor vulnerable to natural disasters. In another one, poverty forces people to degrade environment through over-exploitation, in the absence of alternatives.

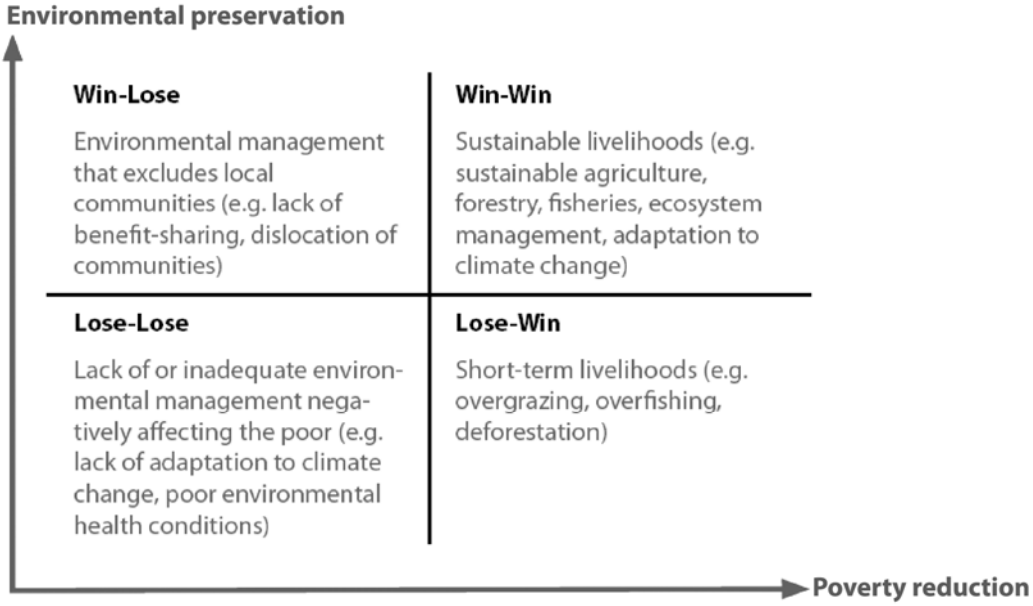
Figure 1: Linkage between Poverty and Environment



Source: UNDP 2008 with minor modification.

Poverty-environment linkages are dynamic and context-specific, reflecting geographic location; scale; and the economic, social, and cultural characteristics of individuals, households, and social groups. In particular, the sex and age of the head of household (male or female, adult or young person) are the key factors influencing poverty-environment linkages. Poverty-environment linkages can be positive or negative, creating virtuous or vicious circles for environmental preservation and poverty reduction (Figure 2.). While tradeoffs may be necessary, poverty-environment linkage aims at achieving the best balance between environmental preservation and poverty reduction for the benefit of the poor and long-term environmental sustainability.

Figure 2: Examples of Positive and Negative Poverty-Environment Linkage



Source: UNDP-UNEP 2009.

Poverty-environment linkages are dynamic and context-specific reflecting both geographic location and scale and economic, social, and cultural characteristics of individuals, households, and social groups. Different social groups can give priority to different environmental issues. In rural areas, poor people are particularly concerned with secure access to and the quality of natural resources-arable land and water, crop and livestock diversity, fish and bushmeat resources, forest products, and biomass for fuel. For the urban poor, water, energy, sanitation and waste removal, drainage, and secure tenure are the key concerns. Poor women regard safe and physically close access to potable water, sanitation facilities, and abundant energy supplies as the crucial aspects of well-being, reflecting women's primary role in managing the household (Brocklesby and Hinshelwood, 2001; UNDP and EU, 2000 as cited in DFID, EU, UNDP, and World Bank, 2002, p. 9).

4. Interlinkages between Poverty, Environment, and Economic development in Nepal

With a US $ 472 per capita GNI in 2008/09 (CBS, 2009), the Nepalise economy is largely characterized by poverty and stagnation. Over 86 percent of Nepal's total population lives in rural areas. Land, forest, mineral, and water are the key natural resources in Nepal for human survival and livelihood. Rural populations, especially the poor, landless, indigenous people, and women rely heavily on forest and land resources for their livelihood. Over 80 percent of Nepalese people derive their livelihood from forest. Around 86 percent of the total energy for cooking and 40 percent of fodder come from forests. Almost two-thirds of the total gainfully employed population is engaged in the primary sector including agriculture, forestry, and fishing (CBS, 2002a). Growth in agriculture, on which 74 percent of the population depends for its livelihood (CBS, 2009), has been slow. The average growth rate of the sector between 2004/05 and 2008/09 was only 2.64 percent per year. Its contribution to GDP has declined steadily to 32.8 percent in 2008/09 from 39 percent in 2004/05 (MoF, 2009b). Predominantly an agricultural country, Nepali economy is a manifestation of staggering disguised unemployment and subsistence farming. GDP per employed person in the six years preceding 2009 was low but has now shown a positive trend, with a rate of 1.75 percent in 2009 (MoF, 2010). Only about one-fifth of the total were engaged in wage employment in the non-agricultural sector in 2008. Unfortunately, the female youth (15-24 years) unemployment rate also increased from 2.1 percent in 1998 to 2.9, percent in 2008 (CBS, 2009).

In poor countries like Nepal, not only are development and sound environmental management complementary to each other, but there is also a close two-way inter-linkage between poverty and environmental degradation. In these countries, without adequate environmental protection, development will be undermined, and without development, environmental protection will fail (World Bank, 1992). In the Hills of Nepal, for example, environmental degradation is both a contributing cause of poverty, as well as its consequence. The following is a brief description of the poverty-related causes and consequences of the major environmental problems in Nepal.

4.1 Poverty and Hill Ecology

In the hills of Nepal, the vicious circle of poverty and environmental degradation is reinforced by the growth of population in the context of a traditional agrarian technology forcing farmers into ever steeper slopes and toward farther forest areas in search of fodder and fuelwood, thus surrounding villages with a widening circle of denuded hill sides (Dahal and Dahal, 2005). The consequences are most severe for small peasants and the near landless who are most vulnerable to natural disasters such as landslides, as well as to the less dramatic but equally crippling slow deterioration of their means of subsistence (Seddon, 1987). The processes by which the impacts are multiplied are as follows (Gurugharana, 1990):

a) As a result of reduced forest cover, less and less dung and compost are available. This has cumulatively resulted in poorer maintenance of soil fertility, reduced production, reduced agri-residue, and further expansion of the marginal land through deforestration. In some areas, dung is also used for fuel. But as dung supply declines due to reduced forest cover, people's dependency on fuelwood increases. Simultaneously, the depletion of grazing land leads to poorer quality animals, which reduces products and labor value. This raises the number of lower quality cattle, aggravating the over-grazing problem.
b) Larger deforestration and diminution of the layer of decomposing leaves enhances surface run-off intensifying erosion of fertile topsoil. This in turn reduces agricultural productivity and deepens poverty, extending further erosion of farming of unsuitable and unstable land, forests, and grasslands.
c) Environmental decline also increases the time spent on fuel and water collection, which reduces the time for other household and productive activities. Moreover, children (especially daughters) have less time for education and water shortages increase sanitation-related health problems. The cumulative impact of all these phenomena is greater poverty.

4.2 Poverty and Tarai Forests

The vicious circle in the hill regions generated by population growth, poverty and environmental degradation has also pushed hill populations to migrate to the Terai which has resulted in population expansion, increased demand of agricultural land, increased urbanization and resettlements, degrading natural resources (especially of water and forests), and diminishing prospects of new employment generation. Furthermore, there have been, for a long time, a indiscriminate logging operations in the Terai. All these have a cumulative impact on depletion of forest resources, a degradation of both the forest and soil resources, and water resources as well (Dahal and Dahal, 2005).

In such a context, the production function of the forest needs to be enhanced for the economic benefit of the community, while the protection and regulation functions have to be directed for ecological betterment (Pradhan, 2006). The forest area of Nepal declined from about 38 percent in 1986 to 29 in 2001. The shrub area increased by 126 percent during 1986-2001 while during the same period forest area decreased by 24 percent (CBS, 2008). The Far Western Nepal winessed the highest level of forest degradation. A more recent estimate suggests that deforestation increased at an annual rate of 1.4 percent between 2000 and 2005 (Baral, Shah, Sherpa, and Paudyal, 2008).

