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DIFFUSION OF AGRICULTURAL TECHNOLOGY AND ITS IMPLICATION FOR FUTURE ADOPTION : A CASE STUDY

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ABSTRACT : Innovations are the vital components of rural development—indeed profound. The adoption of innovation mainly depends on demographic, social, economic and communication set ups. In this present paper the adoption and non adoption in Karjan command area has been analysed with the help of discriminant analysis. The results reveal the overriding influence of communication on adoption of innovation.

Diffusion of economic and cultural innovations over time and space is one of the most dynamic process in determining the prosperity of human society. The importance of diffusion cannot be overstated especially when one thinks of developing the under-developed agricultural system. To extend the fruits of economic development to the maximum number of people, the process of diffusion and adoption of agricultural innovations must be accelerated. The diffusion of agricultural innovations involves not only supply of new farm-technology to the farmers but also the changing of the new technology to suit the environmental framework within which the farmers carry out their activities.

Agriculture has been getting and will continue to get more and more attention. Our plans have been investing large amount of money on irrigation projects, with the expectation that these projects, will enable to realise the expected target. However, the achievement of the implemented projects is below the anticipated level. This under-utilization is partly attributed to the inadequate provision of agricultural inputs and their adoption by farmers. By looking at this it is equally important to understand the decision process of innovation adoption in the command areas. So in this paper an attempt is made to understand the diffusion of innovations in Karjan Command area.

Innovations are vital components of rural policy. There is a commnn understanding that the Indian farmers can increase their production to a considerable extent by adopting most of the agricultural innovations, if they are made available with adequate and assured irrigation facilities. Various studies in this connection have proved that the farmers having the assured irrigation facilities adopt improved agricultural practices much early as compared to the others.

Speedy and extensive change in command areas can be brought about by bringing technological change, adoption of innovations, and by formulation of suitable innovation policies.

A proper formulation of innovation policy requires the knowledge of various factors which bear upon the adoption and non-adoption of new farm technology. Many policy makers believe that the small farm sector can and could play a key role in the

efforts to solve the twin problems of mass unemployment and mass migration to the cities. So the farmers should be motivated and provided with the farming technology to increase their production and thereof increasing their income which in turn will have influence on the twin problems.

The adoption of an innovation by an individual farmer requires the satisfaction of at least four conditions : (1) the availability of information; (2) presence of favourable attitude towards the new idea; (3) means of economic strength to acquire the innovation; and (4) the physical availability of the innovation. But the relative importance of these factors in any given situation will very much depend on the nature of the specific technology under discussion. The understanding of the said factors of adoption will help the planners and policy makers in understanding, controlling and ultimately tackling the problems more efficiently.

Data Base and Methodology

Data for hundred households were collected from six sample villages. Then the respondents were grouped into adopters and non-adopters. One group contains 58 farmers who adopted and the other group comprises of 42 farmers who are non-adopters. These have been put together as it was observed that they are complementary to each other. The important point to be noted is that the samples were drawn in such a manner as to minimize the risk of village attributes contributing in a systematic way to the between groups. The discriminant analysis method which is analogous to multiple regression is used in this study. A discriminant function is usually expressed in the form of :

$$d = b_1z_1 + b_2z_2 + b_3z_3 \ldots b_kz_k$$

where 'd' is a discriminant score, the B's are weighting coefficients, and Z's are discriminating variables. In this analysis, the dependant variables are the condition of adoption and non-adoption of new farm technology (adopters 1 and non-adopters 0).

Discussion

The basic assumption of this study is that the adoption is a function of socio-economic communication and structural characteristics of the family engaged in farm activities. There are 19 variables taken for study to distinguish between the groups. The variables were grouped into three sets as follows:

1. Indicator of personal characteristics.
2. Indicators of economic structure of peasants and the
3. Indicators of communication system.

The choice of these variables in the study was governed by their persumed theoretical importance to innovation adoption.

The personal set contains three discriminating variables. They are family size, years of formal education and age.

