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Adoption of Modern Farming Techniques and Adopter Characteristics: A Case Study of Nepalese Farmers

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Adoption of modern wheat farming techniques by farmers in Kavre District of Nepal is explained by socio-economic factors and various types of information acquired by farmers. Farmers possessing the following characteristics were found to be the adopters of such techniques; education, high caste, frequent contact with extension workers, proximity of the residence to agricultural offices, and information about institutional and technical aspects of farming. Some policy measures are suggested in this study in order to expedite the adoption of modern techniques by a larger number of farmers.

Transfer of technological innovations has been one of the main strategies of agricultural development in developing countries (Hayami and Ruttan, 1971). In Nepal too, high yielding varieties of food grains, including their package inputs, were introduced during the mid-sixties as a setp towards increasing agricultural productivity and aggregate farm production.

In a country like Nepal, where the size of about 88 per cent of the land holdings is less than 2.5 ha, increase in agricultural production must come primarily from the adoption of modern productive technology by a majority of farmers. However, so far the adoption rate of modern technology has been quite low. In Nepal, in 1970 only about 12 per cent of all farmers were found to be adopting some modern inputs, viz, the improved seeds of wheat, paddy and

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maize, and chemical fertilizers (HMG/Nepal, 1970–71). Consequently, factors determining the adoption or non–adoption of modern inputs and better farming practices are of major concern for policy purpose.

It is generally hypothesized that the adoption behaviour at the micro level depends on a variety of personal, socio–economic, and situational factors relating to a farmer. Personal factors relating, a farmer such as age, education, his attitudes, etc. to may induce him to adopt the new practices. Similar is the role of socio–economic factors like land, size, costs, tenancy structure, communication pattern, etc. For example, studies done by Coleman (1951), Wilkening (1952), and van den Ban (1957) highlight factors like education, age, size of farm, social participation, etc., in explaining the wide variations observed in the adoption of new agricultural practices. Other researchers in this field were Bose (1961), Rahudkar (1967) and Gerhart (1975). In his study on the diffusion of HYVs of rice in Nawalparasi district of Nepal, Khadka (1979) found that composite scale of socio–economic status (mainly, occupation, education, and farm size), knowledge of credit and input agencies, credit use and contact with JTA[1] were the important determinants of the farmers,[1] adoption behaviour.

Acquisition of information has been regarded as one of the crucial stages in the process of adoption (Wilkening, 1953; Emery and Oeser, 1958; Rogers, 1962; Singh and Pareek, 1967; Rogers and Shoemaker, 1971; Sharma, 1979) Wilkening conceived of adoption process as consisting of four stages (namely, awareness, obtaining information, conviction and trial, and adoption), out of which information is explicity emphasized in the first two, while the importance of information is implicit in the third stage. Emery and Oeser regard information and consequent decision as the principal determinants of adoption behaviour.

With this background, the main objectives of this study are:

i) to identify factors which significantly influence adoption of modern techniques by farmers; and

ii) based on (i), to suggest some policy measures which are expeeted to expedite adoption of techniques by the majority of farmers.

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[1] JTA in Nepal means Junior Technical Assistant and he is a village extension worker.

Conceptual Framework

Based on above disussions, the conceptual framework posited for this study is shown in Figure 1.