4.3 Poverty and Soil Resource

If Nepal's population is growing at an alarming rate, on one hand, on the other, large sections of the population still live in dire poverty compelling people to clear forests for cultivation, fuel, and settlement. As a result, land is overexploited, leading to soil erosion and considerable decrease in land fertility. It is generally believed that cultivating land on slopes of more than 30 degrees, ploughing up and down the slopes, reckless terracing and drainage cause soil erosion. Soil degradation is perhaps the greatest impediment to development in Nepal, and is primarily related to deforestation and use of pesticides and insecticides. The annual soil loss by the major rivers in Nepal is estimated to be 5 tonnes per ha, which is equivalent to the loss of 75 kg/ha of organic matter, 3.8 kg/ha of nitrogen, 10 kg/ha of potassium and 5 kg/ha of phosphorous (Carson, 1992). Agricultural land increased from 2,968,017 ha (I9.98 percent) in 1986 to 3,090,780 ha (21 percent) in 2001. Of the total area of landholdings, more than fifty percent is in the Tarai, two-fifths in the Hill region, and the remaining Mountain region (CBS, 2002b).

4.4 Biomass-Based Energy Use

Biomass fuels account for 84 percent of energy consumption (fuelwood 72%, agricultural residue 5% and dung-cake 7%), commercial 15% (coal 2.4%, petroleum 9.9%, electricity 2.7%), and renewable energy less than 1%. Forests alone fulfilled almost three-fourths of rural household energy needs whereas in the urban areas about one-third of the households use fuelwood (MoF, 2008). Such reliance on fuelwood and traditional biomass fuels combined with inefficient end-use technologies and combustion in enclosed, poorly vented environment, result in the exposure of the users, who often happen to be poor, and women, to dangerous carcinogenic pollutants, causing respiratory and other illness and higher fuel costs (in cash, kind or labor) compared to those using modern fuels. When environmental concerns or other forces (e.g., the financial interests of stronger societal elements) lead to larger control of forests and other commons without secure ownership or use of rights vested in the previous users (inevitably the poor), the perverse impact on the poor is the diminished capacity to earn a livelihood (fuelwood cutting, fodder gathering, etc). As an example of wrong state policy, one can cite the nationalization of forests in 1957 and as a case of wrong process there was the indiscriminate logging of Tarai forests for commercial purposes and resettlement after mid-1950s, especially after 1979/80, the year of Referendum.

4.5 Underutilization of Potential Resources

In addition to overexploitation of resources such as forests, there is simultaneously the problem of underutilization of many potential renewable natural resources and energy sources, such as water resources and hydropower, solar energy, wind power, biogas, etc. The country is endowed with immense water resources (about 2.27% of the world stock for about 0.35% of world

population). There are about 6000 rivers and rivulets with an average density of rivers over 0.31 km/sq. km. The potential hydropower is 83,000 MW of which about 50 percent is considered economically viable (Shrestha, 1985). However, the installed capacity in the country is only 620MW, which is about 0.75% of the total estimated economically potential (NPC/UNCT, 2010). Similarly, negligible fractions of potential solar power (26.6 million MW), potential biogas plants (over one million family size plants based on over nine million cattle), and potential wind power (400-500 MW in Manang and Mustang alone) have been installed and utilized (Dahal and Dahal, 2005). Such underutilization of renewable sources of energy and rising energy demand in the country have continued the dependence on biomass furthering environmental degradation and productivity decline. This underutilization is a reflection of underdevelopment, and here development and environmental protection show complementarity rather than trade-off.

Despite improvements in energy supply through micro-hydro, solar, biogas, and briquettes, the majority of poor are still dependent on firewood as their primary energy source. Such high dependence on wood in the absence of adequate forest management and replanting of trees is causing deforestation, top-soil erosion, flooding, and other negative environmental consequences.

4.6 Urban and Industrial Pollution

Although the country is overwhelmingly rural (86 percent of population) and industry is still a minor sector (contributing 22% of the GDP), the environmental impacts of land, water, and air pollution in urban areas due to untreated industrial wastes, accumulating household wastes, and lack of safe drinking water and drainage, etc. are assuming alarming proportions. The country's current urban population is 13.9%. In 1952/54, only 3% of the total population lived in the urban areas. However, urbanization in the country is characterized by rapid and haphazard growth. The urban growth rate during the last decade (1991-2001) was 6.65% as against the national population growth rate of 2.25% and rural population growth rate of 1.72% (CBS, 2003). Such rapid growth of urban population has brought tremendous pressure on the urban environment. One of the most visible indicators of the rapid growth of urban population is the heaps of garbage that can be often seen littering the city streets or at dump sites on river banks and in other public places. Households are the main sources of solid waste in the urban areas of Nepal. It is estimated that the residents of the 58 municipalities generate approximately 426,486 tonnes of waste, constituting 83% of all solid waste generated in the country. In comparison, agricultural waste constitutes 11% and industrial waste 6% of the total solid waste. Pollution of the urban environment from the direct discharge of untreated waste water into rivers is a big issue. As a result, most of the rivers in the large cities have been polluted; for instance, in the Kathmandu Valley all the rivers have become open sewers. Finally, air pollution is also increasing in the urban areas, which is more acute in the large urban areas due to increase

in smoke emitted by the increased number of vehicles and industries, and the dirt roads (Pradhan, 2006).

These problems, most acute in the densely populated urban, semi-urban, and industrial areas, severely affect the poor and middle income households who are unable to protect themselves from these hazards, resulting in various water-borne and respiratory diseases. Although, every one suffers to some extent from congestion and land, water, and air pollution, it is the relatively poor who suffer most from hazards of unchecked, uncontrolled, and unplanned urbanization and industrialization (Dahal and Dahal, 2005). If the environmental impacts and social costs (e.g., health impacts) are taken into account, the ongoing haphazard urbanization and industrialization in the country cannot be considered symptoms of development. A progress which worsens the life of a majority of people can hardly be called development, be it modernization, industrialization, urbanization, or growth measured in terms of per capita.

4.7 Drinking Water and Sanitation

The total volume of annual internal renewable freshwater resources of Nepal is 8.88 thousand cubic meters per capita, about four times the figures for India and Pakistan. In a country with such immense water resources, it is a pity that only 80% of the population has got the facility of drinking water and only about 43% are provided with sanitation service at present (NPC, 2010b). But the disparity between the urban and the rural areas in the access to drinking water and sanitation facility is very wide. The people who have access to drinking water are not really safe in drinking water without treatment, household boiling, and filtering. Even water is available only for a few hours every day. There is also acute shortage of waste-water disposal facilities, sewerage systems, and solid waste collection and disposal systems. In addition, the lack of latrines in most semi-urban houses and the traditional habits of defecating on backyards, open defecation spaces, roadsides, banks of ponds, rivers and streams, etc, lead to contaminated water supply and widespread transmission of excreta-related diseases such as diarrhoea, dysentery, typhoid, and parasitic infections.

Apart from painful human suffering, poor health, and loss of lives, poor environmental sanitation causes expenditure on medicines and health care in a country that has to import most of its medicines and suffers from scarcity of hospitals, health manpower, and other medical facilities. It also leads to lower productivity of the Nepali labor force and degradation in the scenic beauty of an otherwise beautiful country (Guru-Gharana, 1990). Poverty, population growth, and lack of education and awareness (including personal and environmental hygiene), coupled with institutional problems including inefficiency and poor technology of public utilities, lead to environmental degradation.

4.8 Inefficiency in Energy and Resource Use

The oil crises of the seventies and growing environmental concerns have prompted industrial countries to reduce energy intensity by developing and adopting energy-efficient products, apparatus, and technologies. But Nepal, like other poor developing countries, has not been able to benefit from such developments (Dahal and Dahal, 2005). There is substantial inefficiency in resource use in households, transport, industry, construction, services, and agriculture. Although petroleum and coal products share less than five percent of the total energy consumption, their import cost to Nepal is about ten percent of all import costs and one-third of the export earnings. Thus, efficiency in the use of commercial energy is of paramount importance for development and poverty alleviation, as well as for control of environmental pollution caused by the burning of such fuels. This problem will be even more severe as industrialization, urbanization, transport and construction works, and increased mechanization of agriculture advance, along with population expansion.

