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## SUMMARIES

### PROBLEMS AND PECULIARITIES IN APPRAISING AGRICULTURAL PROJECTS

V. K. Sharma and A. N. Sharma\*

Any method adopted for appraising industrial or agricultural project has to include the estimation of various costs to be incurred and returns expected from it. But certain peculiar characteristics of agriculture distinguish the process of appraisal of agricultural projects from that of industrial projects. The paper aims at presenting some important factors which have posed problems in the appraisal of irrigation projects with particular emphasis on estimation of returns. Some studies on Tomaria reservoir project and Dhora reservoir project (both located in Nainital district of Uttar Pradesh) made by the first author and his co-workers, have revealed that irrigation decision rules to be applied in the project area, cropping pattern adopted by the farmers in the project area, weather conditions and the net area irrigated were the major factors affecting the estimate of returns. Should we consider existing or optimal irrigation decision rules and cropping pattern for the project area, should we base our estimate of returns on one year's survey ignoring the variation in weather conditions prevailing in different years and should we work out optimal area to be irrigated for the purpose of estimating returns, are some important issues. If we consider optimal irrigation decision rules and cropping pattern, then how to get them implemented; otherwise the estimate will be irrelevant. If we consider existing irrigation scheduling and cropping pattern, both are subject to change in different periods. Probabilistic models may be developed to determine the most appropriate area to be irrigated and to take into account the weather uncertainties, but that will require time-series data on weather variables and returns. Besides these factors, the estimate of returns from irrigation projects will also change according to the system of water distribution among various groups of farmers and among different parts of command area. Variations in water supplies to small, medium and large farmers as well as in head, middle and tail zones of distributaries change the estimate of returns. Estimation of indirect returns like increase in the value of land and social benefits like additional employment further adds to the complexity of estimating returns expected from the irrigation project. A large number of agricultural projects heterogeneous in quality and variation in their prices are also to be considered while estimating returns. As regards cost, the main problem arises due to change in prices of construction material and wages over a period of time taken in getting the proposal approved and in its implementation.

### LIFT IRRIGATION PROJECT : ITS IMPACT ON CROPPING PATTERN, LEVEL OF INVESTMENT AND INCOME ON FARMS

Y. S. Chauhan, V. Prasad, R. I. Singh and S. D. S. Senger†

In this paper an attempt has been made to examine the impact of Lift Irrigation Project—Jasoda (District Farrukhabad, Uttar Pradesh) on the change in cropping pattern, productivity of main crops and the investment and income level of farms in 1977-78 over the base year (1972-73). This project started in 1972-73 was completed on March 1978 with a total cost of Rs. 16,309 lakhs. The project proposes to cover a culturable command area of 1,257 hectares spread over a number of villages. Before the introduction of the project, the irrigated area accounted for 31.78 per cent of the total cultivated area. It increased to 51.57 per cent in 1977-78. Similarly, the intensity of cropping on the sample farms increased from 120.78 per cent in 1972-73 to 155.32 per cent in 1977-78. A remarkable change in the cropping pattern was observed. The area under maize increased from 14.78 to 17.20 per cent, high-yielding variety (HYV) wheat from 11.30 to 25 per cent and potato from 6.18 to 12.80 per cent in the corresponding periods. The mustard crop which was introduced in 1977-78 occupied an area of 10.34 per cent of the total cropped area.

An increase in irrigation facilities brought about a higher investment of each input for crop production which resulted in higher yields and income on the farms. The cost of cultivation of maize increased from Rs. 780.50 to Rs. 1,042.35 per hectare, of HYV wheat from Rs. 1,510.77 to Rs. 2,203.93 per hectare, and of potato from Rs. 2,727.60 to Rs. 3,396.98 per hectare between 1972-73 and 1977-78 respectively. This resulted in an increase in the yield of maize from 13.25 quintals per hectare to 18 quintals, of HYV wheat from 20 to 30 quintals and of potato from 140 to 160 quintals per hectare, during the same period.

In the case of farm business as a whole, the input cost per hectare increased from Rs. 1,619.60 in 1972-73 to Rs. 2,213.58 in 1977-78 due to higher investment made on chemical fertilizers, irrigation changes, quality seeds and human and bullock labour. This resulted in an increase of net income per hectare from Rs. 1,006.15 in 1972-73 to Rs. 1,985.25 in 1977-78. Thus, the farmers, on an

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average, received an additional net income of Rs. 980 per hectare on an additional investment of inputs of Rs. 594 per hectare in 1977-78 over 1972-73. The input-output ratio came to 1 : 1.60 in 1972-73 and 1 : 1.88 in 1977-78. It may be concluded that the lift irrigation project has helped in increasing the area under HYV crops, and the intensity of cropping, which in turn resulted in an increase of yield and income on the farms.

AN ECONOMIC APPRAISAL OF 'ON-FARM DEVELOPMENT PROGRAMME'—A HAND  
CORE OF RAMGANGA COMMAND AREA DEVELOPMENT PROJECT,  
UTTAR PRADESH

R. I. Singh, V. Prasad, T. R. Singh and Shri Ram\*

Of the three major Command Area Development Projects, *i.e.*, Ramganga, Sharda Sahayak and Gandak, introduced during the Fifth Plan in Uttar Pradesh, Ramganga is the biggest multi-purpose project. It is meant to store the supplies of river Ramganga for meeting the acute shortage of water for irrigation in the Western and Central Uttar Pradesh and for providing cheap hydro-electric power. The Command Area Development envisages an all-round development approach with a view to fully utilizing the available irrigation potential through modernization and better operation of irrigation and drainage system and execution of 'on-farm development programme' in outlet command. The project proposes to cover a culturable command area of 8.21 lakh hectares spread over in ten districts of the State, namely, Aligarh, Mathura, Agra, Mainpuri, Etah, Farrukhabad, Allahabad, Etawah, Kanpur and Fatehpur. This paper attempts to evaluate the economic feasibility of irrigation and on-farm development programme undertaken by Ramganga Command Area Development Project and the impact of the project on cropping pattern, irrigated area, cropping intensity and yield levels of principal crops in 1974-75 and 1975-76 over the base year 1973-74. The on-farm development works consisting of topographic survey, planning and design, execution of irrigation channel, lining of irrigation channel, construction of field drainage channels, water control structure, land levelling, construction of chuk road, etc., covered 99,000 hectares during the Fifth Plan period. The progress during the first two years, *i.e.*, 1974-75 and 1975-76 was very slow and it could come to take-off stage only during 1976-77, when considerable staff was posted and Government funds were also made available for on-farm development works.