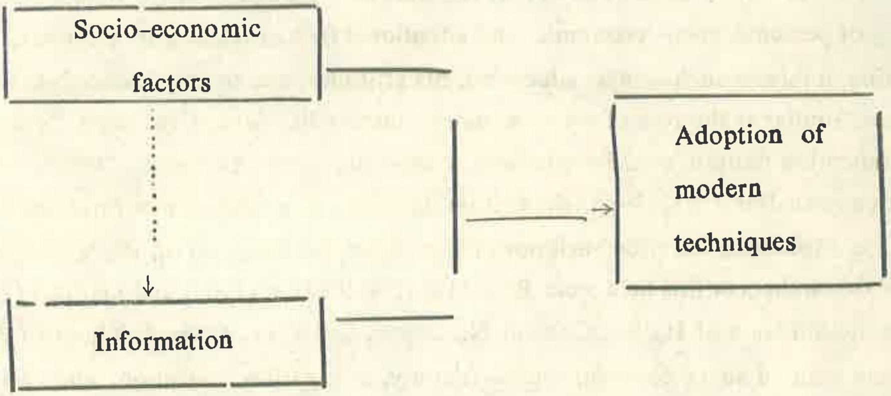

Figure 1: Conceptual Framework of the Study

It is to be noted that only three blocks of variables namely socio-economic factors[1], information, and aooption of modern farming techniques, are considered in this study. It is a simplification of the problem by discarding other types of explanatory factors like credit and risk, attitudinal considerations, and so on.

As shown in the figure, two blocks of variables are posited to influence adoption. They are socio-economic factors and information. Furthermore, acquisition of information is posited to be influenced by various socio-economic factors.

SAMPLING AND DATA

Kavre district in the central hills of Nepal was the primary unit of sampling. Out of 27 village panchayats with extension services in the district, 5 were selected randomly. From these 5 panchayats, 47 households were selected randomly for this study.

Eight socio-economic factors (including personal and situational factors) relating to a farmer were considered for this study, the selection being based on past studies as well as-the nature of the study area. The socio-economic factors are: age of the farmer, his education (years of schooling), caste, tenancy pattern, land size, distance to agricultnral offices, membership in cooperatives, and contacts with extension workers (JTA). The means, the lowest and highest ranges, and the coefficients of variation of all variables are presented in Table 1.

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[1] Henceforth, the term socio-economic factors also includes personal and situational factors.

For quantifying two of the variables, scoring rule was followed. This was done as follows. For caste, 1 for high caste and 0 for low caste and for tenancy 1 for owner-operators and 0 otherwise.

Table 1

Means, Lowest and Highest Ranges, Coefficients of Variation of Study Variables

Variables	Unit	Mean	Range lowest	Range highest	Coefficient of Variation
Socioeconomic Factors					
1. Land size	Ropani	29.04	5.00	80.00	57.02
2. Education	Years	3.30	0.00	14.00	117.58
3. Age	Years	43.57	19.00	70.00	25.87
4. Contacts with JTA	Times	6.09	0.00	18.00	107.72
5. Membership in Cooperatives	Years	2.09	0.00	7.00	119.14
6. Distance to offices	Km.	5.46	0.80	12.10	61.72
7. Tenancy	Index	0.66	0.00	1.00	72.73
8. Caste	Index	0.66	0.00	1.00	72.73
Information					
9. Institutional	Index	0.96	0.00	2.00	89.58
10. Economic	Index	1.11	0.00	3.00	90.99
11. Technical	Index	1.02	0.00	3.00	110 78
Adoption of Techniques	Index	3.96	1.00	9.00	60.61

Also, questions were asked of sampled farmers to assess their state of information regarding some of the institutional, economic and technical aspects relating to improved wheat farming. Score 1 was given for a correct answer, and o for an incorrect answer. The questions on each type of information are given in Appendix 1. Some summary data on various type of information are also presented in Table 1.

Similarly, an index for the adoption of modern farming techniques by farmers was constructed. Ten such techniques were considered. They are; use of HYV seed, treatment by chemicals line sowing, irrigation timings, use of insecticides use of nitrogenous and phosphorous fertilizers, use of potash fertilizer, use of institutional credit, use of extension workers, and use of modern farming tools. On point was assigned for each technique adopted by a farmer to form on adoption index. One the average, farmers in the sample have adopted about 4 out of 10 modern techniques (see Table 1)

Statistical Methodology

Linear regression analysis will be used to meet the objectives of this study. The analysis is divided into two parts, namely explanation of adoption of techniques and explanation of types of information.

