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DISTRICTWISE RETURN TO INVESTMENT IN AGRICULTURAL EXTENSION IN HARYANA

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Few attempts seem to have been made to work out the return to agricultural extension investment in general and under different agro-climatic regions in particular, which accounts for a major share of the annual budget of the agricultural sector. More specifically, the main objectives of this study are (*i*) to examine the allocation pattern of agricultural extension investment, (*ii*) to study the resource poroductivity, and (*iii*) to find out the regional variations in the marginal value productivity of agricultural extension investment.

METHODOLOGY

The present study relates to the old Hissar, Rohtak, Karnal, Ambala, Jind, Gurgaon and Mohindergarh districts of Haryana State and is based on the secondary data collected from published and unpublished sources. The Haryana State is divided into three agro-climatic regions. Districts Hissar, Gurgaon and Mohindergarh form the semi-arid region of the State whereas district Karnal falls under the assured irrigated region having more than 70 per cent of the total cropped area irrigated. Ambala district represents the rainfed agriculture of the State. Rohtak and Jind districts which do not fall completely in any one of the three regions have been dropped in regional discussion.

The data regarding gross area irrigated, total cropped area, consumption of fertilizers (nutrients) as well as agricultural production were obtained from the Statistical Abstract of Haryana for the period 1970-71 to 1978-79. The data on agricultural extension investment were collected from the Office of the Director of Agriculture, Haryana, Chandigarh. The total agricultural production was worked out giving due weights to the different groups of agricultural commodities and the weights used for different groups of agricultural commodities were taken from the Statistical Abstract of Haryana.

To estimate the relative contribution of the input variables to agricultural productivity, both linear and log linear equations, using all the five variables were fitted to the data for each of the seven districts individually. Using the usual criteria of consistency in sign, significance of regression coefficients and closeness of fit of the model, the linear model was used to arrive at the final regression functions. It was observed that the log linear form was not appropriate for depicting the relationship between the dependent and independent variables (see the Appendix). In final, regression equation of the following form was fitted:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3$$

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where

Y = total agricultural production in thousand tonnes,
a = constant,
x_1 = agricultural extension investment in rupees,
x_2 = fertilizer consumption in tonnes (nutrients),
x_3 = Gross area irrigated in thousand hectares.

To work out the return per rupee of agricultural extension investment for different districts, the marginal value productivity was worked out in physical term in the absence of an appropriate price series for agricultural production as a whole. Further, 't' test was used to test the significance of the regression coefficients.

RESULTS AND DISCUSSION

Agricultural Extension Investment Allocation

Table I presents the data of average agricultural extension investment, fertilizer consumption and irrigated area per hectare of total cropped area for different districts of Haryana State. The table reveals very low extension investment. Agricultural extension investment per hectare was the highest in Karnal district, being Rs. 8.48 followed by district Gurgaon, Rs. 7.36. Hissar district stands third having Rs. 6.90 per hectare of agricultural extension investment. It was the lowest, *i.e.*, Rs. 2 for Jind district whereas it was Rs. 3.50, Rs. 3.64 and Rs. 4.58 for Rohtak, Ambala and Mohindergarh districts, respectively. The average agricultural extension investment for the State as a whole was Rs. 5.21. In the case of per hectare fertilizer consumption too Karnal stands first consuming 44.25 kg. per hectare. Ambala stands second consuming 35.63 kg. per hectare. Mohindergarh comes at the bottom using only 6.57 kg. per hectare. Hissar, Rohtak, Gurgaon and Jind districts used 12.36, 11.91, 11.69 and 10.52 kg. per hectare, respectively. A similar trend was observed for area irrigated per hectare as a proportion of total cropped area except for Ambala district. District Ambala needs less irrigation as it receives nearly 1,000 mm. of average annual rainfall. This districtwise variation in agricultural extension investment if viewed in the