The immediate impact of on-farm development work was observed in the case of extension of irrigation and cropping intensity due to the reduction in seepage losses. The irrigated area increased from 52.86 per cent of the net cultivated area in 1973-74 to 56.53 per cent in 1974-75 and nearly 58 per cent in 1975-76, and the intensity of cropping increased from 133.85 per cent in 1973-74 to about 135 per cent in 1975-76. It resulted in an increase of area under paddy from 4.47 lakh hectares to 4.60 lakh hectares, that under wheat from 12.71 lakh hectares to 12.86 lakh hectares, that under total oilseeds from 1.80 lakh hectares to 2.40 lakh hectares and that under potato from 0.69 lakh hectares to 0.82 lakh hectares in the corresponding years. The yield per hectare of foodgrains increased from 9.13 quintals in 1973-74 to 10.69 quintals in 1975-76. The per hectare yield of rice increased from 9.08 to 9.41 quintals, that of wheat from 11.02 to 14 quintals, that of potato from 94.30 to 110.97 quintals, that of sugarcane from 342.56 to 387.90 quintals and that of total oilseeds from 6.61 to 7.28 quintals in the corresponding years.

The increase in foodgrains production on per rupee of investment in on-farm development works was 0.15 kg. in 1974-75 and 0.41 kg. in 1975-76, and the increase in gross income was Re. 0.50 and Re. 0.73 for the respective periods. The poor returns on per rupee of on-farm development cost were mainly due to the short time lag between programme planning and achievement of results (production) and lack of funds and staff.

AN ECONOMIC APPRAISAL OF A MINOR IRRIGATION PROJECT (TUBEWELL):  
A CASE STUDY

M. P. Azad, J. S. Garg, G. N. Singh and K. N. Pandey†

The present study is based on an intensive enquiry of 30 farmers, owning tubewells in block Kalanpur, district Kanpur in Uttar Pradesh. The analysis of profitability of the project is much dependent on its command area and water supply from the tubewell. The main factor determining the command area of an irrigation project is the cropping pattern. The initial investment of a tubewell, on an average, in the study area came to Rs. 12,100, whereas its maintenance and operating cost came to Rs. 6,500. The analysis of the cropping pattern and intensity of cropping on the

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farms under pre-and post-project periods showed a marked reallocation of area. The shift in the area was mostly in favour of high-yielding varieties (HYVs) which increased from 3.16 to 10.21 per cent of the cropped area in the case of paddy and from 2.27 to 29.65 per cent in the case of wheat under the pre-and post-project periods respectively. The area under local paddy, local wheat, gram, pea and barley declined from 15.32, 25.10, 8.60, 6.62 and 5.34 per cent of the cropped area under the pre-project period to 5.63, 6.22, 5.10, 5.24 per cent and almost nil respectively under the post-project period. The intensity of cropping increased from 126.50 per cent under the pre-project period to 191 per cent under the post-project period.

As regards cost and return, the study showed that the input cost, value of output and net profit per hectare in almost all the crops were significantly higher on the sample farms under the post-irrigation project period as compared to the pre-project period. The investment on cash crops like potato and mustard was significantly higher on farms under the post-project period in comparison to the pre-project period. The study also indicated that wheat and paddy were the main crops of the study area, contributing about 44.02 and 14.71 per cent to the total input cost, 43.06 and 12.40 per cent to the total output and 41.77 and 9.27 per cent to the total net income respectively. These were significantly higher under the post-project period as compared to the corresponding values of 35.62 and 17.46 per cent, 29.31 and 14.78 per cent, and 20.57 and 11.07 per cent respectively in the pre-project period. The share of HYVs of wheat in the total cost, total output and total net profit was higher in the post-project period (being 38.12, 37.84 and 37.47 per cent respectively), as compared to its share in the pre-project period (4.13, 4.03 and 3.91 per cent respectively). The corresponding values in the case of local wheat were 5.90, 5.20 and 4.29 per cent in the post-project period and 31.49, 25.27 and 16.66 per cent in the pre-project period.

The study revealed that, on an average, an incremental income of Rs. 10,700.84 was obtained per holding with the installation of a tubewell. The incremental income to the total initial investment of the project worked out to 88.4 per cent. The pay-back period of the tubewell project came to 1.13 years, indicating thereby that the tubewell will pay out its initial cost out of the earnings expected from investment within a year. This also reflects that instead of long-term loan, if short-term loan is available for investment, the farmer will not hesitate to use it for investment on the installation of a tubewell, as the farmer will be in a position to repay the loan well in time. The simple rate of interest of minor irrigation project came to 152.30 per cent, showing very high profitability of the initial investment on the tubewell project in the study area. If the rate of interest on long-term investment is supposed to be 12 per cent, the rate of return as worked out is very high with 1.52 unit rate of return. The cost-benefit ratio in the present study worked out to 1 : 3.84. Thus it may be concluded that the installation of the tubewell project on an eight-hectare farm is a technically feasible and economically viable project.

#### FORMULATION AND APPRAISAL OF RURAL ELECTRIFICATION PROJECTS IN UTTAR PRADESH —A CRITICAL REVIEW

Vishwa Nath†

The importance of electricity for the development of rural India cannot be over-emphasized. It is well-known that the level of electrification in India is very low and the level of rural electrification is lower still. Even after Independence, rural electrification has not made the desired progress, which has resulted in the poor exploitation of resources in the rural areas of the country and in turn in the increase in rural poverty. To give a boost to the rural electrification programme, the Government of India established the Rural Electrification Corporation (REC) in 1969, which sanctions rural electrification projects all over the country. These projects are mainly agriculture development-oriented wherein provisions are made to release electric connections to private tubewells, State tubewells, lift irrigation schemes, rural industries and also to light the rural houses. These projects have two distinguished parts: one is the load assessment and the other is the technical provision to meet out the required load estimated. The assessment of load is a very complex problem and that is why the formulation of projects becomes difficult to an organization, which has not adopted the multi-disciplinary approach. The Rural Electrification Wing of the U. P. State Electricity Board (SEB), which formulates and puts up the rural electrification projects in Uttar Pradesh for sanction by the REC, is faced with the same problem of project formulation. Since it is having only technical expertise, it has not been able to study the necessary socio-economic factors which decide the agricultural, industrial and domestic lighting load in the rural areas. Also, the selection of area is done without any systematic approach. Though the appraisal work by the officers of REC is taken up in its correct perspective, it has not been very much effective as the project formulation itself is not improved. Since these types of projects require techno-economic expertise at all levels of formulation, appraisal, implementation and post-evaluation, the SEB should adopt a multi-disciplinary approach to get success in the field of rural electrification. If this is done, the pace of rural electrification would be much faster and in turn it will accelerate the development of rural economy.

