BJAE, VI, 1-2 (1983) 51-60 Note

FARM RESOURCE PRODUCTIVITY UNDER COOPERATIVE AND INDIVIDUAL MANAGEMENT

Shamsul Alam*

ABSTRACT

Productivity and efficiency of two groups of farms were compared. One group have been practicing cooperating joint farming in Boro paddy production. The other group comprised of fully individually operated farms. Both the groups produce Boro crop under deep tubewell irrigation. A Cobb-Douglas type production function analysis as well as residual method of analysing efficiency revealed that *the* farmers under cooperative management showed lower performance than the individually operated farms. The differences in production performance between the two groups happened owing to poor management of cooperative farms. Strong national commitment with government technical support and constant assistance of an effective extension service are important in attaining success of cooperatives.

I. INTRODUCTION

The efficiency of farm resource utilization is a vital issue for agricultural development and policy formulation. The relative efficiency of individual and cooperative resource management is a subject of theoretical and empirical interest for situation prevailing in Bangladesh.

Cooperative organization has a long history in Bangladesh. Cooperatives in-the field of agricultural production have been mostly confined to service type organizations supporting inputs procurement, provision and distribution of institutional credit, raising capital and thus to assist individual farm units in enhancing production. After independence of Bangladesh the- government proclaimed the goal to move toward a socialist pattern of economy. So the issue of cooperative farming and experiment on that gained

*Assistant Professor, Department of Cooperation and Marketing, Bangladesh Agricultural University, Mymensingh. The paper is based an the author's Masters Thesis submitted to the Faculty of Economics, Thammarsat University, Bangkok in 1983. The author is grateful to Dr. M.A. jobbar, Dr. M.A. Sattar Mandal and Professor A. M. Muazzam Husain for their helpful comments on an earlier draft of the paper.

much importance as a strategy for agricultural transformation. Some research, educational and voluntary organizations started the practice of group action experimentally in agricultural production in different parts of the country (for the geneses and analyses of impacts of such projects, see Alam 1983). The Shimla experimental Cooperative Farming Project under the Sponsorship of Bangladesh Agricultural University, Mymensingh is one such voluntary experiment initiated after independence.

Cooperative joint farming activities were started in the village Shimla under Muktagacha Police Station of Mymensingh district as a pioneer village in 1972 on the basis of partial coolectivisation of members' land falling under the command area of a deep tube-well irrigation facility. This experiment was started with pronounced commitments to a gradual transformation from peasant farming system to a collectivised one within the framework of a village based cooperative organization. The basic operational principle of the cooperative farming project was joint use of inputs for the cultivation of Boro paddy. The member farmers of the project pooled land, labour and performed post-tillage operations including harvesting under joint management. Ownership right of farmers to land was retained, but the individual plots were organised into compact blocks for ease of supervision and for production practices. The net produce was distributed according to land contribution after deductions for loans, collective production costs and certain common funds (for detailed analyses of the moded of organization and operational principles followed by the societies, see Husain 1979, Ahmed 1980). Shimla Cooperative Farming Approach has been replicated in five villages under different thanas of Mymensingh district.

This study attempts to analyse the economic impact of cooperative farming on farm resource productivity in comparison to individually operated farms. The study may prove helpful to identify the preconditions for higher growth goals, limitations of and approaches to future cooperative farming policies in Bangladesh.

Section II presents the analytical framework and source of data. Observations and interpretations of the empirical results are provided in Section III. Section IV contains concluding remarks.

II. DATA SOURCE AND ANAYLYTICAL FRAMEWORK

This study is based on survey of 67 owner operated farms of which 34 farms were selected from two cooperative societies, viz., Douhakhola and Gopalpur joint farming societies. Shimla experiment was replicated in these villages in 1975 and 1977 respectively. Thirty three individually operated farms were selcted from two villages adjacent to the cooperative villages. Production performances of the cooperative member farms was

compared with the individually operated farms. Crop production activities in the year 1982 were taken into consideration for the analysis. Distribution of farm size categories is not significantly different between the two groups of farmers.