Table-I

Discriminant Coefficients of the Personal Set.

Variable	Discriminant Coefficients
1. Family size	0.20807
2. Age of respondent	0.02296
3. Years of formal education	0.07878

Family size is a variable for which two interpretations can be given. The first one is that the greater the size of the family, lower the risk bearing capacity. This would be the case when family size reflects mainly the consumption needs of dependent members. Another possible interpretation could be valid only when family size reflects the labour capacity of the farm family; under this situation a greater family size would imply a higher capacity to generate non-farm income and a higher availability of labour, particularly at harvest time when there might be a shortage of labour in the region.

In the present analysis, family size has higher discriminant coefficient of 0.20807 when compared to the remaining two

variables and it emerges out as a very good discriminator between adopters and non-adopters.

The second variable included in the discriminant function is the age of a farmer. It was hypothesized that the young farmers, being bold in nature, will take the risk in adopting new practice than the older peasants who are conservative and traditional. Here the age does not come as a good explanatory between the groups.

Education is the aggregate of all the processes by means of which person develops abilities, attitudes and other forms of behaviour possessing positive value in the society in which he lives. In other words, it is the social process by which people are subjected to influence of selected and controlled environment so that they may attain social competence and optimum individual development. A high level of agricultural productivity is found to be associated with the higher levels of literacy in the rural areas of India. Since adoption behaviour being essentially a process of learning involving knowledge, attitude, skill regarding improved agricultural practices, it cannot be an exception to it. It was therefore presupposed that the adoption very much depends on and is positively correlated with the educational level of peasants. An examination of discriminant coefficient (Table I) shows that there is no relation between education and adoption. One possible reason may be that it is not the education which is responsible for adoption behaviour but there might be other factors which might have influenced the adoption behaviour. In personal set only one out of three variables is able to discriminate the two groups and it is the family size.

The variables forming the resource set represent the farm structure and economic status of farmers. It is quite relevant to make certain observations regarding the importance of these variables in defining innovation.

The operational farm size has shown consistently the positive association with that of adoption. There are two contradictory views regarding the size of holding and adoption of new practices. According to the first view the number of larger farmers adopt innovations faster than the small farmers. This phenomena is due to a number of advantages. The other view is that the number of small farmers adopt improved agricultural practices much faster than the large farmers. The small farmers are motivated to adopt new technology for better agricultural returns. The increased need for improving economic condition acts as a strong motivating factor in case of small farmers. This may not be a motivating factor in case of larger farmers.

However, considering these views, it is hypothesised that the farmers of large operationl holdings tend to adopt much faster as compared to the farmers of small and medium sized holdings. But the present study shows no asscociation between the size of holding the level of adoption (the coefficient is 0.09825).

Table-II

Discriminant Function Coefficients for Resource Set.

Variable	Discriminant Coefficients
1. Irrigated Area	0.01418
2. Unirrigated Area	-0.03020
3. Operational holding size	0.09825
4. No. of Fragments	0.15612
5. Area under cash crops	0.01740
6. Possession of Tubewell	1.33431
7. Possession of Agri. Implements	1.09010
8. Agriculture Income	-0.0003
9. Off-farm income	0.00012

The fragmentation of holdings is closely associated with irrigated farms. This factor alone does not lead to the lower level of adoption as in this situation. It depends on the type of innovation. However, the adoption of new technology is possible in case

of fragmented holdings. Table-II reveals that fragmentation is a satisfactory variable in discriminating the groups with a coefficient of 0.1561.

The other variables of resource set are irrigated area, unirrigated area, area under cash crop, possession of tubewell, agricultural implements, income from farm and non-farm income. Due to lack of space the significance of these is not discussed here. The beta value for these factors are given in Table-II. The results show that only two of the seven variables are significant in influencing the level of adoption. These two variables are namely the possession of tubewell and the agricultural implements which show the coefficient value as 1.3343 and 1.0901 respectively.