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ECONOMIC SIGNIFICANCE OF UNDER-UTILIZATION OF IRRIGATION  
RESOURCE: AN *EX POST* EVALUATION OF GHOD IRRIGATION  
PROJECT PERFORMANCE

Jagannathrao R. Pawar, Chandrakant S. Kadam and T. K. T. Acharya\*

An attempt is made in the paper to explain empirically the extent of divergence between the expected and actual magnitudes of cost and benefits associated with under-utilization of created irrigation potential and to find out the reasons for such divergence by way of *ex post* evaluation of the performance of the Ghod Irrigation Project in Maharashtra. The study is based on the data obtained from the Irrigation Department and a sample of 90 benefited and 90 non-benefited cultivators drawn from eight villages in the command area of the project with two-stage stratified random sampling design. The estimated per hectare costs and returns of various crops produced under irrigated and rainfed conditions have been used for computing the expected and actual benefits of the project as a whole.

The study revealed that 39 per cent of the available irrigation potential of the project was unused. As a result, there was considerable difference between the proposed and actual crop patterns in the command area of the project. The actual net returns from crop production were estimated at Rs. 167.93 lakhs for the command area as against the expected net returns of Rs. 208.05 lakhs. The analysis of the extent of divergence between the expected and actual magnitudes of cost and benefits of the project revealed that because of under-utilization of available irrigation potential, there has been a loss of Rs. 37.64 lakhs per annum. The Government was also put to a loss to the extent of Rs. 1.76 lakhs of yearly receipts from water rates.

The sample cultivators reported various reasons for the under-utilization of available irrigation potential as a result of which there has been divergence between the expected and actual benefits from the project. Inadequate and untimely supply of canal water, unsuitability of land for irrigation, inadequate funds, defective canal water distribution system, lack of infrastructure facility and inadequate supply of fertilizers and credit were the prominent reasons for such divergence. The study, therefore, suggests that removal of defects in the present system of distribution of canal water and simultaneous efforts for land development and supply of adequate inputs and technical know-how would help solve the problem of under-utilization of canal water, resulting thereby in the minimization of gap between the expected and actual benefits of the irrigation projects.

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PROJECT APPRAISAL FOR MINOR IRRIGATION TANKS—A CASE STUDY OF  
PANCHMAHALS DISTRICT

Ravindra H. Dholakia and Sudarshan Iyengar†

This paper attempts to examine and analyse the current practices in project planning for the minor irrigation sector at the district level with the help of 28 minor irrigation tank projects in Panchmahals—A Drought Prone Area Programme (DPAP) district in Gujarat. After describing the procedures followed at the district for the formulation and appraisal of a project, some problems specific to irrigation projects are discussed. It is argued that mere construction of head work and canals does not ensure the success of an irrigation project. Command area development, consolidation of land and inter-sectoral co-ordination are necessary conditions for the irrigation projects to be successful. However, these aspects, specific to an irrigation project, are completely neglected while formulating projects not only by the district development agency but also by separate agencies like the DPAP. Such neglect usually leads to less than optimum utilization of the potential created by the irrigation projects. The actual working of the minor irrigation tank projects is also analysed. It is felt that the economic feasibility study is taken as a formal official practice which does not have any direct bearing on the decision regarding the projects at the district level. The paper raises a few objections against the current practices of project appraisal at the district level, points out some problems related to the organizational structure of the district and suggests the application of PERT-CPM techniques for efficient implementation of the projects.

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AN EVALUATION OF DAIRY DEVELOPMENT PROGRAMME OF SFDA  
RATNAGIRI-SATARA (MAHARASHTRA STATE)

J. B. Salunkhe and S. B. Singh\*

An attempt has been made in the present paper to evaluate the impact of dairy development programme of Small Farmers' Development Agency (SFDA), Ratnagiri-Satara (Maharashtra). Out of eight talukas covered under the SFDA programme, Jaoli taluka was selected purposively where dairy programme was taken up on a large scale and had also the highest percentage of identified small farmers. Then, three villages were selected at random. Further, a sample of 30 beneficiaries was drawn randomly from the three selected villages and their number was distributed among the villages in proportion to the number of beneficiaries available in each village. Lastly, 15 non-beneficiaries, forming 50 per cent of the total beneficiaries included in the sample, were also selected from the same villages. The study covered the year of 1974-75. The study revealed that, on an average, the net income per buffalo for beneficiary farmers was Rs. 935, while it was Rs. 687 for non-beneficiary farmers. The higher net income for beneficiaries was mainly due to high milk yielding breeds supplied to them under the dairy development programme by the Agency, along with the supply of feeds by the village co-operatives at cheaper rate to the beneficiaries. Further, the net income per buffalo decreased with an increase in the size of farm of non-beneficiaries, while no clear trend was observed in the case of beneficiaries. About 53 per cent of the beneficiaries earned a net income of more than Rs. 900 per buffalo, while all the non-beneficiaries earned a net income of less than Rs. 900 per buffalo.

In the case of beneficiaries, per buffalo and per day milk production was 738.71 litres and 2.63 litres, while in the case of non-beneficiaries it was 550 litres and 1.99 litres respectively. Further, the proportion of sales to total milk production was about 73 per cent on beneficiary farms, while it was about 65 per cent on non-beneficiary farms. Sales per beneficiary buffalo amounted to Rs. 864, while it was Rs. 568 in the case of non-beneficiary. Thus, it can be concluded that dairy development programme of the SFDA has significantly increased the milk production and net income per buffalo on beneficiary farms.

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ECONOMIC EVALUATION OF AN IRRIGATION PROJECT: A STUDY OF  
THE WEST BANAS PROJECT

A. S. Charan\*\*

The paper deals with the impact of investment in irrigation project on economic efficiency in terms of increase in agricultural production and on the pattern of income distribution in the region. The West Banas Project which is a medium sized irrigation project was selected for case study. The study revealed that the introduction of irrigation in the region helped primarily the agricultural sector through increased stability of agricultural production and through intensity of inputs used resulted in an increase in production. The primary benefit-cost ratio calculated for the year 1968-69 which worked out to 2.70:1 clearly proves the economic feasibility of the project. Besides, the analysis of income data also suggested that the project helped not only to bring more number of people above the poverty line, it also helped in having a relatively even distribution of income in the region. This goes to show that while taking decision or for that matter, making evaluation at *ex ante* and *ex post* levels, these considerations can very well be incorporated in project analysis.

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APPRAISAL AND EVALUATION OF AGRICULTURAL MARKETS REGULATION  
PROGRAMME—A CASE STUDY OF RAJASTHAN

S. S. Acharya and N. L. Agarwal†

The paper aims at presenting the conceptual framework for evaluating the performance of regulation of marketing of agricultural commodities and application of existing methodologies for project evaluation. Both financial feasibility and benefit-cost (B-C) analyses of the programme were attempted. The financial feasibility was determined for the market committees and B-C analysis was carried out from the viewpoint of producer farmers. In all the years (1963-64 to 1976-77) except the first year,

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revenues of market committees exceeded expenditure by a very great margin. By the end of the year 1976-77, the excess of cumulative inflow over outflow was approximately Rs. 10 crores. The programme is financially very sound.