It was hypothesized that the joint farming activities under cooperatives have enhanced qualities of management of the member farms which should be reflected in farm resource productivity. So, it was assumed that the differences, if any , in production performance between the two groups would be owing to differences in management qualities of the farmers.

Resource productivity analyses were done by following a production function approach. To estimate marginal and total factor productivity and to test statistical significance of input variables in explaining output variation, a Cobb-Douglas type production function was employed. Cobb-Douglas type production function was chosen considering ease of handling logarithmic transformation of the function and its convenience in interpreting elasticities of production. Estimation of parameters also involve loss of fewer degrees of freedom than other algebraic forms (Heady 1972, p. 25). To cross-check the estimates of factor returns a residual method of analysing efficiency was also employed to measure returns to land and returns of labour.

For production function analysis, the OLS technique was used to estimate production elasticities. The estimated model is

$$\text{Ln } Y_i = \text{Ln } A + \Sigma \beta_j \text{Ln} X_{ij} \qquad \begin{matrix} i=1, 2, \ldots \ldots, n \\ j=1, 2, \ldots \ldots, l \end{matrix}$$

Estimation was done under the assumptions of normally and independently distributed error term with zero expected value and constant variance. Attempt was made to test whether there were significantly different production functions for the groups of farmers of two management background. This was done by applying Chow-test (Koutsoyiannis 1977, PP. 164-8).

III. EMPIRICAL RESULTS AND DISCUSSION

Efficiency Analyses

To identify significant explanatory variables, step-wise regressions with several combinations of different independent variables were run. Accordingly,three significant

variables viz., gross cultivated acre (land), man-days utilised (labour) and value of seeds, ferti lizer and irrigation (cash capital) were identified and they explain89 per cent of variation in gross value of output for all farms (Table 1). The homogeneity test of production functions between two groups based on management categoryproved that there was no difference in the production functions between the two groups of farmers. So, for estimation of marginal and total factor productivities, values of input coefficients were taken from pooled production function for all farms.

The computed Fratio in the Chow-test stood at 7.62 against a tabular value of 3.65 with 4,59 degrees of freedom at 1% significant level. Implication of the results of the Chow-test is that, irrespective of the form of management, farm practices and cropping system pursued, the sample farms in the reference period belonged to the same production function and were almost in a similar state of art of agriculture.

Intercorrelations among input variables is considered a problem in production function estimation. For this study, the regression results for all farms with highly significant indivivual coefficients are assumed free of high intercorrelations, because the t value for each input in the pooled regression for all farms is found highly significant.[1]

Marginal productivity of the significant input variables were computed at their geometric mean levels. Estimated values of the marginal productivities of the above three input variables and total factor productivity are shown in Table 2. Marginal productivity analysis indicates that an increase in one gross cultivated acre, *Ceteris Paribus*, would increase output by Taka 1177, and Taka 1380 in cooperative and individually operated farms respectively. One additional man-day of labour employed would give returns of Taka 13 for cooperative farm and Taka 18 for individually operated farms. An additional one Taka invested in seeds, fertilizer and irrigation would increase Taka 2.23 and Taka 2.39 for cooperative and individually operated farms respectively. Marginal productivities of these three inputs are higher in case of the individually operated farms.

Marginal productivity of land seems to be lower than the average annual cash leasing value of an acre of land which was estimated as Taka 1800.00 (assuming available best alternative use of the land and thus the opportunity cost of land use). This situation is not consistent with income/profit maximization objective of farm production activities. This gap between marginal productivity and available alternative return might have arisen owing to prevailing imperfect land market in the study area and/or because calculated opportunity cost did not represent the true value of the marginal productivity of land.