The estimates for Nepal are not available, but conservation measures are estimated (World Resources, 1992/93 as cited in Dahal and Dahal, 2005, p. 156) to significantly reduce the projected increases in energy consumption of developing countries (by 25 percent), capital expenditures on energy (by 50 percent), and carbon dioxide emissions (by 30 percent), by 2025 since the developing countries, including Nepal are beginning to consider and adopt conservation and energy-efficient strategies and technologies as an alternative resource in itself.

4.9 Characteristics of the Poor in Nepal

In 2005, the proportion of Nepal's population living on less than US $ 1 per day was estimated to be 24.1% (CBS/World Bank, 2005) and 31 percent of the population were assessed to be below the national poverty line. The country's current poverty level is still 25.4%, suggesting that it has been reduced by 5.6% points since 2005 (NPC, 2010a). The 2008/09 assessment of variation in poverty incidence geographically and socially indicated that 95.5% of the poor people live in rural areas and the incidence of poverty in rural areas (28.5%) is almost four times higher than that in the urban areas, which is 7.6% (CBS, 2009). Variation in poverty by geographic region is significant. The High Mountains and Western Hills hold a higher percentage of poor than the Tarai and eastern parts of the country.

The poor lack economic assets including land, the most important asset in agricultural setting. The average operational landholding per capita is about one-third and one-half of the per capita holdings for the non-poor respectively in the Terai and the hills. Moreover, the quality of the land of the poor is usually much lower than that of the non-poor households. The only important asset that the poor possess is unskilled labor, forced to sell at extremely low wages, because of oversupply of such labor and negligible marginal productivity. In rural areas, the opportunities for non-farm employment are very few and the demand for labor is highly seasonal. The rate of rural underemployment is reported to be more than two-fifths. In addition to low and

irregular income and lack of economic assets, there is also widespread indebtedness among the poor.

Women often constitute a relatively more deprived group because of intra-household as well as social and legal discrimination between the sexes. Most rural females of age 16 years and above are either lactating or pregnant and give birth to about six children during their reproductive age. Gender disparity starts right from birth, continues through different stages of the girl's life, and is deepened and perpetuated through various rituals. Sons are considered assets while daughters are considered liabilities (Dahal and Dahal, 2005). Both girl child and adult women suffer relatively more severely from the consequences of poverty. The cultural emphasis on the sacrifices of women, and disparities in access to economic resources and social services are the major causes for the larger deprivation of females.

Most of the poor are born of a malnourished and illiterate mother, suffer from birth complications, birth injuries, neo-natal tetanus, low birth weight, and infant mortality risks (64 per thousand live births is the national average, which obviously is much higher for the poor). Poor children suffer from acute respiratory infection, diarrhoeal diseases, typhoid, tetanus, etc., and malnutrition, especially from deficiency of vitamin A, iron, protein, and iodine. The national average of infant mortality is 41 per 1000 births and child mortality is 50 per 1000 births (NPC, 2010b), which is much higher for the poor children. The surviving poor children, especially girls, have to assist their parents in farming, livestock rearing, water, fuelwood and fodder collection, and household chores.

5. Conclusion

Sustainable development is a major challenge due to poverty in Nepal, where majority of the population is still dependent on environmental resources for securing a livelihood. Rapid population growth and poverty in the country has brought considerable stress on the natural resources, and has often led to the accelerated deterioration of the local and regional environment including deforestation, soil erosion and landslides, degradation of water quality, destruction of hydrological system, floods and droughts, desertification, and air pollution. The most cumulative consequence is the hindrance it causes in reducing poverty at the desired level. Therefore, the primary policy response to poverty and environmental issues in Nepal must promote the idea of sustainable development. The root question, however, is whether the agenda of sustainable development as put into practice actually serves the interests of the poor and results in environmental improvement. Access to resources and voice on decision making of the poor demand access and voice for a very large fraction of the population that is often poor and reliant on the local environment for subsistence. To understand the interplay between the local environment and poverty, one needs to relate the data gathered in a particular context to the socioeconomic data from the same area. This would allow us to answer important questions

such as: i) to what extent are different income categories affected by natural resource degradation? and, ii) to what extent are the various income categories affected by pollution? The answers could then guide targeted efforts to mitigate environmental pressures bringing the largest effects on the poorest people. The Ministry of Population and Environment (MoPE) has been set up with a mandate of development and management of environment, but when development activities in other sectors such as roads, drinking water, irrigation, urban settlement happen, there is often lack of coordination of these agencies with MoPE. Therefore, a mechanism must be put in place to coordinate the sectoral agencies in the context of environmental management and development as a top priority. Community-based conservation strategy is essential for the sustainable use of forests and biodiversity. Community forestry has been successful in conserving forests and satisfying the basic needs of the user groups. Such initiatives should be strengthened and expanded. Energy saving and less polluting devices and technologies in the household, industry, transport, construction services, and agriculture should be promoted through technology transfer and research and credit incentives.

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Socio-Economic Impacts of Group Organic Certification on Smallholder Coffee Farmers In Nepal

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Abstract

Different kinds of certification schemes have emerged as a source of significant innovative revenue for standard setting and livelihood promotion strategy in the environmental realm. This study examines the potential for group organic certification of coffee to contribute to socio-economic and environmental sustainability in the selected rural regions of Nepal. Information was collected through semi-structured interviews and focus group discussions in Gulmi and Kavrepalanchok districts of Nepal in 2008. The study findings revealed that group organic certification plays a positive role in smallholders' livelihoods. Certification is also seen as a catalyst to enter international markets coupled with environmental and social benefits. The regression analysis indicated experience of farmers, yield of coffee, percentage of shade trees cover, altitude of farm, membership, and the certification dummy as the key determining factors for household income from coffee sector. Coffee production-related shock and interaction between certification and shock exert a significant negative impact on household income. The results suggest that participation in group organic certification increases farmers' welfare through increased income.

JEL Classification: C01, O13, Q12, Q13

Key words: Group organic certification, Smallholders, Coffee, Welfare, Sustainable development.

1. Introduction

Among the various agricultural goods produced in and exported from Nepal, the competitiveness of coffee has increased fast in recent years, contributing to the development of farmers in rural Nepal. The increasing trend of exporting coffee from Nepal has been impressive. The share of coffee exports currently amounts to around 7% of the country's total and 15% of agricultural export share (FAOSTAT /World Bank, 2006). Nepali farmers are producing coffee in the eastern to western mid-hill regions of Nepal, despite that fact that it has very small presence in the world coffee arena. However, the ecological settings in the Himalayan hills provide a unique opportunity for the resource-poor farmers in Nepal to sell their

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organic coffee as a specialty coffee in the global market. It has very small premium in the world coffees arena, but it has been gaining importance in terms of area planted and production. Annually, total coffee production and area planted to coffee in Nepal is increasing by 35% and 28% respectively (AEC/FNCCI, 2007).

Following the advantage of organic coffee, farmers are organizing in some functional cooperatives and getting group organic certificate. Farmers are members of the district level cooperatives and follow the guidelines prepared by them. Although studies have stated that farmers receive price premiums for organic certified coffee (Bacon, 2005; Daviron and Ponte, 2005), the impact of certification on farmer welfare is a very complex issue because production intensities, yields, prices, and production costs vary widely both in conventional and organic production. In addition, organic certification has often been proposed, not only as a development tool for creating additional income for the farmers, but also as a means to reach environmental goals and to prevent further soil fertility losses. While these potentials have received attention both from the development practitioners and academics, there is hardly any peer reviewed literature on the impact of producing group certified organic coffee on the smallholders' livelihood, in particular, in South Asia.

The objective of this study is there to examine the potential for group organic certification of coffee in relation to socio-economic and environmental sustainability in the selected rural regions of Nepal. More specifically, the central question of this study is whether organically certified version as opposed to the conventional chains, provides better livelihood opportunities to the smallholder coffee producing farmers.

2. Literature Review

By the turn of the 20th century several certification schemes have already made inroads into the mainstream global coffee market: Fair trade, organic, and shade grown are the major ones among them (Ponte, 2004). The objectives of those certification initiatives were different depending on the various ecological and socio-economic concerns. All the three certification schemes pay a price premium to the producer/association. Among them, fair trade pays the highest premium followed by organic and shade-grown. Differentiated coffees can be clearly distinguished from mainstream coffees due to distinct origins, defined processes, and exceptional taste. They embrace the geographic indications of origin, gourmet and specialty, organic, fair trade, eco-friendly, shade grown, private or corporate standards (Lewin *et al.*, 2004). The desired standards for organic coffee depend on the importing country and the certification label since there is no single internationally accepted definition for the term 'organic'. Yet, the International Federation of Organic Agriculture Movements (IFOAM) defined several principles on which organic agriculture is based. According to IFOAM, organic agriculture should enhance the health of soils, plants, animals, and humans, provide that there is no use of synthetic agro-chemical inputs. It is a holistic approach which aims at sustainable

resource use and requires the interaction of humans to be fair at all levels and to all parties (IFOAM, 2006).