The tangible and measurable benefits were measured in terms of the savings in the cost and/or quantity of produce during the process of marketing by the farmers. In 1967-68, the aggregate saving accrued to the farmers was estimated at Rs. 152.61 lakhs and in 1976-77 it increased to Rs. 3,491.13 lakhs. The intangible benefits accruing to the farmers are better prices, correct weighing of the produce, proper accounting and forum for expression, on the one hand, and amenities in the market, link roads and godowns, on the other. A part of these benefits can be judged by the expenditure of market committees on creation of these facilities.

The cost of the programme borne by the farmers was the market fee paid by them. Up to July 1973, the rate of market fee was 0.20 to 0.31 per cent of the value of the produce which was then revised to one per cent. Till August 1975, it was borne by farmers and since then the farmers are not required to bear any marketing cost including market fee. Thus, of late, the cost to the farmers is zero. The B-C ratio for farmers is, therefore, very high, but only if the unborne cost of marketing is not reflected in the lower selling price for them. In the process of price discovery, the wholesalers or buyers in the market might transfer the burden to the producer seller by lower biddings. In that case, the benefits to the farmers may be eroded to the extent this happens. The programme of market regulation is financially feasible and viable for market committees. On the face of it, it is strongly biased in favour of the farming community. It is a measure of income redistribution but whether it is sustained is yet to be seen. The conventional techniques of project appraisal like internal rate of return and pay-back period cannot be applied as far as the farming community is concerned. These can only be applied to the programmes of creation of market infrastructure in physical terms.

#### ECONOMIC BENEFITS AND COSTS OF LINING OF IRRIGATION CHANNELS IN SEMI-ARID AREA OF RAJASTHAN

R. C. Verma and N. R. Sogani\*

The problem of scarcity of irrigation water in areas like Rajasthan can be solved to a great extent if water lost in the long runs of unlined field channels is saved by lining them with suitable material. However, lining of channels would require investment of considerable amount and farmers would undertake the project only if the benefits accruing from it are greater than the cost incurred upon. This study was taken up specifically to have a benefit-cost analysis of such a project before recommending it to the farmers. The study was conducted in village "Naga-Ki-Dhani" of Sambhar Panchayat Samiti in Jaipur district, Rajasthan. The holdings of the village, which numbered 34, were divided into four size-groups, viz., very small, small, medium and large. Two holdings from each size-group were selected for detailed study. Water losses in the unlined channels were estimated with the help of 'Partial Flumes'. Cost estimates for lining the channels were prepared for cement-concrete mixture. To estimate the benefits accruing from lining of channels following points were considered: (i) increase in income due to increase in the cropped area, (ii) decrease in the irrigation cost, and (iii) decrease in the maintenance cost of the channel. Income from increase in the cropped area, due to saved irrigation water, was worked out by using the 'linear programming' technique.

Benefit-cost ratios were computed to test the profitability of the project. The following model

was used for the purpose: Net B-C ratio =  $\frac{PV_b - PV_c}{PV_k}$

where,  $PV_b$  = present value of benefits or gross returns from the project.

$PV_c$  = present value of annual maintenance cost,

$PV_k$  = present value of capital cost investment.

The results of analysis revealed that on an average 2,422.52 cubic metres of irrigation water in a year was lost in unlined channels. Out of this, about 47 per cent was lost in the main channels and the remaining in the secondary channels. The estimated amount of expenditure on lining of *kutcha* channels (both main and secondary) would vary from Rs. 3,556.80 on very small farm to Rs. 9,174.72 on large farm. In case the farmers decide to line only their main channels the expenditure would reduce by about six times. The estimated expenditure on the maintenance of lined channels would vary from Rs. 100.62 to Rs. 259.55 when all the channels are lined. It would reduce considerably when only the main channels are lined. By lining their *kutcha* channels the farmers would get substantial benefits which include the returns from increase in farm production, decrease in maintenance cost and decrease in irrigation cost. The additional benefits vary from a minimum of Rs. 165.32 on very small farm to a maximum of Rs. 870.48 on large farm. If secondary channels are also lined, the benefits would increase further by two to three times.

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The benefit-cost ratios computed for the lining of main channels are much greater than unity for all the farm situations even at 16 per cent rate of interest. However, the benefit-cost ratios are less than unity at this rate of interest when secondary channels are also lined.

Thus, assuming 16 per cent as the normal rate of interest, it would be profitable for the farmers to line their main channels only. Lining of secondary channels, along with the main channels, would be profitable if funds are made available to the farmers at the subsidised rate of interest.

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### ECONOMIC EVALUATION OF CHAMBAL IRRIGATION PROJECT IN MADHYA PRADESH

J. S. Sisodia\*

The major contribution of any irrigation project comes in the form of direct primary benefits to the cultivators who use irrigation water in the project area. This paper describes the direct primary benefits resulting from the Chambal Irrigation Project in Madhya Pradesh. Since *ex post* evaluation of the project was attempted in this study, it deals with a comparative study of the economy of the command and non-command region. The data for the present paper were obtained from a study of "Bench Mark Socio-Economic Survey of Chambal Command Area" conducted during the year 1977-78. The study covered 216 cultivators (156 cultivators from the command area and 60 cultivators from the non-command area). The analysis of the data suggests the disadvantageous position of the non-command farmers in comparison to farmers in the command area. The extent of land holding and the quality of land possessed, area irrigated and intensity of cropping on non-command farms were inferior to those of command farms. The cropping pattern of non-command farmers was predominantly foodgrains oriented (98.14 per cent), especially cereals oriented (57.90 per cent); that of command farmers struck a better balance between foodgrain and cash crops. The level of technology used, yields per hectare and gross farm output in all the size-groups were significantly higher in the canal irrigated area as compared to that in the non-command area. After meeting the cost of cultivation, which was also comparatively higher, the farmers of the command area had greater net surplus with them. Thus the project has largely helped in increasing agricultural production. On the basis of the above results, direct primary benefit-cost ratio of the project was calculated. The Government investment in Chambal Irrigation Project is justified, as the results indicated a direct benefit of Rs. 2.04 on an investment of one rupee as annual cost. Thus the ratio has proved the economical feasibility of the project.

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### IDENTIFICATION, APPRAISAL AND EVALUATION OF AGRICULTURAL PROJECTS

Sreelekha Basu†

Agriculture plays a vital role in our development process. It has various types of contribution to the general economic growth. An agricultural development plan is an investment programming with specific projects involving investment activities. Identification, appraisal and evaluation of agricultural projects have special features, distinguishing them from projects in other sectors.