Firstly, adoption of techniques will be explained seperately by socio-economic factors and types of information. This will enable us to know what socio-economic characteristics of farmers are important in the adoption of techniques, and what types of information acquisition will influence adoption of techniques.

For this, the following two regression equations were estimated:

i) Adoption = f (socio-economoic factors)
ii) Adoption = f (types of information)

Secondly, three regression equations were estimated with each type of information as a dependent variable, and socio-economic factors as independent variables. These estimates will show what adopter characteristics explain acquisition of each type of information. For this, the following three regression equations will be estimated:

iii) Institutional Information = f (socio-economic factors)
iv) Economic Information = f (socio-economic factors)
v) Technical Information = f (socio-economic factors)

Results and Discussion

I. Explanation of Adoption Pattern

A. By Socio-Economic Factors:

For this, the estimates of regression equation (i) are presented in Table 2.

Four socio-economic factors were found to be statistically significant at the 10 per cent level or below. All the signs appeared as expected. Education appeared significant at the 10 per cent level with positive sign. This means that higher the education, more likely are the farmers to be adopters. Similarly, 'contacts with JTA' appeared significant with positive sign. This shows that as farmers' contacts with JTA increase, they are more likely to be adopters. The significancy of the coefficient of 'distance to offices' with negative sign suggests that farmers living nearer to agricultural offices are more adopters than those living farther away. Finally caste appeared significant with positive sign, thus higher caste farmers are more likely to be adopters. Contrary to the expectation, land size and tenancy pattern did not appear significant.

Table 2

Regression Estimates of Adoption of Techniques on Socioeconomic Factors

Explanatory Variables	Coefficients	Standard errors
Intercept	2.312*	1.541
Land size	-0.10	0.020
Education	0.134*	0.092
Age	0.022	0.029
Contacts with JTA	0.214***	0.050
Membership in Cooperatives	-0.047	0.131
Distance to Offices	-0.144**	0.079
Tenancy Pattern	-0.508	0.615
Caste	0.724*	0.548

$$R^2 = 0.54$$

$$\bar{R}^2 = 0.44$$

Significant Levels : * at the 0.10 level of t, ** at the 0.05 level of t, *** at the 0.01 level of t.

The R^2 value shows that 54 per cent of the variation in adoption index are explained by the socio-economic factors. For cross-sectional data, this extent of R^2 value should be considered satisfactory.

B. By Types of Information:

For this, the estimates of regression equation (ii) are presented in Table 3.

Three types of information considered in this study could explain about 42 per cent of the variation in adoption index. The coefficients of institutional and technical information appeared significant with the expected positive signs. This shows that farmers who are well informed in institutional and technical aspects of information about modern farming techniques are more likely to be adopters.

II. Explaining Information Acquisition:

For this, the regression equations (iii), (iv), and (v) were estimated. The results are presented in Table 4.

Table 3

Regression Estimates of Adoption of Techniques on Types of Information

Explanatory Variables	Coefficients	Standard errors
Intercept	2.035***	0.429
Institutional Information	1.162***	0.394
Economic Information	0.433	0.368
Technical Information	0.323	0.178

$$R^2 = 0.42$$

$$\bar{R}^2 = 0.38$$

Significant levels : * at the 0.10 level of t, ** at the 0.05 level of t, *** at the 0.01 level of t.

Table 4

Regression Fstimates of Three Types of Information on Socioeconomic Factors

Explanatory Variables	Regression Coefficients with Dependent Variable		
	Inst. Infrom.	Eco. Inform.	Tech.Inform.
1. Intercept	0.482 (0.570)	1.050** (0.595)	-0.547 (0.764)
2. Land size	-0.009 (0.007)	0.0001 (0.008)	-0.011 (0.010)
3. Education	0.013 (0.034)	0.025 (0.035)	0.045 (0.045)
4. Age	0.006 (0.011)	-0.014 (0.011)	0.017 (0.145)
5. Contacts with JTA	0.075 *** (0.019)	0.061 *** (0.019)	0.049** (0.025)
6. Membership in Cooperatives	0.046 (0.048)	0.149 *** (0.050)	0.239 (0.065)
7. Distance of Offices	-0.051 ** (0.029)	0.010 (0.030)	0.010 (0.039)
8. Tenancy	0.084 (0.227)	-0.170 (0.237)	0.350 (0.305)
9. Caste	0.137 (0.203)	-0.043 (0.212)	-0.129 (0,272)
R^2	0.51	0.61	0.49
$\bar{R}^2$	0.41	0.53	03.8