The increasing popularity of organic or fair trade coffee among roasters and consumers in recent years is driven by quality and social, environmental or health consciousness (Rice, 2001; Daviron and Ponte, 2005). National governments, NGOs, and international donors promote the marketing of coffee through group-based, certified market channels as a viable business model for small farmers (Willer and Yussefi, 2007; Linton, 2008).

Since organic certification is too costly for an individual small-scale producer, farmers form producer groups join cooperatives to obtain group certification (Rice, 2001). In order to be certified as a group, producers must keep detailed records of their farm management, have a proven internal control system, and are inspected annually by a third-party certifier (Daviron and Ponte, 2005). One of the most important principles of group certification is the systems' flexibility (Fonseca, 2004a), which means the schemes have to be appropriate to the respective smallholder realities and have to allow for the different local circumstances (de Alcântra and de Alcântra, 2004).

IFOAM describes two main categories of alternative certifications, namely, Group Certification and Participatory Guarantee System (PGS). A central point in the group certification process is that it allows certification at a relatively low price through the Internal Control System (ICS). Farmers are certified as a group (which varies in size), and share the costs for certification. The group is homogenous in terms of its geographical location and production system, and also markets products collectively (Myers, 2002; Fonseca, 2004a). This system has been developed as a local alternative to the annual external control of every single farmer. Unlike Third Party Certification (TPS) schemes, ICS schemes can be linked to the extension and advice system within a group. The external inspector then mainly evaluates the functioning and efficiency of the ICS and only performs a few spot checks of individual smallholders (Wilhelm and Fürst, 2002; IFOAM, 2006a). One of the main benefits of such schemes is the substantial reduction in costs, which makes certification feasible for smallholders. This, combined with improved market access, can improve farmers' incomes and livelihoods (Myers, 2002). Improved income is the most obvious benefit, but there are also other, less tangible benefits for farmers, which are mainly social or learning benefits. This can also create very strong networks among the farmers, which leads to mutual support, information exchange, advice, and machinery or product sharing (Myers, 2002).

3. Data and Methodology

In 2008, Primary data were collected through a survey conducted in two districts, namely, Gulmi and Kavrepalanchok of Nepal from August to October 2008. A multi-stage sampling

procedure was used to select districts, VDCs[1], and small-scale coffee producers. A total of 120 respondents were selected using a three-stage sampling procedure. In the first stage, Gulmi and Kavre were purposively selected based on two considerations: (1) Group organic certification/ Internal Control System[2] applied in Gulmi district; and (2) Selection of two major coffee producing districts in Nepal with similar geographic location of coffee farms. Selection of smallholder respondents with and without certification was not possible in Gulmi, since farmers in the district practiced group organic certification in each coffee producing sub-location. In the second stage, three Village Development Committees (VDCs) in each district were purposively selected following two criteria: (1) altitude of the coffee farms [high (>1000 m), medium (850-1000 m), and low (<850-700 m)] and (2) small-scale coffee farmers (having less than a hectare of coffee cultivation). Finally, in the third stage, 20 farming households were randomly selected from each VDC and interviewed using pre-tested semi-structured questionnaires.

Focus group discussions were also conducted: with the members of Coffee Cooperative Federation in Gulmi, with two District Coffee Producers' Associations, and with traders/exporters. The focus group discussions and interviews provided qualitative information for conducting a SWOT[3] analysis of coffee production and marketing as well as contractual relationships between farmers and buyers (cooperatives and/or companies).

Data were analyzed based on three factors: economic, social, and environment. For economic factors, regression model was used to identify whether or not the certification (dummy) contributes to higher household income from coffee sector. The Ordinary Least Square (OLS) method was used to estimate the contribution of the various factors to household income from coffee. The multiple regression function estimated in the study can be expressed as (following Gujarati, 2003):

$$Y_i = \alpha + \beta_i \chi_i + \varepsilon_i, \qquad i = 1,....,n \qquad (1.1)$$

where, Y_i is the annual household income from coffee sector (dependent variable); α is the constant term; β_i is the coefficient of the estimators; and χ_i represents the independent variable in the regression model. The econometric model used in the study is specified as follows:

*Ln*INCOME = f (EXPE, *Ln*YIELD, SHADE, ALTI, SHOCK, CERTI, ERTI*SHOCK) (1.2)

Equation (1.2) hypothesized that farmer's annual household income from coffee sector depends on the seven explanatory variables (Table 1), which also summarized the expected sign for the effect that they might have on natural logarithm of coffee income (*Ln*INCOME) for each case.

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[1] A 'VDC' is the lowest administrative unit in Nepal comprising small villages.

[2] An Internal Control System (ICS) is the part of a documented quality assurance system that allows an external certification body to delegate the periodical inspection of individual group members in an identified body or unit within the certified operator.

[3] Strengths, Weaknesses, Opportunities, Threats.

Table 1: Description of Variables in the Model and à P*riori E*xpectation

Variable	Description	Type of variable	Expected sign
*Ln*INCOME	Annual household income from coffee sector (Rs. in natural log form)	Continuous	
Independent Variables:			
EXPE	Experience of the farmer in coffee cultivation. (Years)	Continuous	+
*Ln*YIELD	Yield of fresh coffee cherries in 2007 (Quintals ha^{-1} in natural log form)	Continuous	+
SHADE	Shade trees cover (%)	Continuous	+/-
ALTI	Altitude of village in which farmer grows coffee (1= >1000m, 0 = Otherwise)	Dummy	+
SHOCK	Whether farmer faced coffee production-related shocks during last two years. (1=Yes, 0=No)	Dummy	-
CERTI	Whether coffee is organically certified (1=certified, 0=non-certified)	Dummy	+
CERTI*SHOCK	Interaction between certification and shock	Dummy	-

4. Results and Discussions

The average coffee yield per hectare was 2.45 metric ton (mt) ranging from 0.25 to 8.14 mt ha^{-1} of fresh cherry. The average yield of fresh cherry per hectare was higher in a non-certified farm (2.78 mt ha^{-1}) compared to certified farm (2.07 mt ha^{-1}) which was significantly different between two groups (Table 2). The yields are too low. The variability of coffee yield among the sampled farms may be partly due to climatic differences, biennial yield pattern of coffee, age of coffee trees, and agronomical practices.

The percentage of coffee orchard with shade trees cover was 57, which was higher in non-certified farms (63.8%) than the certified ones (50.7%). The difference was also statistically significant. Banana, citrus, guava, jackfruit, avocado, lapsi (Hug plum *Spondias nepalensis*), litchi, papaya, mango, peach, pear, plum, pomegranate, pineapple, and some fodder trees have been used as shade trees in coffee orchards. Around 55 percent of the farmers in the survey areas practiced intercropping and reported earnings from ginger, turmeric, cardamom (*Elettaria cardamomum)*, maize, pea, bean, cowpea, chilly, sweet potato, radish, and leafy vegetables in coffee farms. As for additional average income from intercrops and shade trees, they were not significantly different between two groups.

The average annual income from coffee was Rs[1] 6,056 for the total sample, ranging from Rs 120 to Rs 60,000 among the sample households. A comparison of the mean values between the groups clearly indicated that certified farmers had a high annual income from coffee (Rs 6,140) compared to the non-certified ones (Rs 5,966), but the difference between the two groups was not statistically significant. It was observed that majority of coffee producers (71.7%) in

[1] The exchange rate at the time of the survey was approximately 71 Rs/$US.

the certified areas were facing coffee production-related shocks[1] during the last three years compared to the non-certified producers (21.7%) and the difference was significant between the two groups.

The majority of the certified producers (43.3%) maintained a record on coffee production and marketing activities (book-keeping) compared to the non-certified ones (18.37%). About 92% of the certified producers had reported to have access to service facilities from cooperatives, coffee producers' associations, Winrock International Nepal or Coffee Promotion Project/Helvetas, Nepal as opposed to 73% of the non-certified ones.