TABLE 1 ESTIMATED VALUES OF INPUT COEFFICIENTS AND RELATED STATISTICS

Groups	Const. term	Cropped acreage	Total man-days utilized	Value of seeds fertilizer and irrigation	R	F	D.F.
Cooperative management	5.62 (5.92)	0.3852 (1.8172)	0.5707* (2.5041)	-0.0008 (-0.0061)	0.89	77.65**	3,30
Individually operated farms	5.62 (8.20)	0.4633** (3.8138)	0.2452* (2.1338)	0.2459* (2.4357)	0.89	78.15**	3,29
All farms	5.95 (11.43)	0.5194** (5.2707)	0.2614** (2.7034)	0.1704* (2.3039)	0.89	172.60**	3,63

Note :

Singificant at 5% level.

Singnificant at 1% level.

Figures in the parentheses are calculated t-ratios.

TABLE 2. MARGINAL PRODUCTIVITY AND TOTAL FACTOR FETURNS

A. MARGINAL PRODUCTIVITY OF FACTORS OF PRODUCTION (IN TAKA)

Group	Per gross cultivated acre	Per man-day Labour	Per Taka expenditure on seeds, fertilizer and irrigation
Cooperative management	1,177	13	2.23
Individually operated farms	1,380	18	2.39

B. TOTAL FACTOR PRODUCTIVITY PER GROSS CULTIVATED ACRE (IN TAKA)

Group	Gross cultivated acre (land)	Total labour returns	Returns on seeds/ fertilizer and irrigation	Total productivity
Cooperative management	1,177	613	404	2,194
Individually operatied farms	1,380	823	616	2,819

Estimated marginal productivity of labour per man-day turned out to be around their average wage rates (acquisition cost of labour). So, it can be said that all farms in the study area are using their labour force efficiently. Trend of this labour returns per man-day has corroborated the estimated returns to labour computed by the residual method of return analysis. By residual method, returns to labour was computed by using the following formula previosuly used by Sen (1967) :

(Value of gross output-All costs excluding labour) / (Total man-days utilized)

The return to one man-day of labour was computed at Taka 15 for cooperative farms and Taka 20 for individually operated farms. Average wage rate for cooperative and individually operated farms was estimated at Taka 16 per man-day.

Cash expenses in the farming activities have shown increasing marginal returns which imply that there was additional scope to increase cash investment.

Total factor returns per acre (marginal productivity of each factor × total inputs in an acre of land), was also found to be higher for individually operated farms. By residual method, returns to land (total productivity in an acre of land) for cooperative farms was estimated at Taka 1864 (total productivity of land by following production function approach was Taka 2194) and for individually operated farms was Taka 2837 (Taka 2819 by production function approach, vide Table 2). Returns to land was computed as the gross output value minus the costs of variable inputs like seeds/seedlings, fertilizer, pesticides, irrigation costs, costs of hired labour and cost of services of some fixed resources such as costs of manure, draft power and owned labour, and all these are expressed per net acre cultivated.

Thus,it appears that both cooperative and individually operated farms were efficient, at least in using farm labour : both the groups have satisfied the condition of equality of marginal productivity of labour with the marginal cost (acquisition cost). However, in terms of overall resource utilization, farmers under cooperative management did not show better performance than the individually operated farms. Thus, the results of this study revealed that there was no significant impact of cooperative management on production performance of the member farms. The reasons for such a situation are explained below.

Defects in Cooperative Organization

A look into the operation and management of the cooperative societies under study revealed that these societies could not play adequate role in enhancing members' management qualities. The cooperative farming project adopted a partial approach in

cooperative farming. Member farmers were only producing Boro paddy under cooperative joint management. Yet in this crop, individually operated farms achieved higher productivity than cooperative managemen. (Table 3). For other crops the member farms operated individually. This partial cooperative production efforts was also plagued with a number of problems which were related to membership participation, infrastructural facilities and public policy towards cooperative joint farming activities.