N. B. Figures in the parantheses are the standard errors of the Coefficients.

Significant Levels : * at the 0.10 level of t, ** at the 0.05 level of t, *** at the 0.01 level of t.

Eight socio-economic factors could explain about 51 per cent of the variation in institutional information. However, only the coefficients of 'contacts with JTA' and 'distance to offices' appeared significant with expected signs. This shows that farmers who contact JTAs more frequently and farmers who live nearer to offices are more likely to be informed about institutional aspects of modern farming

In case of economic information, again 'contacts with JTA' and 'membership in cooperatives' appeared significant with positive signs. Again farmers who contact JTAs more frequently and farmers who participate longer in cooperatives are more likely to be informed about prices of inputs. Sixty one per cent of the variation in economic information is explained by eight socio-economic factors.

Regarding technical information also 'contacts with JTA' and 'membership in co-operatives' appeared significant with positive signs. The interpretation would be the same as earlier. Forty Nine per cent of the variation in technical information is explained by eight socio-economic factors.

However, since, institutional and technical information only appeared important in the adoption of techniques (see Table 3), the regression estimates of economic information on socio-economic factors (equation iv) is of little relevancy here in the context of adoption of techniques. Conclusions can be drawn on the estimates of regression equations (iii) and (v) only.

Conclusions based on these findings are presented in the next section.

Conclusion:

Regression estimates revealed that farmers who possess the following characteristics are more likely to be adopters: education, frequent contacts with JTA, nearness to agricultural offices, high caste, informed in institutional and technical aspects of modern farming. Similarly, farmers who frequently contact JTAs, who live nearer to agricultural offices and who participate longer in cooperative societies tend to acquire more of institutional and technical information, which in turn are important for adoption of techniques.

The nature of the characteristics of farmers associated with adoption as derived from this analysis, when assessed against existing socio-economic structure of the study area, will show that only a minority of farmers possess most of these characteristics. Given the magnitude of inequality in resources as well as in social structure of rural Nepal, the continuation of present extension approach will lead to more inequitable distribution of adoption. Furthurmore it is abvious that only a minority of farmers will come within the periphery of such extension programs. So, restructuring of the extension program biased towards the majority of small farmers is essential.

Nevertheless, given the present extension approach, some programs can still be designed to accelerate the pace of adoption by the majority. Education seems to be an important necessity, for which non-formal education covering the majority of the illiterate farmers can be initiated. Group extension programs can be designed to meet the present shortage of JTAs. Similarly, farmers can be encouraged to participate in formal organizations, like cooperatives. Institutional and technical information should be disseminated to the largest number of farmers possible.

However, detailed implication can be drawn only after furthur comprehensive studies elsewhere in the country. In this regard, this paper expects to stimulate further research in this area.

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Appendix

Information Level of Farmers

The specifiic questions asked of sampled farmers to assess their information relating to improved wheat farming are as follows:

(a) Institutional Information:
  (i) rate of interest on agricultural credit from co-operative society:
  (ii) name of local extension worker.

(b) Economic Information:
  (i) price of HYV wheat seed (R.R. 21) from local co-operative society:
  (ii) price of fertilizer – ammonium sulphate:
  (iii) price of fertiliser – Complesal.

(c) Technical Information:
  (i) recommended seeding rate of HYV wheat (R.R. 21) per unit land area:
  (ii) recommended fertilisation rate – ammonium sulphate per unit land area:
  (iii) recommended fertilisation rate – Complesal per unit land area.