The study also revealed that 33% of the certified producers had a membership in village level saving and credit cooperatives compared to 15% of the non-certified. The difference was statistically significantly different at 5% level. With respect to upgrading at farm and trading, the training variable is not statistically significant between the two groups.

Table 2: Comparison of Group Organic Certified in Gulmi District, and Non-Certified Coffee Kavre District

Description of the variables	Certified (n=60)	Non-Certified (n=60)	Average (n=120)	Test of significance #
Characteristics of farmers				
Gender (Male=1)	51.7	65	58.3	2.194
Experience in coffee cultivation (years)	9.8	8.6	9.2	1.139
Household size (number)	6.5	7.6	7	-1.953*
Characteristics of farms				
Yield of coffee cherry in 2007 ($qq^{\#\#} ha^{-1}$)	20.7	27.8	24.5	-1.844*
HH coffee cherry production in 2007 (qq)	2.0	2.7	2.4	-1.0737
Land under coffee cultivation(ha)	0.12	0.09	0.11	1.624
% of shade trees cover	50.7	63.8	57.2	-2.457**
Income from coffee (Rs)	6,140	5,966	6,056	0.103
Income from shade trees (Rs)	3,597	2,388	3,008	1.328
Income from intercrops (Rs)	1,718	1,672	1,696	0.063
Altitude of coffee farm (>1000 m=1) %	27	30	28	0.164
Coffee production-related shocks (yes=1)%	71.7	21.7	46.7	30.134***
Upgrading at farm and trading				
Training received (yes =1) %	70	58.3	64.2	1.331
Group membership (yes=1)%	33	15	24	5.502**
Book keeping on coffee (yes=1)%	43.3	18.3	30.8	8.792***

Note: Statistical significance at the 0.01 (***), 0.05 (**), and 0.1 (*) levels of probability; # t-test for continuous variables and Chi-square test for dummy variables. ## One quintal (qq) is equivalent to 0.1 metric ton.

[1] Coffee production-related shocks: epidemic of white stem borer pests and other natural disasters like hailstone, wilting, and drought.

Benefits from Group Organic Certification: About 78% of the smallholder farmers in the certified district of Gulmi believed that they were benefited from organic certification of their coffee. However, 8% of the smallholders did not feel any benefits from the time invested in fulfilling certification criteria. Some 10% of the smallholders did not know about the benefits of certified organic coffee production.

Organic certified smallholders received 20% higher price premiums for fresh cherry than the non-certified smallholders in the conventional market chain. The certified smallholders had received 6% price premiums for dry parchment compared to the non-certified smallholders in the conventional market chain (Table 3).

Table 3: Average Prices Reported at The Farm Gate for the 2007-08 Harvest

Farm gate price in 2007	Coffee Producers		t-test
	Certified (n=60)	Non- certified (n=60)	
Fresh coffee cherry (Rs/kg)	30	25.08	11.195***
Dry parchment (Rs/kg)	160	151.19	5.817***
Dry cherry (Rs/kg)	70	No sale	

Note: *** indicates significant at 1% level.

Farmers in Gulmi district saw price security from the market stability brought by cooperatives in the organic certified marketing chain, smooth selling induced in the domestic/ international market by the market guarantee provided by cooperatives, environmental benefits and high price of coffee as the most important benefits of group organic certified production system, whereas quality and diversified income were reported to be the least important benefits (Table 4).

Table 4: Types of Benefits Reported from Certified Organic Coffee Production

Types of benefits of certified organic coffee (n=47)	Score							Index	Rank
	6	5	4	3	2	1	Total		
Price security	31	8	5	1	1	0	251	5.5	I
Easy to sell/market guarantee	10	12	10	10	3	1	197	4.3	II
Environmental benefits	8	10	10	4	10	4	174	3.8	III
High price of coffee	4	5	16	6	15	0	161	3.5	IV
Better coffee quality	1	2	2	6	10	25	87	1.9	V
Diversified income sources	0	1	5	0	10	30	75	1.6	VI

Note: The scale values considered were 6= very high, 5 = high, 4 =medium, 3=low, 2=very low, and 1=negligible benefits from certified organic coffee production.

5. Determinants of Household Income from Coffee

The econometric analysis focused on the 117[1] smallholder coffee producers spread in the certified and non-certified district clusters. It was expected that the coefficients indicating the

[1] Three of the samples were not included in the model for either too high or too low values (outliers).

nature of relationships between smallholder household income from coffee and socio-economic attributes would be negative for shocks, and positive for all explanatory variables listed in equation 1.2. The dependent variable was household income earned from coffee sales in 2007. Initial regression runs revealed heteroscedasticity (H.S.) in the variance of annual household income from the coffee sector. To achieve approximately normality and homogeneity of the error term, the variables of annual household income from coffee and yield of coffee in 2007 were transformed into natural logarithms (following Gujarati, 2003).

The value of coefficient of multiple determination (R^2) showed that 73% of the variation in the annual household income from coffee was explained by the independent variables in the econometric model. Table 5 shows that the F-Statistic (29.90) confirms the stability of the overall regression equation and is jointly significant at 1% level (P=0.000) in explaining the level of smallholder household coffee income.

The regression results presented in Table 5 show farmers' experience in coffee cultivation (EXPE) had a positive significant impact on household coffee income at 1% level of significance. This implies that when farmers' experience in coffee production increases by 1 year, there is an increase of 4.5% in annual household income from coffee. Productivity of coffee (*Ln*YIELD) had a positive and statistically significant impact on household income from coffee. When productivity of coffee increases by 1%, annual household income from coffee also increases by 49%. Similarly, the high percentage of shade tree (SHADE) had a positive and significant impact on income to the smallholder. This result is in line with the findings of Muschler (2001) that shade trees provide moisture and manure to soil as well as potentially reducing incidence of pests like the white stem borer in coffee farms.

The altitude of the coffee orchard (>1000 meters above the sea level) (ALTI) also had a positive and statistically significant impact on annual household coffee income. Results also showed that the coffee production shock faced by smallholders (SHOCK) had a negative but significant impact on smallholder household income from coffee at 1% level. It means that farmers who face coffee production-related shock had 49.5% less annual household income from coffee compared to those who did not face such shocks.

It was observed that the 'certification dummy' (CERTI) had a positive and significant impact on household coffee income at 5% level of significance. This is because the certified farmers received 6 to 20% price premium compared to the premium received by the non-certified. Further, the variable of interaction of 'certification and shock' (CERTI*SHOCK) had a negative but significant impact on household coffee income. It means that certified farmers' having coffee production-related shocks experienced negative influence on household coffee income.

Table 5: Econometric Estimates for Determinants of Household Income from Coffee in 2007

Variable [a]	Coefficient	Robust Std. Error	T- value
EXPE	0.045***	0.013	3.37 (0.001)
*Ln*YIELD	0.492***	0.076	6.47 (0.000)
SHADE	0.008***	0.003	2.98 (0.004)
ALTI	0.363**	0.152	2.39 (0.019)
SHOCK	-0.495**	0.241	-2.05 (0.043)
CERTI	0.576**	0.279	2.06 (0.042)
CERTI*SHOCK	-0.625*	0.346	-1.81 (0.074)
CONSTANT	5.225***	0.333	15.66 (0.000)
F-value (13, 103)	: 29.90***		
R- Square	: 0.73		
Mean VIF	: 1.94		
Ramsey RESET test (ovtest)	: F(3, 100) = 0.13, Prob > F = 0.9414		
Number of observations (n)	: 117		

Note: ***, **, and * indicate significant at 1% (p=0.01), 5% (p=0.05), and 10% (p $\geq$ 0.10). Figures in parentheses are P-values.

6. Concluding Remarks

In recent years, Nepali coffee has emerged as an important cash crop among the small-scale producers. While there are marked differences between certified and conventional smallholder coffee producers in some aspects, the two groups also share some similarities. Group organic certification has been positive impact on the lives and livelihoods of small-scale producers in terms of capacity building, increased and stable income, price premium (6-20%) , and environmental benefits. In addition, it is seen as a passport for Nepali coffee to the international market. It was also observed that there are specific pockets separated by altitude, aspects, and specific distance from snow-covered mountains that may contribute to specific quality/taste. However, processing, labeling, and marketing of specialty coffees with proper identity have yet to be practiced.

