EDUCATION IN AGRICULTURAL PRODUCTIVITY, EFFICIENCY, AND DEVELOPMENT: THE NEPALESE CASE

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Introduction and Objectives

Nepalese agricultural productivity growth has been very low for a long time. An important reason is the low level of technological innovation and lack of substantial investment in the development of human capital (Schultz, 1964). Education makes a substantial contribution to agricultural productivity in areas of changing technology (Nelson and Phelps; and Schultz, 1975) and contributes to productivity through the worker and allocative effects[1] (Welch).

This paper studies the main agricultural and educational characteristics of modernizing and traditional regions of Nepal to determine the factors responsible for differences in the levels of technological innovation, education, and extension between the regions; examines whether there is a relationship between education and factors such as farm income or modern input use; investigates whether education contributes to farm productivity through the worker, allocative, or both effects in the two types of areas; tests whether education makes a substantially higher contribution to output in the technolgically dynamic environment than in the traditional area; determines whether education and extension are substitutes in the farm decisionmaking process; and tests whether the educated farmers attain higher economic efficiency than the illiterates.

Data and Model

Bara district in the central terai region was selected to represent the modernizing terai region, and Gorkha district in the western hills was chosen to represent the more traditional hill region. Micro level, cross sectional data for the crop year 1979/1980 collected by interviewing 205 sample farmers of Bara and 149 farmers of Gorkha were utilized.[2] Production and profit functions as well as tabular analysis were used.

Education, Extension, and Modern Innovation

The terai farm operators have had slightly more education (5.04 years) than the hill farmers (4.18 years). The terai producers also had higher contact (4 contacts) with extension agents than their hill counterparts (1 contact). The former were also spending larger sums (Rs 3,002 per farm or Rs 410 per bigha[3]) on modern inputs (HYV seed, fertilizer, and pesticides) than the hill farmers (Rs 170 per farm or Rs 155 per bigha). Tractors and pumpsets were employed by the terai producers while no such innovations were utilized by hill farmers. This demonstrated that the terai farmers were technologically more dynamic than the hill farmers, and they also had more education and extension contacts.

The main reasons for low levels of farm innovation, education, and extension in the hill region appeared to be unavailability of suitable modern inputs, lack of proper knowledge of new inputs, poor transport and other infrastructure, low capital formation, poor credit availability, lower political consciousness and influence of the hill farmers, and lesser importance of the hill region as a food producing area.

Relation Between Education and Other Factors

Since costs in terms of physical resources and time are incurred in the pursuit of learning, and since such costs increase with the level of education, any rational demand for increased education must be associated with higher expected earnings. The more educated farmers can attain higher income by adopting modern inputs and practices together with optimally allocating the new and existing resources among competing uses. Relationships between different levels of education--primary, secondary, high school, and college--and other variables--farm revenue and modern input use--are examined here.

Total income (revenue) of the sample farmers increased with level of farm operators' education in both regions. Per bigha income of the educated farmers was higher than that of the illiterates and per bigha income also consistently rose with the increased levels of farm operators' education in both areas (except for the drop in the secondary level relative to the primary level in the terai). The result thus supports the contention that a positive correlation exists between the level of earnings and the levels of education. Since the educated and illiterate farmers differ in characteristics such as cultivated area or fertilizer use, one must, however, be careful not to attribute the total earning differential between the educated and illiterates to education alone.

The use of modern inputs increased consistently with the level of operators' education in the terai region. Even though the pattern of increase in the use of modern inputs was not as consistent in the hills as it was in the terai, all levels of educated farmers were employing more modern inputs than illiterates. For each level of operator's education, the level of use of modern inputs was much higher in the terai than in the hill region. The findings indicate that education makes farmers innovative, and enhances their innovative ability much more in a modernizing agriculture than in a traditional agriculture.

Production Function Estimates, and Allocative and Worker Effects of Education

Engineering, gross sales, and value added production functions were estimated for the terai and hill regions (table 1). All the functions suggested that education made a positive and generally significant contribution to agricultural output. However, extension had a non-significant impact on output regardless of its sign. This may indicate either that the extension programme in Nepal has not been effective due to understaffing, inadequate training of extension agents, and lack of coordination between extension and research, or that defining the extension variable as number of contacts may be inadequate. A negative coefficient of education-extension interaction term (EX) weakly supported the contention that education and extension were substitutes in the farm decision-making process in the terai, while the coefficient did not lend much support for or against the hypothesis in the hill region.