The communication set which includes the seven variables indicate the aspects of communication such as the awareness of farm demonstration, willingness to adoption, contact with village leval worker, programmes known, awareness of programmes for small and marginal farmers, physical proximity from the main transport line, and the distance from first order settlement. The choice of variables in this context are governed by their assumed theoretical importance in the process of the adoption of innovation.

Table--III

Discriminant Function Coefficients for the Communication Set

variable	Discriminant Coefficients
1. Presence of Demonstration Farm	0·0469
2. Willingness to have demonstration	0·32459
3. Contact with VLW	0·60588
4. Distance from main roads	0·39401
5. Attended only demonstration	0·08225
6. Programmes known	0·58133
7. Distance from 1st order settlement	0 25950

The variables of communication figure out as good discriminators than the variables of the other two sets. In the communication set out of seven variables five have shown the values of discriminant coefficient exceeding 0.1500 (Table-III.) The variables which are less significant are the farm demonstration and the programmes known from village level worker.

In order to see the overall performance of these 19 variables the discriminant scores were computed. The frequency distribution of the groups were plotted on the graph (Fig. 1). The frequency distribution of the two groups are distinctly separated. The centroid of both the groups falls on the right hand side of the distribution with distance of 4·55 from the centre of distribution. In the case of adopters the percentage frequency distribution is fairly high in the centre of distribution. In case of non-adopters, it is skewed distribution.

The predictability of the equation is examined by way of classification. The table given below gives the ability of this analysis in predicting population.

Table- IV

Classification Table for All Nineteen Discriminant Variables

Actual Groups	Predicted Group Non-adopters	Adopters	No. of Cases
Non-adopters	37 (88%)	5 (11·9%)	42
Adopters	14 (24·56%)	43 (75·44%)	57

Percentage of 'known' groups correctly classified : 81 per cent.

It identifies 88 per cent of non-adopters and 75 per cent of adopters giving an overall classification of 81 per cent which is the highest among the three sets of discriminating variables.

Policy Implications for Future Adoption

It is but natural that the adoption of fertilizer, pesticides, and HYV's is associated with the irrigation practices, farm size etc., which are complementary to each other.