Results from the econometric model revealed that experience in coffee cultivation, yield of coffee, percentage of shade trees cover, the altitude dummy (>1000 m above sea level), and the certification dummy played a significant and positive role in the annual household income from coffee. In contrast, two variables - 'shock' and interaction of 'certification and shock' - played a significant but negative role in household income from coffee. The findings suggest that developing institutional supports such as group level organic certification along with a strong social networking, provision of research and extension programs, farm level management practices like improving the yield by controlling the epidemic of white stem borer, effective shade tree management, and upgrading of wet processing technology at the farm level are required to bring benefit to the farmers from coffee cultivation.

In light of the above discussion, the study concludes that group organic certification is considered as a catalyst to increase exports of Nepali coffee. NTCDB should fix different prices of organic certified, and conventional fresh cherry as an incentive to the producers, with farmers

benefiting in terms of economics (price premium), environment, and social development. Moreover, increased research in the coffee sector and extension of institutional support are necessary to improve the livelihoods of the smallholder coffee producers in the rural parts of Nepal.

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BOOK REVIEW

Liberalizing Food Grains Markets: Experiences, Impact, and Lessons from South Asia

Edited by A. Ganesh Kumar, Devesh Roy, and Ashok Gulati, Published by Oxford University Press, New Delhi; Price IC Rs 750; Pages 208.

Dilli Raj Khanal[1]

The book based on country case studies and findings by three noted scholars contains seven chapters with the first chapter introducing the theme and the last one concluding. Chapter two is by Nuimuddin Chowdhury, Nasir Farid, and Devesh Roy on *Food Market Liberalization in Bangladesh: How Well Did the Government and the Markets Deliver?* Chapter three is on *Achieving Food Security in a Cost-Effective Way: Implications of Domestic Deregulation and Liberalized Trade in India* by Shikha Jha, P.R. Srinivasan, and A. Ganesh Kumar. *Liberalization and Food Security in Nepal* is by Bishwambher Pyakuryal, Y.B. Thapa, and Devesh Roy. *Impact of Domestic Agricultural Trade Liberalization and Market Reform Policies on Food Security in Pakistan* is written by Nuimuddin Chowdhury, Nasir Farid, and Devesh Roy. The last paper is by Jeevika Weerahewa on *Impact of Trade Liberalization and Market Reforms on the Paddy-Rice Sector in Sri Lanka*.

Amidst continued food market liberalization, the food price rise impacting, among others, food security immensely is one of the foremost policy challenges globally, including South Asia today. The drastic increase in food prices during 2007-2008 followed by some decline during the period of heightened financial and economic crisis and again a sharp rise thereafter underscores the need for finding out the underlying major reasons. As available information indicates, the prices of traded food staples such as wheat, corn, and rice soared throughout 2010, nearing the peaks reached during the global food crisis of 2008. The trends show that the price surge may continue in this year 2011 with foodstuffs and basic commodities hitting new highs and expected to climb further with the risk of greater hunger and deprivation including increased threat of widespread social unrest as happened during 2007-2008. Against such a background, the usefulness of the book containing research-based country case studies in the South Asian context hardly needs justification.

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The book begins with an introductory chapter in which two major factors contributing to food market liberalization have been pointed out. One, along with the beginning of improvement in food self-sufficiency amidst some market orientation, South Asian countries began to realize the drawbacks of interventionist policies. Second, the requirement to fulfill WTO and other international commitments also obligated South Asian countries to bring about policy changes in the direction of liberalization, away from government control and trade restriction. Nonetheless, as indicated in the same chapter, recognizing that no uniform food market liberalization policies were pursued by the South Asian countries with relatively a conservative stand of India and Pakistan toward food markets and more market-oriented reforms of countries like Bangladesh, Nepa,l and Sri Lanka, the case studies have tried to examine the ramifications of such divergent policies, especially for food security in five countries.

The study findings, based on both qualitative and quantitative analysis, give some important messages. First, public sector intervention in domestic grain markets through procurement and storage has been in vogue in all the five countries, though it has been substantially rolled back in Nepal and to a lesser extent in Bangladesh and Sri Lanka as well. India and Pakistan studies indicate that interventions in the marketing of food grains bring serious inefficiencies compared to private sector trading. Similarly, country studies also show that border reforms in terms of elimination of tariffs and subsidies and removal of quantitative restrictions would have a considerable differential impact on the producers and consumers depending upon whether the country in question is a net food exporter or importer. The findings also clearly show that the spatial integration of domestic markets is the key to improving food security. This finding is primarily based on the scenario prevailing in countries like Nepal where it has immense policy relevance. Finally, despite reemphasizing that government intervention is not the solution to the problem, the findings of the case studies also suggest that traders' market power in the form of oligopoly is one of the real problems.

From the policy standpoint, two broad types of reforms or policy changes are suggested by the country case studies. One is country-specific and another has regional dimensions. On the domestic front, some distinct suggestions are made. First, citing the contrasting experience of Bangladesh and Nepal, it is suggested that the primary role of the government should be to invest in infrastructure which, in turn, could help promote agricultural production and deepen agriculture markets. As an offshoot, it is also recommended that the government should move away from subsidizing inputs used primarily by only a few farmers and toward subsidizing the general purpose public goods, such as agricultural research and extension services. Similarly, rather than following a pro-cyclical tariff policy, maintenance of tariff at a consistent level as in the case of Sri Lanka is also recommended. In the case of food surplus countries like India and Pakistan, further measures to correct market imperfections and anomalies have strongly been recommended suggesting that time has come to restrict the role of government in facilitating private participation and maintaining orderly conditions in the food grain markets. Overall, it is recommended that the government's role ultimately be limited to promoting competition within

the country, to free domestic price determination from policy-induced distortions to help farmers to better allocate resources and allow the consumers to benefit from competitively priced foods.

On the regional front, policy coordination among the countries of South Asia has been strongly recommended, particularly in view of the rising intraregional trade in rice and wheat in the region. Keeping in view, the vary adverse impact of output subsidy in India with its deleterious impact on the farmers of Bangladesh, Nepal, and Sri Lanka, more policy coordination coupled with grater policy discipline on the part of India is suggested. Studies indicate that the regional food bank and freer trade would smooth price differentials across space and time by moving grains from the surplus to the deficit areas. Based on such reasoning, it is ultimately argued that effective food policy measures have a great potential for decreasing poverty and enhancing growth.

Notwithstanding the immense usefulness of the book, some of the conclusions and policy recommendations made are highly debatable because they are grounded on unfounded premises and the ground realities of the South Asian countries. Most of the analysis is driven by the neo-liberalism-led supply response and self-market correcting arguments and hence the corresponding policy and market failures at the ground level augmented by structural and institutional constraints and anomalies have been downplayed to a great extent. Why, for instance, with a small break during the financial crisis, is there a phenomenal rise in the food prices over almost half a decade? The question posses a big policy challenge which fully contradicts the so-called supply response arguments of the neo-liberalism led policies. As an offshoot, there is also a tendency at both the global and South Asian market levels that suggests that despite the apparent adequate supply of agricultural products, in any instance, the upward pressure on the price continues. For instance, some food price-elated studies in the Nepali context show that the oligopolistic trade power has increased tremendously with exploitation of both the producer farmers and the consumers. This again reinforces the breakdown or failures of the self-correcting demand and supply imbalances argument and casts doubt on the logic that a freer food market facilitated by the dismantling of public procurement and/or distribution system would enhance the food security system. Some of the global phenomena impacting the South Asian market also indicate the need for a more balanced role of the public sector and the market in correcting distortions that are adversely affecting production, productivity, and distribution of food.

Studies point out that under the neo-liberalism-led global dominant regime the explosion in commodity prices is being fueled by the cheap credit policies of governments and central banks designed to boost national stock markets and business profits by providing the banks and corporations with virtually free credit. As an offshoot, the modern global food supply chains are characterized by extremely high levels of concentration in the middle of those chains. Such concentration leads to excessive buyer power, which harms the consumers and food producers at the end of the supply chains. The harms suffered by farmers are serious enough as they

constitute violation of the international human right to food, as expressed in the Universal Declaration of Human Rights and, more specifically, in the International Covenant on Economic, Social, and Cultural Rights. The World Bank report of 2008 states that just three companies controlled over 80 percent of the world's tea markets, while concentration ratios were 40 percent in international trading in cocoa, 51 percent in cocoa grinding, and 50 percent in confectionary manufacturing, respectively. It appears that never before in history have so many consumers and so many farmers been bought and sold through so few middlemen.