Land rich farmers took the leadership in management and tried to gain their self interest out of cooperative enterprises. Members were found to be more attentive to their own individual plots than their land given to the cooperative joint pool. Most of the cash needs of the joint farming activities were met out of borrowing from banks. It was observed that in most cases, the richer farmers failed to repay their cost- shares in the society and thus created anomalies in loan repayment. To manage cooperative pooled harvest, certain infrastructural facilities like common threshing yard, drying yard and storage facilities are needed but such facilities were proved quite inadequate. Meetings were not held regularly and percentage of attendance in the meetings held was also low. Timely supply of some technical inputs from the government delivery agencies (e.g., oil-fuel, spare

TABLE 3. MEAN INPUT LEVELS AND YIELD OF BORO (PER ACRE)

	Cooperative farms	Individually operated farms
Labour inpnt (man-days)	58	60
Bullock power (pair-days)	9	10
Expenditure (Taka) on		
Seeds/seedlings	173	109
Fertilizer	169	236
Irrigation	120	230
Boro production (mds)		
Traditional variety	19.2	30.4
High yielding variety	36·0	40.2

parts of deep tubewells, fertilizers, pesticides and cash loan) were not ensured and as a result a total or partial crop failure occured. Proper training, motivation and necessary legal support were absent to make joint farming activities successful.

IV. CONCLUDING REMARKS

Definite policy lessons cannot be deduced on the basis of the findings of such a case study where, cooperative farming societies studied cannot be taken as example of ideally organized cooperative farming activities. However, some policy implications can be indicated on the basis of the findings of the study. These are as follows :

(i) As a sporadic effort and a partial approach, cooperative farming system cannot achieve much success. Strong national commitment with government technical support and constant assistance of an effective extension service are important pre-requisites in attaining success in cooperative farming.

(ii) High marginal returns on seeds, fertilizer and irrigation imply that there is ample scope to increase farmers' income by increasing cash investment on seeds, fertilizer and irrigation. Increased provision of cash capital facilities to farmers for investment in better quality seeds, in fertilizer and irrigation can increase total revenue to a great extent.

(iii) With the present form of resource allocation it seems farmers are efficient in farm labour utilization (as the returns to labour is around wage cost). So, any effort to bring about technological change in farming should be designed in such a way that it promotes intensity of farm labour use, e.g., encouraging adoption of seed-fertilizer technology.

Note

1. Multicollinearity is considered harmful only when all of the influences of the explanatory variables cannot be disentangled, for example, when at the 5% level of significance, the value of the F-statistic is significantly different from zero but none of the t-statistics for the regression is significant (Kmenta 1971). If collinearity is high, one may obtain a high R^2 but none or very few estimated coefficients are found statistically significant (Gujarati 1979).

REFERENCES

Ahmed 1980 — J.U. Ahmed : *Resource Use Pattern and Cost/Returns in Cooperative Boro Paddy Production in Bangladesh*. Dhaka : NFRHRD, July, 1980.

Alam 1983 — Shamsul Alam : "Farm Resource Productivity Under Alternative Management Practices'," Bangkok : Unpublished Master's Thesis, Thamasat University, 1983.

Gujarati 1979 Damodar Gujarati : *Basic Econometrics.* Delhi : McGraw-Hill Inc., 1979.

Heady 1972 Earl O. Heady : *Agricultural Production Functions.* Ames, Iowa : Iowa State University Press, 1972.

Husain 1979 A.M. Muazzam Husain : "The Shimla Cooperative Farming Project in Bangladesh" in *Group Farming in Asia,* Edited by John Wong. Singapore : Singapore University. Press, 1979.

Kmenta 1971 Jan Kmenta : *Elements of Econometrics.* London : Collier-Macmillan Publishers, 1971

Koutsoyiannis 1977 A. Koutsoyiannis : *The Theory of Econometrics.* London : The Macmillan Press, 1977.

Sen 1967 Bandhudas Sen : "Farm Productivity and Soil Fertility in Indian Agriculture". *Indian Journal of Agricultural Economics,* XXII (1967).