Identification of a project (or a bundle of projects) would depend on various factors like creation of fresh potentials, making the best use of existing potentials, keeping track of inter-dependence, linkage and sequence of projects, etc. Once a project is identified, it is mainly appraised on the criteria of increase in national output, employment, savings and foreign exchange earnings. Appraisal of agricultural projects may be 'financial' or 'economical'. Economic appraisal is partially influenced by non-economic (social and political) considerations, where selection of a project is not fully justified on economic efficiency. In economic appraisal attempts are made to identify and quantify secondary benefits accruing from the project, which is a considerable improvement on the criterion of financial appraisal. It also attempts to study the impact of intangible benefits, though these are not strictly monetary. In the economic appraisal of a project 'cost-benefit' technique is generally used where 'costs' relate to goods and services 'spent', and 'benefits' relate to goods and services 'earned'. Estimates of 'costs' and 'benefits' are usually done with the help of a technique known as 'shadow pricing' for the purpose of correcting market evaluation.

Estimation of cost-benefit ratios is a complicated job for agricultural projects, as it is often impossible to associate output in agricultural sector to a particular investment project. Further, in countries like India a large portion of investment in terms of labour (and material) in agriculture is usually undertaken (donated) by farm families and unpaid help, where no wage payment (or any

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expenditure) is involved. This may lead to under-estimation of the cost component. For benefits also there are chances of under-estimation as induced benefits resulting from multiplier effects are difficult to assess.

Studies on cost-benefit ratios are geared to some specific objectives laid down by policy decisions. Cost-benefit ratios can be calculated for more than one objective, provided the weight attached by planners and decision-makers to each one, relative to the other, is precisely defined. However, it is not easy to lay down priorities and it is more difficult to quantify benefits and cost in respect of an objective other than 'economic efficiency'. Economic appraisals may have to undertake the job of educating the decision-makers on the results obtained with the help of various assumptions like maximization of employment generation or maximization of income and asset formation to come first, followed by considerations of their distributional effects.

For developing countries with a lagging agricultural sector, the latest thinking is to make a distinction between the 'productive' part and the 'social' part of agricultural investment. For projects with a 'social' content, new series of integrated socio-economic statistics are necessary not only for formulation and pre-investment appraisal of a project, but also for monitoring and evaluation of the same, to avoid leakage of benefits from the intended recipients to others.

#### APPRAISAL AND EVALUATION OF IRRIGATION PROJECT ON THE SMALL FARMS IN PUNJAB

K. C. Dhawan and A. S. Kahlon\*

This paper makes an attempt to evaluate the benefits and costs of tubewell irrigation on small farms (7.5 acres or less) in the Punjab. This study was conducted in Ferozepur district of the State where irrigation is a major constraint for increasing production. The economic rationale of irrigation project was studied by introducing 5 HP diesel engine in the resource-mix and subsequently by developing optimal production plans by using linear programming technique. Irrigation, land and capital were the major limiting resources in the study area. These resources were identified carefully. Irrigation restrictions were identified by developing various periods when there was a heavy demand for water.

The optimal plans developed with given availability of irrigation resources showed very high marginal value productivity (MVP). Further, the analysis clearly brought out that there existed a greater scope for the small farmers to raise their farm income through investment on irrigation resources which acted as a main constraint for proper utilization of all the other resources. The results indicated that the size of holding was so small that the farmers could not make full use of additional irrigation facilities created by installing a new irrigation project on small farms. However, it generated sufficient income to cover fixed as well as variable costs. To make full use of this resource, either the small farmers should sell surplus irrigation water to their neighbours or if possible, two or more small farmers could own an irrigation project jointly so that the proper use of this resource could be made. Consequently, they can increase their income through a reduction in the fixed cost. Besides, an irrigation project could further be made a more economical proposition provided the small farmers expand their cropped acreage by following multiple cropping schemes. Owned irrigation resource would minimize the risk and uncertainty involved in the process of purchasing irrigation water from outside. Briefly, additional irrigation facilities generated sufficient income, cropped the whole area, created more employment and minimized the risk on small holdings. It made the small farm a viable unit and thus the venture of investment in the tubewells appeared economically worthwhile.

#### FRUIT MARKETING AND PROCESSING PROJECT—A REVIEW OF THE POST-EVALUATION STUDY

C. S. Raghubanshi, A. P. Jain and B. K. Sikka†

Himachal Pradesh Horticultural Produce Marketing and Processing Corporation—'A Government Undertaking' created under an International Agreement with World Bank authorities was initiated in June 1974 for the establishment of modern marketing facilities, namely, grading/packing houses, cold storages and processing plant and transportation network (roads and cableways) to vitalise the apple marketing system in Himachal. However, not much headway in the implementation of the project was made due to technical, financial and managerial problems. For technical reasons, the project is constructing cold storages in producing areas rather than in major urban

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terminal markets. The project has yielded benefit in several ways such as increased value of output, quality improvement, changes in location and time of sale of fruits, greater physical production, changes in form (grading and processing), cost reduction, reduction in transportation, incremental net benefits and income transfers.

The financial analysis revealed a wide divergence between the projected cash inflow, outflow, net cash flow and actual cash outflow, cash inflow and net cash flow. According to the projected cash flows, the project could have earned profits in the first year and second year, but incurred some losses in the third year due to heavy investment costs; thereafter, it was projected to yield profits with interruptions in the thirteenth and fourteenth years where again investment cost was projected to be quite high, resulting in a substantial loss in the fourteenth year. However, the actual cash flows have shown wide divergence right from the first year of the operation of the project. In the first year, the difference between the projected and the actual cash flows was Rs. 2.07 million whereas it was Rs. 1.3 million and Rs. 5.3 million in the second and third year respectively. According to the projected cash flow, the project should have earned Rs. 4.7 million and Rs. 3.5 million as net cash flow in the first and second year and a loss of Rs. 7.3 million in the third year. The divergence between the projected and actual cash flows was due to lack of managerial and administrative expertise and absence of adequate trained and experienced personnel. The chief executive was overburdened as he had to attend to all the technical, administrative and routine matters. Project concept was new to both management and fruit growers as well. The delay in the clearance of the various project components also hampered the progress and adversely affected the performance of the project. The typical climate of the project area was also a hindrance in the performance.