One additional irony of the current hunger statistics is said to be such that the people most likely to be going hungry are not consumers, those involved in the making and production of food. According to a survey done by the UN Millennium Project in 2005, farmers cultivating small patches of land (smallholders) and landless agricultural workers together made up around 70 percent of the people suffering from hunger. Another feature of the widespread hunger is said to be not food production declining or being unable to catch up with population growth, but faulty distribution of food via oligopolies.

According to the Food and Agriculture Organization (FAO), food security in a particular society exists "when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". It is evident that genuine food security among a population requires a wide range of policy and institutional features, some of which are associated with the need for public intervention. Ignoring anarchism and policy-induced anomalies and distortions in the market in the name of food market liberalization could be dangerous from the standpoint of food security. Instead, there is a need for translating the food security goal into achievement within a stipulated timeframe rather than be carried away by rhetoric or propaganda.

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BOOK REVIEW

Rice in the Global Economy: Strategic Research and Policy Issues for Food Security

Edited by Sushil Pandey, Derek Byerlee, David Dawe, Achim Dobermann, Samarendu Mohanty, Scott Rozelle, and Bill Hardy, Published by International Rice Research Institute 2010. Pages 476.

Dr. Krishna Pahari[1]

This important book with contributions by a team of IRRI researchers has been released when heightened concern for food insecurity has once again been on the global agenda at a time when the number of people suffering from hunger has crossed the one billion mark for the first time in the history of mankind. The book is organized into three main themes, namely: i) rice in the global food economy; ii) the evolving rice market structure; and iii) technological opportunities and R&D policies.

Under the first theme, in Chapter 1.1, David Dowe, Sushil Pandey, and Andrew Nelson present an informative analysis of the emerging trends and spatial patterns of global production of rice, believed to be first domesticated in China about 7,000 years ago. Even though rice is now grown and consumed worldwide, its production and consumption are dominated by the so-called 'rice producing Asia', a region from Pakistan in the west to Japan in the east. Seven countries in this region: China, India, Indonesia, Bangladesh, Vietnam, Myanmar, and Thailand together account for more than 80% of global rice production. Rice is by far the most important crop for the poor, supplying 27% of the calories in low- and lower-middle-income countries. Thus, the importance of rice to food security, particularly to the poor populations in Asia, is self-evident.

Chapter 1.2 contains an analysis of rice and its structural transformation by C. Peter Timmer. No country in the world can manage transition out of poverty without raising agricultural productivity that involves structural transformation in which agriculture through higher productivity contributes to urbanization and industrialization. As the GDP per capita rises, the share of agricultural GDP in the overall economy declines and so does the share of agricultural employment. However, in the early stages of structural transformation, there is a substantial gap between the share of the labor force employed by agriculture and the share of

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GDP generated by that work force. This gap narrows with higher incomes as can be seen from the countries, which made rapid economic progress. Thus managing this period during structural transformation, where the farm incomes visibly fall behind incomes being earned in the rest of the economy, presents potential problems, which can only be resolved by a sound policy intervention by the government suggesting that the Asian countries were able to use agricultural terms of trade as a policy instrument for keeping labor employed in agriculture, a lesson that is of immense significance to a country like Nepal. The author has tried to explain the historical patterns of structural transformation and empirically tried to illustrate the changing patterns over the past four decades, pointing out that Asian patterns have been different and that the special nature of rice economies could have made this difference.

Peter B.R. Hazel in Chapter 1.3 provides an overview of the Green Revolution (GR) and how it transformed agriculture in Asia, particularly rice, suggesting that continuing further increase in productivity in the future may be difficult with the same approach. Hazel says that in spite of significant increase in production, the Green Revolution did not eradicate poverty and malnutrition. This may explain the need of increased focus on addressing the needs of the poor and the food-insecure through provision of safety nets or other programs targeted to uplift the poor. He has also presented the changing investment priorities in the agriculture sector, which helps to understand why agriculture has suffered in recent years. Asian countries spent 15.4% of their total government spending on agriculture by 1972. Agricultural spending in Nepal increased from 13.7% in 1972 to 22% in 1985, which declined to 8.5% in 1990 and now stands at less than 3% of the total spending. Such a shift in priority away from agriculture is believed to be a result of faulty policy that was heavily reliant on the notion that boosting overall economy by stimulating market mechanism would take care of all sectors. Such reliance on 'liberalization' alone without considering the specificities of agriculture sector is believed by many to be the cause of stagnant agriculture observed in Nepal for the last few decades. A critical review of such policies in the past could provide us insight on the right policies for the future when food security has again been on high agenda every where. This chapter also presents some observations on the role of subsidy and the author argues that subsidies played a useful role in the early stages of GR. Given the specificities of Nepal-with its porous open border with India and the significant subsidies to farmers provided on the Indian side-subsidies have become an important issue of discussion and the experience from other Asian countries could help us in taking the appropriate policy measures.

Pandey et al. in chapter 1.4 analyze how the increasing rural-to-urban migration and shift toward off-farm employment (particularly by the male members) have made the role of women more important in the agriculture sector and point to the need to have gender-sensitive policies with strategies and programs to upgrade the skills and capacity of women to manage the rice farms.

Larson et al. in Chapter 1.5 present an analysis of the possibilities of fostering a Green Revolution in rice in the African continent which they believe could affect the global rice supply and demand situation. Considering the greater impact of rice R& D in stimulating green

revolution in Asia, there is a need for increased focus on rice research and policy reforms to spur green revolution in Africa and enhance the future global supply of rice.

Peter Timmer et al. offer a long-run dynamics of rice consumption for the period 1960-2050 (Chapter 1.6). More than 88% of the global rice consumption occurs in Asia. The authors state that rice consumption per capita decreases with higher income which brings the purchasing power to afford more nutritious and diversified diet. Thus, global per capita consumption increased at 0.9% per year between 1961 and 1990, and then declined by 0.11% per year between 1990 and 2008. All other regions except Africa (where eating rice is a new food habit) have now a declining growth rate of rice consumption. Overall, the authors predict that global total consumption is likely to go down after 2020 and mention that the income elasticity of demand by a country is available with them and it would be useful to obtain this for Nepal since rice vis-à-vis other food consumption is an important issue of discussion in Nepal. With regard to the impact of climate change on agriculture, the authors quote studies, which suggest that rice production in South Asia is projected to decline to 14.5% in 2050 with climate change while that figure for wheat is likely to be 48.8%.

In Chapter 2.1 "Economic development, land tenure, and the changing optimum farm size", Kejiro Otsuka and Jonna P. Estudillo draw on lessons from the experiences including from China, Japan, and South East Asia, to demonstrate that the optimum farm size changes as the economy develops (since the wage rates increase). In most of the developing countries in Asia, where wage rates are relatively low, the optimum farm size seems small and thus the central land tenure issue is to transfer land from the large to small farmers to equate the land-labor ratio. They further add that the optimum farm size increases sharply as the wage rates increase. The critical land tenure issue then becomes the transfer of land from the small to large farmers to reap the potentially large benefits of scale of economies. At a time when land reform has become an important debate in Nepal, this experience could provide some reference by considering the present pattern of landownership and make an informed decision that contributes to maximum farm efficiency. Other chapters under this theme deal with the issue of inputs, namely, seeds, fertilizers and irrigation, pest management, and emerging techniques of post production management, which highlight the importance of the judicious use of inputs and new production technologies to increase yield potential, reduce yield and efficiency gaps, and minimize post-harvest losses, that add more value to the cropping systems.

Under the third theme, in Chapter 3.1, Paul A. Doros and Eric Wales (international rice trade: structure, conduct and performance) conclude that rice exports are likely to continue to be dominated by few countries which means that the price shocks are likely to occur in the future too. This finding has an implication for a country like Nepal: the need of boosting production to become self-reliant in order to safeguard its populations from any such shock arising out of export bans from other countries, which means we have to meet any food deficit within the country. David Dowe et al., in Chapter 3.2, present experience from a number of Asian countries and show that rice price stabilization has been an objective of many Asian developing countries over the years most of which have been successful. They also share the domestic

policy instruments with examples of Thailand, China, India, Japan, Korea, and other OECD countries. Thus, price stabilization policies (against free trade) have been a common practice in a number of countries though in different ways. Such policies also have important effects as in many of the poorest countries rice accounts for more than 60% of the caloric intake. They also stress that in order to understand the importance of higher rice prices for welfare, poverty, and food security, it is first important to distinguish between the net rice produces and the net rice consumers. In a country like Nepal, where more than 60% of the farm dwellers are deficit farmers (even if farming is number one source of livelihood here), food price rises are likely to cause further food insecurity to the poor. Thus food price stability is very important.