The worker and allocative effects of farm operator's education based on the estimates in table 1 are reported in table 2. Three features are important. First, both the worker and allocative effects of education contributed significantly to agricultural output in modernizing terai and traditional hill regions. Second, the allocative effect was the most crucial in both areas.[4] Of the components of the allocative effect, both the input allocation and input selection effects contributed substantially to output in the dynamic terai while the latter effect was almost non-significant relative to the former in the hill region. Third, all effects of education were stronger in the terai than in the hill region. This also means that education makes a much higher contribution to output in a modernizing agriculture than in a traditional[5] environment.

Table 1. Estimates from Engineering, Gross Sales, and Value Added Production Functions, Terai and Hill Regions, Nepal

Independent Variables	Terai			Hill		
	Engineering (Rice)	Gross Sales	Value Added	Engineering (Maize)	Gross Sales	Value Added
Land	0.382*	0.300*	0.415*	0.250*	0.169*	0.220*
	(0.051)	(0.054)	(0.066)	(0.072)	(0.060)	(0.060)
F Labour	0.228*	0.252*	0.357*	0.160	0.274*	0.298*
	(0.054)	(0.058)	(0.083)	(0.099)	(0.065)	(0.071)
H Labour	0.172*	0.120*	-	0.018	0.014	-
	(0.034)	(0.038)	-	(0.033)	(0.018)	-
Capital	0.055*	0.061	0.066*	0.195*	0.183*	0.209*
	(0.016)	(0.018)	(0.025)	(0.062)	(0.041)	(0.044)
Bullock	0.047	-0.053	-	0.304*	0.252*	-
	(0.039)	(0.044)	-	(0.093)	(0.076)	-
F Bullock	-	-	-0.016	-	-	0.064*
	-	-	(0.057)	-	-	(0.030)
Fertilizer	0.037*	0.154	-	0.048	-0.012	-
	(0.020)	(0.035)	-	(0.047)	(0.019)	-
Education	0.011	0.030*	0.050*	0.022	0.051	0.057*
	(0.010)	(0.011)	(0.016)	(0.017)	(0.012)	(0.012)
Extension	0.004	-0.013	-0.008	0.212	-0.009	-0.007
	(0.029)	(0.013)	(0.019)	(0.215)	(0.049)	(0.052)
Age	0.025	0.168*	0.199	0.150	0.133	0.145
	(0.089)	(0.096)	(0.138)	(0.187)	(0.122)	(0.128)
EX	-0.000	-0.001	-0.003	-0.004	0.001	0.000
	(0.004)	(0.002)	(0.003)	(0.003)	(0.006)	(0.006)
Large Farms	0.238*	0.273*	0.357*	-	0.107	0.150
	(0.080)	(0.088)	(0.122)	-	(0.096)	(0.097)
Machine	0.013	-0.008	-	-	-	-
	(0.019)	(0.014)	-	-	-	-
Constant	-2.339	3.559	2.968	-2.227	-4.160	4.012
R^2	0.8566	0.8401	0.6791	0.5375	0.7348	0.6756
F	95.6	84.0	95.9	16.0	34.5	32.2

The figures in parentheses are standard errors of the estimates.
* Significant at least at 10 percent level.

Table 2. The Worker and Allocative Effects of Farm Operator's Terai and Hill Regions, Nepal (in Rupees)

Effect	Terai	Hill
Total (I + II)	1,002	563
(I) Worker	154 (14)*	24 (2)*
(II) Allocative (a + b)	848	539
a. Input - allocation	713 (63)*	527 (31)*
b. Input - selection	135 (23)*	12 (4)*

*Standard error in parentheses, all significant at 1 percent level.