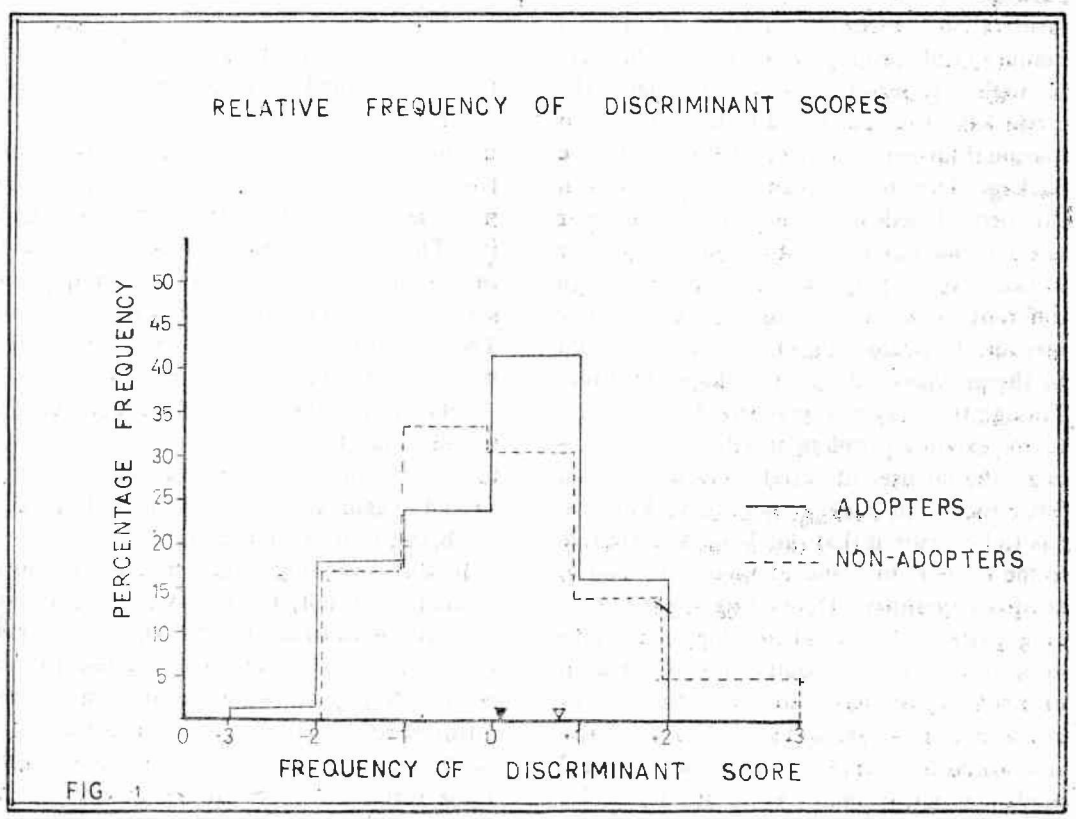

FIG. 1

However, our focus is on farmers who are non-adopters and more earnest in their effort to realize production potentials of their farm. The farmers traditional and conservative outlook and their psychology do not form the source of non-adoption. Adequate information is a necessary precondition for the adoption of innovation. The process of adoption of an innovation fails to gain momentum across different social groups. Therefore, it is worth to investigate the specific institutional and market conditions which determine the accessibility to inputs. The results of this study rather support this view. For instance, in the case of adopters the land holding size is 14.28 acres and the same is 3.26 for non-adopters. However, this leads us to understand the implications for rural development policy, especially with regard to the non-adpotion caused by the inaccessibility to inputs.

The following are the important aspects emerging out of present study which need to be considered while framing the policy measures. The possession of tubewells and agricultural implements are found to be significantly associated with adoption (only the large farmers possessed these facilities). Besides providing irrigation facilities, the proper distribution system for the provision of agricultural implements should be thought of so that the small and marginal farmers get access to these inputs. The agricultural package programme, which includes fertilizer, pesticides, improved seeds involves capital costs and is beyond the capability of small and marginal farmers. Hence, the ways and means of reducing their cost have to be examined. The chemical fertilizers constitutes one of the largest cost factors in the

package. It is desirable to initiate the farmers to identify suitable traditional manure and propagate it among farmers through extension service. Besides, the credit has to be advanced to the small and marginal farmers to meet the cost of the package. The credit advanced to farmers in the form of cash is often put to improper use and this has been observed in number of farm and village surveys conducted in different parts of the country. An effective measure to counter check this process could be the provision of credit package in kind. Though this may not give the best solution to the existing problem it will at least minimize the misuse of credit given in cash. Since the credit package is to be in kind, it has to be ensured that this is made available to the farmers in time of their need and in adequate quantity. Depending on the cropping pattern, the size of holding, soil conditions and so on the requirments of a region or a sub-region have to be estimated in advance and the same has to be procured and stored in reserve so that the farmers' needs are met in time. Adequate care also has to be taken to ensure the flexibility in the content of package so that it becomes responsive to the needs of the individual farmers. Above all, the relevant procedures for the disbursement of credit package have to be simplified and streamlined further so that illiterate farmers are not put to undue hardships which might defer them from going in for the adoption of the package in spite of their awareness about it. The present study has also shown the communication system as an important set of variables in influencing the adoption. The demonstration through extension should be followed up to ensure the awareness of the farmers about the package. At the initial stage the number of demonstration farms should be increased. The proper spatial organization of settlements is needed for better spatial interaction.

In the foregoing discussion an attempt is made to briefly the policy measures and suggestions in order to present an overall view. Attention has to be given to the market, transport, communication and other infrastructural aspects, since the discussion of the present study clearly indicates that these forces influence the physical accessibility to inputs.

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