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#### BENEFIT-COST ANALYSIS OF TWO ALTERNATIVE PROJECTS IN AGRICULTURE— A CASE STUDY

S. S. Pal, A. K. Hati, N. K. Roy and S. K. Chowdhury\*

In this paper benefit-cost analysis on deep tubewell (DTW) and shallow tubewells (STW) has been done, using current data relating to Krishnanagar block-I of Nadia district in West Bengal, collected at the farm level as well as official level. The analysis is based on the standard criteria of present value, benefit-cost ratio, internal rate of economic return, pay-back period, annual marginal return and the sensitivity analysis. A Cobb-Douglas production function analysis is also made to assess the marginal productivity of water use by both the categories (DTW and STW water users of farmers). While on the basis of the above criteria, the STW has a clear edge over the DTW, the result of production function analysis is also consistent which reveals that the marginal productivity of water in the case of STW is higher. This points to the state of better management of shallow tubewells. The study suggests that as between the two alternative projects, STW is preferable.

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#### SOME OBSERVATIONS ON THE CHARACTERISTICS OF AGRICULTURAL PROJECTS

M. D. Borkataky and A. K. Neog†

The objectives of this paper are to focus some aspects of the characteristics of agricultural projects. The paper utilizes secondary data (unless stated otherwise) and to that extent it has its own limitations. A project is meant to be a set of economic activities within a defined area, having two aspects, *viz.*, input and output. Agricultural projects have certain distinctive characteristics, which may not necessarily be present in non-agricultural projects. In any project land, labour, capital and entrepreneur are the factors of production which are more or less proportionately used. An agricultural project uses relatively greater proportion of land and labour, but the former is fixed in supply and the latter is abundant in a country like India. The productivity and efficiency of the factors, as used in agricultural projects, suffer from heterogeneity. The labourers are usually unorganized in the agricultural sector. There is a dearth of capital for agricultural projects. The choice of objective for the agricultural projects is to optimize the return to labour and land used rather than to capital. The range of choice of technology is less open to an agricultural project. The process of production is biological for agricultural projects whereas for industrial projects the process is mechanical. As such, an agricultural project may not be in a position to attain its optimum output which may not be the case for an industrial project. Agricultural projects are subject to the law of diminishing returns in the short run as compared to their industrial counterparts. An agricultural project suffers from seasonality of demand for its activities and products. Structural factors like farm size, fragmentation of holdings, etc., disturb the production plan of an agricultural project to a great extent while these are not likely to be counted in other projects. An agricultural project cannot capitalise

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the future like an industrial project because, the estimates of returns are highly conjectural. To get the anticipated return, all agricultural operations need to be properly timed as per net work analysis. Thus risk and uncertainty play more important part in agricultural projects. The degree of multiplicity of products is more in agricultural projects.

The general belief is that agricultural projects like irrigation, etc., have high linkage effects. Hirschman is of the opinion that the "agriculture in general and subsistence agriculture in particular are characterized by the scarcity of linkage effects". Rural electrification is a kind of backward linkage for an irrigation project. An evaluation study of rural electrification conducted in Assam revealed that in 1975-76 about 88 per cent of its power was used for domestic purposes. According to this study, in only three out of ten selected villages, power was used for agricultural purposes and that too, to a negligible extent. Of course, sometimes as the study has mentioned, policies and lack of inter-departmental co-ordination may also restrict linkages. Further an agricultural project cannot automatically produce linkages where production and demand for the input structure are rigid. One forward linkage effect is said to be multiple cropping. With the introduction of lift irrigation facilities in the Mayong area of the Nowgong district in Assam, the *rabi* crops have been replaced by *bodo* (winter paddy) and summer paddy—both the traditional and high-yielding varieties (HYV)—in the command area. Multiple cropping clearly needs more labour per hectare. This is the direct forward linkage effect though the study does not furnish data on employment. It is possible that the increase in employment in agriculture is proportional to the rise in intensity provided capital structure at the micro level does not undergo any major change. The study has disclosed that a section of farmers leased out land presumably due to shortage of family labour in the event of intensification of cropping. Other forward linkage effects were due to the adoption of HYV seeds by the farmers creating demand for seeds, fertilizer, etc. Lateral linkages are noticeable as a number of farmers of the neighbouring villages where irrigation facilities were not available were attracted to the irrigated land and they cultivated land taken on lease. The backward linkage was observed in the high demand for power. The project has yielded direct output effect as the average yield per hectare has increased from 15.6 quintals in 1967-68 to 21.3 quintals in 1968-69. The demand for storage processing and marketing facilities was high.

The generation of income by agricultural projects increases the income elasticity of demand in a country like ours. Hence such projects may not create durable assets unless additional income is sizeable. A study of the impact of Small Farmers' Development Agency/Marginal Farmers and Agricultural Labourers' development programmes in Nowgong district indicated that there was no material increase in farm assets except land. It revealed that actually farm assets have been on the wane. From a study conducted by the authors themselves, in the area covered by the Mayong Lift Irrigation Project, it is found that an agricultural project may perhaps tend to bring about equitable distribution of income in the short run to some extent as compared to its other counterparts. Agricultural projects are initiated amidst such socio-economic conditions wherein they are to work under different socio-economic constraints. The linkage effects are found to be less prominent and effective in the case of agricultural projects.

## INVESTMENT DECISIONS IN COFFEE PLANTATIONS

R. Umakesan and V. Rajagopalan\*

Maximizing present value of net benefit is a simple decision rule for investment in a static context. But this rule would prove to be inadequate, once dynamic aspect enters the decision process. Then the question of optimum timing of investment also assumes importance. Analyses of optimal timing of investment projects normally involve two basic assumptions: the benefits are independent of the age of the project and there is no time lag in production. Both these assumptions are not valid for projects involving perennial crops in which case the benefits depend on the age structure of the crops. A strategy of staggering initial planting and judicious replanting appears to pay rich dividend by way of higher present value of net benefit and smaller variance in annual flow of income stream. This strategy is put to test in studying decision behaviour of coffee planters in South India. The specific objectives were to determine the optimum area to be replanted every year and the optimum time (age of the crop) for replacement. The study covered a simple random sample of 247 coffee planters in South India and evaluated their decision behaviour with the aid of net present value of benefit (NPV) and the internal rate of return (IRR). The NPV indicated that the initial cost of establishment of coffee crop could be fully paid out in a period of 14 years. The IRR was 18.42 per cent and higher than the market rate of interest of 12.5 per cent. Therefore, investment in coffee production was an economically viable investment project.

Through an iterative process the impact of replanting a hectare of crop for every 4, 5, 6, 7 and 8 hectares of total area was evaluated. It was shown that keeping, at any time, 83.3 per cent of

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the crop in bearing would bring maximum net returns. It implied that, given a four-year gestation, replacement of 3.34 per cent of crop area annually was optimal. A comparison of amortized present value of the returns with marginal net revenue indicated that replanting had to commence from the nineteenth year of the crop. Therefore, choosing the oldest of the plants that are older than 18 years and replanting every year 3.34 per cent of the total crop area was found to be an optimal production strategy for the coffee planters.