Under theme four, Wassmann et al., present an analysis of how the global climate change is likely to impact rice production. The next two chapters deal with technological opportunities for improved germplasm (Mackill et al.) and positioning of rice research globally: investments, institutional arrangements, and emerging challenges. Here they point out to the need of increased investment in research and increased partnership with diverse stakeholders such as GRISP (Global Rice Science Partnership) under the CGIAR Consortium.

In sum, this book could be an excellent reference material for policy level personnel and researchers concerned with agriculture and food security, in general, and rice, in particular, in Asia and the rest of the world. The book has renewed efforts for much larger sustained investments and lays out a rich menu of technological and institutional options for sustainably improving rice systems and enhancing the overall performance of the global rice economy. It is particularly useful to those involved in shaping policy on agriculture and food security in a country like Nepal. The book covers issues about the rice economy in Asia and in the world, but would be useful to have a more focused publication based on agriculture, including rice in Nepal, taking up various aspects of production, economic transformation, and the options to address the emerging challenges related to agriculture and food security in this country.

BOOK REVIEW

The Nepali Yak

Authors: Mohan Kharel, Bhola S. Shrestha, and Rabindra Shrestha, Published by Himalayan College of Agricultural Sciences and Technology (HICAST), Gatthaghar, Bhaktapur, Pages 120.

Mandip Rai[1]

In an area in dire need of literature, it is relieving that Mohan Kharel, Bhola S. Shrestha, and Rabindra Shrestha have been able to publish "The Nepali Yak", dealing solely with Yak, the high hills, and mountains, a publication long overdue.

Although the book opens with general background and introduction, the subsequent chapters mostly deal with preliminary technical matters and cover a wide range of topics from animal husbandry practices to reproductive performance to yak products to biotechnology in yaks. The collection of placed contextually would have illustrated the points made more clearly and precisely. The target audience presumably is the first year agriculture/livestock/veterinary students, but if the book had devoted a few chapters on policy discussion, making conclusive opinions and policy recommendations, it could also have been useful for development workers and policy-makers. Still, if their knowledge of Yak is limited, they can still benefit from the book. The language used is dry and the book is presented in a textbook format, hence it may not find audience beyond the students taking a preliminary course on yak with the intension of passing the course. With the same information but presented in a different style and with added chapters on policy dialogue, the book can find wider audience while retaining the targeted one.

Since most of the Nepalese farmers practice integrated farming systems where livestock is an integral part, the importance of livestock development for overall agriculture development cannot be over-stressed. Nonetheless, not much literature can be found in Nepal that deals with the issues of economics of livestock. If one scans the publications available in the sector, one becomes quickly aware of literature that deals primarily with animal husbandry, animal breeding, farm management, and the required veterinary services and practices, but finding literature on the economics of livestock development can be a difficult task.

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A number of interesting and economically rational questions related to the economics of livestock can be asked. The literature available suggests that as income grows and people are more educated about human nutrition, the demand for livestock products such as meat and milk also tends to grow. Do the farmers, especially the ones residing in the peri-urban areas and hence physically closer to markets, follow the price signals for livestock raising? Or do they find it easier and socially more acceptable to follow the cultural dictates than the market ones? Can they be provided enough information so that they are capable of choosing amongst the many livestock-based enterprises and between a livestock-based enterprise and a crop/horticulture-based one? How can livestock keepers be profitably linked to the larger industries? We have a case in hand here. Nepali leather/shoe industry is growing and yet the required leather/hide is imported from India, China, and Pakistan while there are hundreds of thousands of cattle and buffaloes in Nepal. It is interesting to note that because of the lack of proper processing plants the Nepali hides and skin have to be exported to India for processing before they are transformed into leather that can be used technically to make shoes, bags, and belts. What can the government do together with the private sector so that such gaps in value adding are filled and the industry sustains itself domestically? Yak cheese and hard cheese are quite popular in the urban centers but could a functional and profitable (to all parties) chain be established between the yak keepers and the growing number of supermarkets in Kathmandu and other urban centers?

The questions asked above are some areas on which the livestock economists can shed light and may be translations can be made at programatic levels so that hard evidence becomes available. One may look forward in the future to economists addressing such livestock research issues.

Gudelines for Contributors

Nepalese Journal of Agricultural Economics (NJAE) is a yearly publication of Nepal Agricultural Economics Society. It is envisaged to serve as a platform for sharing and exchange of knowledge and information on agricultural economics, resource economics, natural resources management, agricultural policy, agricultural marketing and trade, and environmental economics. It also aims to capture first-hand knowledge on research achievements in the above-mentioned fields. NJAE welcomes feedback and suggestions for improving the quality of the journal.

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Papers and short notes on original research and reviews of research, written in English, in the field of agricultural economics and related allied fields are accepted for publication. The articles should be based on the application of quantitative tools and techniques (econometrics and statistics). Submission of a paper implies that it has not been published previously and is not under consideration for publication elsewhere. If another version of the article is under consideration by another publication, or has been, or will be published elsewhere, authors should clearly indicate this at the time of submission.

Manuscript Preparation

General: The manuscript must be typewritten, double spaced with wide margins and submitted in duplicate. A font size of 12, Times New Roman and US spelling is recommended. Follow this order when typing manuscript: Title, Author (s) name and address, Abstract, Keywords, Main text (with introduction, objectives, conceptual/ analytical framework, research methods/techniques, discussion, conclusion), Acknowledgement, Appendix, References, Figures, and Tables.

Paper Length: The length of an article (including references, footnotes, tables, figures and appendices) should not exceed 7,000 words.

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Government of Nepal
Ministry of Agriculture and Cooperatives
High Value Agriculture Project in Hill and Mountain Areas (HVAP)

Wishing success and prosperity in the first issue publication of Nepalese Journal of Agriculture Economics (NJAE) and also wishes in the happy occasion of Deepawali, Chhat and New Year (Nepal Sambat)

Project Management Unit (PMU), Surkhet
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Brief Notes on HVAP

- Project implemented with the financial loan and grants by International Fund for Agriculture Development (IFAD)
- The project was signed by Government of Nepal and IFAD on 5 July 2010.
- Ministry of Agriculture and Cooperatives (MoAC) is the main implementing body of the project.
- SNV (The Netherland Development Agency) and Agro-Enterprise Centre (AEC) would be the main implementing partners of the project.
- The project is in implementation through the fiscal year 2010/11 and the duration of the project is six years.
- Project implementation concept: Support in the sustainable and effective value chain development of the selected commodities by integrating and focusing women and marginal farmers with the identification of high value commodities and appropriate strategy .
- Goal of the project: To reduce poverty and vulnerability of women and men in hill and mountain areas of the Mid-Western Development Region.
- The project will cover 10 districts along the Chinchu-Jajarkot, Surkhet-Dailekh and Surkhet-Jumla (Karnali Highway) road corridors. The project districts are
  Mid-Western Districts: Humla, Jumla, Mugu, Dolpa, Kalikot, Surkhet, Dailekh, Salyan, Jajarkot
  Far-Western District: Accham

Articles in This Issue	Articles in tho Forthcoming Issues (suggestive)
• Agricultural growth rates • Genetic resources rice landraces • Landless, poverty and food security cycles • Groundwater markets for irrigations • Rice market practice • Regional market integrations • Investment on rice research • Fertilizer market integration with world • Poverty-environment nexus • Organic certification of coffee • Liberalizing food grains markets in South Asia • Rice in the global economy • Nepali Yak	• Investment and agricultural growth in Asia • Macroeconomics of agricultural growth • Issues in high-altitude agriculture • Economics of livestock • Agri-trade in Nepal-India-China triangle • Farmers' water users associayion in South Asia • System of current agricultural statistics • Legislations on food and nutrition security and agri-marketing • Women's empowerment for agricultural productivity • Rural economy – appraisal • Economics of bee keeping, and more
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