Profit Function and Tests of Efficiency Differences Between Educated and Illiterate Farmers

Economic efficiency differences between the educated and illiterate farmers were tested (table 3). The hypothesis of absolute price efficiency of educated, illiterates, or both (hypotheses 1-3) were rejected in both regions. This meant that neither the educated nor the illiterates maximized profits in the sense of equating the marginal value product of variable inputs (hired labour, bullock, and fertilizer) with their respective opportunity costs in the year under study. However, the test of equal relative economic efficiency was rejected in favour of the higher economic efficiency of the educated in both regions. The hypothesis of equal relative price and technical efficiency was also rejected in favour of higher allocative and technical efficiency of the educated in both regions. Furthermore, the hypothesis of equal relative price efficiency was rejected in the hill region, while it was not rejected in the terai. The tests thus indicated that the educated farmers were more economically efficient than the illiterates in both regions. The higher relative economic efficiency of the educated in the hill area was a result of their being more technically and allocatively efficient than the illiterates, while the higher economic efficiency of the educated in the terai results mainly from their being technically more efficient than the illiterates.

Education and Agricultural Productivity

An increase in the average education of a farm operator by one year expanded output by 5.2 percent (Rs 1,103) in the terai and 5.9 percent (Rs 583) in the hill region. Similarly, an additional year of various levels of education--primary, secondary, high school, and college--increased agricultural output from 3.7 percent (Rs 785) to 10.7 percent (Rs 2,270) in the terai and 5.8 percent (Rs 573) to 10.1 percent (Rs 1,037) in the hill region. Even though the percentage increase in output for the average and different levels of education was similar in the terai and hill regions, the total increase in output resulting from an additional year of education was much higher in the modernizing terai than in the more traditional hill region. The rate of increase in output generally declined with a rise in the level of education up to high school level in both regions. The contribution of college education remained almost constant (relative to secondary and high school) in the hill region while it substantially rose in the terai. This result suggests that education made a higher contribution to output in a modernizing environment than in a more traditinal agriculture, the law of diminishing marginal productivity applied even in the use of educational input, and higher (college) education had a value in a changing environment while such a skill had a very limited role in a more static area.

Table 3. Tests of Efficiency Differences Between Educated and Illiterate Farmers, Terai and Hill Regions, Nepal

Hypotheses	Computed F-ratios	
	Terai	Hill
Absolute price efficiency of both educated and illiterate	F(6,804) = 7.72*	F(6,580) = 5.23*
Absolute price efficiency of educated	F(3,804) = 14.75*	F(3,580) = 3.99*
Absolute price efficiency of illiterate	F(3,804) = 10.79*	F(3,580) = 4.10*
Equal relative economic efficiency	F(1,804) = 7.93*	F(1,580) = 16.36*
Equal relative price efficiency	F(3,804) = 0.35	F(3,580) = 7.04*
Equal relative price and technical efficiency	F(4,804) = 2.88**	F(4,580) = 7.54*

*Significant at 1 percent.
**Significant at 5 percent level.

Conclusions and Implications

Education and farm income and education and modern input use were both positively related. Education made a positive contribution to agricultural productivity (output) and efficiency in both the terai and hill regions. The contribution of education to productivity was much higher in the dynamic terai than in the static hills. The results thus suggest that a development strategy combining investment in technology and human capital is likely to accelerate the agricultural development process faster than investment in either separately (Pudasaini, 1982b).

Notes

[1]The worker effect refers to the educated farmers' ability to accomplish higher output for a given level of inputs, while the allocative effect refers to the educated farmers' ability to make optimal decisions in regard to proper selection and optimal allocation of resources among competing uses.

[2]Due to space limitation, survey method and models (production and profit functions) are not discussed here (see Pudasaini, 1981).

[3]1 bigha = 0.68 hectares, US$1 = 12 rupees.

[4]Huffman also found the greater importance of the allocative effect than the worker effect in his study.

[5]A survey of literature by Lockheed et al. also reported a much higher contribution of education to output in a modernizing environment than in a traditional area. The findings that both effects contributed to the output, the allocative effect surpassed the worker effect, and all the effects were higher in the terai remain valid for all levels of education even when four--primary, secondary, high school, and college--are included in the functions (see Pudasaini, 1981 and 1982a).

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