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AGRICULTURAL PRODUCTION PROGRAMMES—AN EXAMINATION  
OF EXTENSION SERVICES (TUMKUR DISTRICT,  
KARNATAKA)

V. S. Satyapriya\*

The role of agricultural extension education in the success of the various agricultural production programmes needs no emphasis. This calls for a closer examination of the existing system of extension education and its impact. The present paper makes an attempt at understanding this aspect of the programme. The study is based on a random sample of 232 villages from Tumkur district, Karnataka. The basic data are collected from the records of the agricultural assistants (village level workers) and covers roughly the period 1970-71 to 1976-77. The organizational structure for implementing the agricultural production programmes is examined first. This is followed by an analysis of the extent of extension work mainly in terms of number of block demonstrations and mini-kit trials conducted, number of villages covered and the extent of soil survey work carried out in the sample villages. This is followed by an examination of the impact of these activities in terms of the area covered under high-yielding variety (HYV) and improved variety of crops.

The various agricultural production programmes are intended to popularise the cultivation of HYV and improved variety of crops. The area to be covered under the agricultural production programme is determined by the Deputy Director of Agriculture at the district level. The targetted area under each crop is allocated to different blocks in accordance with the local conditions. These programmes are to see their success at the hands of the Agricultural Assistants (AAs), who operate under the direction of the Agricultural Extension Officers (AEOs) at the block level. The average number of AAs under each AEO was 6, and each AEO was in charge of 98 villages on an average. The average number of villages per AA was 16 (which varied from 11 to 30 between taluks) and the number of potential adopters for each AA was a little over 2,000.

Coming to the block demonstrations and mini-kit trials conducted in the sample villages, it was brought out that during the seven years 1970-71 to 1976-77, block demonstrations were conducted in nine villages and mini-kit trials in 44 villages. If the villages where both block demonstrations and mini-kit trials were conducted, though at different points of time, are counted once only, then the actual number of villages exposed to such demonstrations was only 48. This is out of a sample of 232 villages and over a period of seven years.

Proper knowledge of soil is essential for the cultivation of any crop and more so in the cultivation of HYV and improved variety of crops. The area covered under the soil survey programme for the seven-year period was less than one-fourth of the net cropped area in these villages.

The impact of the extension activity was brought out by an examination of the level of adoption of HYV and improved variety of crops. The level of adoption, *i.e.*, the area under HYV/improved variety as a proportion of gross cropped area, increased from about 13 per cent in 1970-71 to 16 per cent in 1975-76. *Ragi* and paddy were the major HYV crops sharing around three-fourths of the area under HYV/improved variety of crops. While the area under HYV crops increased by over 40 per cent between 1970-71 and 1975-76, the area under paddy showed the maximum increase of 73 per cent. Even after a decade of introduction of HYV crops on a large scale, the area covered under HYV and improved variety of crops was a little over 13 per cent in the district under study. For the State as a whole, this proportion was about 15 per cent. The low adoption calls for (a) identification of the factors limiting the adoption and (b) measures to overcome these impediments. One factor—a major one—limiting the adoption of new technology in crop production brought out by the study is the sporadicity of the extension education programmes and amply demonstrated by the low frequency of demonstrations and the meagre staff burdened with the responsibility of carrying out the extension work. Further, there appears to be no sufficient emphasis on extension education as it was revealed that it has been possible to contact only one-third of the cultivators, as far as the adoption of new technology in crop production is concerned. Adoption of new technology in crop production as the only possible solution for encouraging agricultural production needs no special emphasis, as the other avenues open for increasing agricultural production are very much limited, if they are not already fully exploited. Thus if programmes aiming at improving agricultural production have to yield the desired results, it is imperative that extension education is made an integral part of all such programmes.

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## NATIONAL SEEDS PROGRAMME—AN APPRAISAL

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The introduction of new seed varieties from the early sixties was one of the main catalysts for the rapid expansion of foodgrain production that occurred in the country during the last one decade. In the ten-year period ending 1971-72, the foodgrain production grew at 3.6 per cent per annum of which 2.8 per cent was attributable to rising productivity. As a sequel to the recommendations of the Seed Review Team (1968), National Commission on Agriculture (1971), a Joint Working Party constituted by Government of India in early 1975 had submitted a National Seeds Programme (NSP) in September 1975 which came into operation in early 1976. The NSP aims to develop a broad-based decentralised network of seed production agencies throughout the country, capable of meeting the requirements of different quantities of certified seeds for the planned agricultural development in coming years. The erstwhile functions of production, certification, processing, quality control and marketing carried out by a single central agency, *viz.*, the National Seeds Corporation (NSC) have been decentralised to a large extent. In pursuance of this programme, State Seed Corporations (SSCs) were established in 1976 with World Bank assistance in the States of Andhra Pradesh, Maharashtra, Haryana and Punjab under Phase-I. The States of Rajasthan, Uttar Pradesh, Bihar, Orissa and Karnataka are in line to set up SSCs in their respective States shortly.

The first phase SSCs have completed two years of operation (1976-77 and 1977-78) under the scheme. The NSC as a chief co-ordinator of the programme has experienced severe jolts in achieving its sales targets and sales operations have decreased by 37.68 per cent in first year, *i.e.*, 1976-77 as compared to 1975-76, the pre-NSP year. Production, processing, marketing activities have shown downward trend at an alarming rate. Therefore, the targets and achievements made during the two years under production, processing, marketing, employment aspects were critically examined and the following conclusions have emerged out of the study: (i) The SSCs may have to confine the production of certified seeds to project areas and keep the enthusiasm of shareholder growers by paying attractive procurement price. The agencies involved in the multiplication of breeder, foundation and certified seeds should adhere to the discipline and produce seeds conforming to the prescribed standards. (ii) The SSCs may give top priority in the setting up of required number of processing plants close to the production centres. (iii) The NSC and SSCs should meet the total demand by playing effective role in inter- and intra-State marketing by achieving economies in scale and by reducing final sale price of seed so as to attract many small and marginal farmers to go in for certified seeds. (iv) The SSCs may have to extend their wholehearted co-operation in absorbing the technical and non-technical staff of the NSC rendered surplus due to implementation of NSP. Non-utilization of experienced staff results in set-back in achieving production and marketing targets of new SSCs, on the one hand, and impose financial burden on NSC in its limited post-NSP functions.

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 EVALUATION OF THE IMPACT OF FARM MANAGEMENT TRAINING PROJECT  
 OVER AGRICULTURAL PERFORMANCE OF THE FARMERS

Radhey Shyam, D. K. Singh, B. K. Mishra and R. A. G. Mahuley\*

Mere inventions of and increase in modern techniques of agriculture do not warrant rapid growth of agriculture. Unless the farmers are trained in respect of the correct use of modern technology of farming, no fruitful result can be obtained on the agricultural front. Realising the importance of broadcasting technical know-how at the grass-root-level, a training programme for the farmers was organized during 1975-76, 1976-77 and 1977-78 in Phulpur block of Allahabad district in Uttar Pradesh with the collaboration of a team of experts from International Labour Organisation. At the first instance, 40 farmers from 20 villages (two from each village) were included in the training programme. The main objectives of the programme were to train the farmers in respect of (a) modern practices of agriculture, (b) storage and marketing of agricultural produce and (c) to train them to carry out their farm business on commercial lines. The important items included in the training programme were (i) preparation of field for sowing, (ii) correct use of fertilizers at basal dressing and top dressing in various high-yielding variety crops, (iii) pre-assessment of crop disease and remedial steps for their removal, (iv) cropping scheme and crop rotation and time and frequency of irrigation and (v) inter-culture and harvesting and storage and marketing facilities. The training programmes were organized on the fields of farmers through demonstration process by experts and personnel engaged under the programme. Packets of fertilizers and modern seeds were distributed for demonstration to the farmers. The trainee farmers were also guided in respect of sources from which they could obtain fertilizer stocks, new varieties of seed, tools, implements, and credit facilities. In a way the said training programme was finance-cum-training programme. The data were

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collected for the years 1975-76, 1976-77 and 1977-78 with 1975-76 as base year. For evaluating the impact of training, a 'before and after' method has been adopted in the paper.

The survey data revealed that having been benefited by the training, the farmers had made a dent into their traditional way of cultivation. The farmers had changed their cropping scheme on commercial lines. The crops which were more remunerative in a commercial sense attracted more and more area in the subsequent years. The utilization of land in the slack period had increased the cropping intensity from 209 to 218 per cent. The technique of correct use of fertilizers and timely application of irrigation as learnt by the farmers during the training had enhanced the productivity of various crops. The per hectare yield of paddy increased from 16 quintals in 1975-76 to 29 quintals in 1977-78. By carrying out cultivation on the guided lines, the farmers increased the yield of potato from 125 quintals per hectare to as high as 198 quintals over the same period. The impact of the said training is discernible from the increase in net income over the period of three years. The farmers obtained an overall net income of Rs. 1,745 per hectare. Potato crop appeared to be the most remunerative crop. The net income of the trainee farmers from potato cultivation increased from Rs. 2,934 per hectare to Rs. 7,492 over the period of three years. The net income from paddy and wheat witnessed an increase from Rs. 603 to Rs. 982 and from Rs. 659 to Rs. 1,815 respectively over the period. Apart from the increase in fertility by application of green manuring, the growing of *moong* resulted in an increase in net income from Rs. 418 to Rs. 1,150. The findings of this paper highlighted the fact that the integrated approach to cultivation practices has a positive impact on the overall farm economy. The drawbacks as noted in the implementation of the said programme must necessarily be removed if such an integrated approach to agriculture carried on an experimental basis is applied on a large scale.

#### THE EFFECTS OF INTER-REGIONAL TRADE AND MARKET INFRASTRUCTURE ON AGGREGATE PRODUCTIVITY OF AGRICULTURE

M. von Oppen\*

This paper presents several methods which may be used to quantify the impact of agricultural markets and market flows on aggregate productivity. By means of an inter-regional trade model based on quadratic programming it is demonstrated how restrictions in the trade flows between States in India influence cropping patterns and reduce productivity. As improved technologies intensify the differences in comparative advantages among regions, trade restrictions tend to have an increasingly depressing effect on productivity of the aggregate of all regions. In another approach, a generalized least squares regression model is applied to explain the variability—Statewise over 15 years—of foodgrain yields as a function of inputs and rainfall and of the degree to which foodgrain was allowed to be traded among States. The results of both approaches are comparable and of the same order of magnitude; they show that (institutional) investments which lead to free flow of foodgrains across State boundaries are yielding returns in terms of increases in aggregate productivity with a lag of about two years.

A mechanism that operates at the State level should also be effective at the local or district level. This was tested on time-series data for districts of Andhra Pradesh and revealed that farmers' access to markets (density of regulated market places) has a significant effect—with a lag of only one year—on aggregate productivity, net of effects of other inputs and rainfall. Addition of surfaced roads, however, seemed to have no impact on productivity; instead, roads appear to be following wherever production increases most.

Measurement of the inherently productive nature of marketing and exchange in agriculture (net of other factors) suggests that considerable pay-offs would accrue from investments in institutional and physical infrastructure that will improve market efficiency.

#### DISECONOMIES AND INSTITUTIONAL CONSTRAINTS IN LAND AUGMENTATION PROJECTS AND THEIR LESSONS FOR PROJECT EVALUATION: THE KUTTANAD EXPERIENCE

K. P. Kannan\*

This paper makes an attempt to examine and analyse the nature of externalities, most of which are diseconomies, of various development projects implemented in a densely inhabited and intensely exploited water-logged region in Kerala. The analysis is sought to be carried out within the institutional constraints which seem to have contributed to the creation of a situation in which the econo-

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mically and politically weaker sections of the inhabitants have been more adversely affected than the rest. With the main objective of intensifying paddy cultivation in Kuttanad, a water-logged region, three projects were conceived and implemented. These three projects, a Spillway at Thottappally, a Regulator at Thanneermukkom and construction of permanent submersible outer bunds, were meant to check the floods during monsoon and the incursion of saline water during summer. Technical flaws in design and location and the difficulties in constructing the approach channel to the required specifications have effectively reduced the utility of the Spillway in controlling flood. The operation of the Regulator, though incomplete, gave rise to a number of adverse ecological and income distributional effects without, at the same time, enabling the intensification of paddy cultivation. Experience has shown that the intensification of paddy cultivation, given its relatively higher cost, is more a function of the paddy prices than the control of saline water incursion. The third project, namely, the construction of permanent bunds, has been extremely slow in its implementation because of its high cost which has coincided with a period of relative decline in the prices of paddy.

A number of factors have contributed to such a state of affairs. The design and execution of projects have been treated purely within the domain of technical experts and, therefore, resulted in the exclusion of non-technical parameters. However, the selection of such projects had a clear bias in favour of the dominant interest group in the region, namely, the farmers. Single-minded attention was given to the intensification of paddy cultivation. The projects executed for such intensification of paddy cultivation was never viewed in terms of their likely impact on other groups in the region, *viz.*, fishermen, lime-shell collectors or even from the point of view of their likely effect on the ecology of the region. Only when the ecological effects began to adversely affect all the sections of the population including the farmers and the projects proved to be complete failures, and the additional cultivation of paddy became no more profitable, were these widespread apprehensions awakened about the efficacy of the projects executed and those under execution.

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