TABLE I—MEAN AGRICULTURAL EXTENSION INVESTMENT, FERTILIZER CONSUMPTION AND IRRIGATED AREA PER HECTARE OF CROPPED AREA

District	Agricultural extension investment (Rs./hectare)	Fertilizer consumption (kg.)	Area irrigated (hectare)
Hissar	6·90	12·36	0·54
Rohtak	3·50	11·91	0·47
Karnal	8·48	44·25	0·76
Ambala	3·64	35·63	0·31
Jind	2·00	10·52	0·67
Gurgaon	7·36	11·69	0·33
Mohindergarh	4·58	6·57	0·16
State	5·21	17·41	0·49

context of negligible agricultural extension investment as a whole shows the magnitude of the variation in agricultural extension investment under different agro-climatic regions of the State. District Karnal having assured irrigation facilities receiving an annual average rainfall of nearly 750 mm. has used a major share of the total agricultural extension investment. On the other hand, the districts belonging to the drought-prone region of the State got a very small share of the total State agricultural extension investment.

Estimation of Relative Contribution of the Input Variables

It can be seen from Table II that the area irrigated made the greatest contribution to the dependent variable except for the districts of Ambala and Mohindergarh. The plausible reason for these two exceptions may be the higher average annual rainfall for Ambala and a negligible proportion of irrigated area to the total cropped area in Mohindergarh district. The contribution of agricultural extension investment was placed second except for Karnal where fertilizer consumption was placed second. The regression coefficients for irrigation for Hissar, Rohtak, Karnal, Jind and Gurgaon were significant at 5 per cent level of significance. The cofficients for Ambala and Mohindergarh districts were non-significant. The regression coefficients for fertilizer consumption were significant for only Karnal and Ambala districts at 5 per cent level of significance. In the case of agricultural extension investment the regression coefficient for each district was positive but non-significant. The values of R^2 were quite high. In none of the cases it was less than 0.89, the model explaining more than 89 per cent of the variation in the dependent variable in each of the districts.

TABLE II—FINAL RUN LINEAR FUNCTIONS

District	Constant (a)	Regression coefficients			R^2
		Agricultural extension investment $x_1(b_1)$	Fertilizer consumption $x_2(b_2)$	Gross area irrigated $x_3(b_3)$	
Hissar	5·0993	0·0240	0·0077	0·5550*	0·9870
		(0·0670)	(0·0376)	(0·2158)	
Rohtak	6·4235	0·0091	0·0069	1·5856*	0·9626
		(0·0153)	(0·0448)	(0·7221)	
Karnal	10·3823	0·0096	0·1143*	1·1594*	0·9884
		(0·0424)	(0·0280)	(0·4864)	
Ambala	6·5729	0·1877	0·1113*	0·0003	0·8954
		(0·1878)	(0·0172)	(0·0312)	
Jind	6·1632	0·0662	0·0494	0·2426*	0·9841
		(0·0971)	(0·0963)	(0·0542)	
Gurgaon	6·1288	0·0239	0·0051	1·6807*	0·9833
		(0·0727)	(0·0276)	(0·2174)	
Mohindergarh ..	6·1979	0·1015	0·0326	0·0051	0·9868
		(0·1480)	(0·0808)	(0·0074)	

* Significant at 5 per cent level of significance.
Figures in parentheses indicate standard errors.

The non-significance of the regression coefficients for fertilizer consumption is well in accordance with the findings that the so-called green revolution is limited only to a few crops like wheat and rice. This finding is further reconfirmed with the finding of average fertilizer consumption per hectare of total cropped area (see Table I). The regression coefficient for agricultural extension investment is no doubt non-significant, but it stands second in order of the contribution of independent variables to the dependent variable. Its contribution to the dependent variable confirms its importance in total agricultural production. The non-significance of regression coefficients may be because of the negligible per hectare agricultural extension investment which ranged from Rs. 2 to Rs. 8.48 in different districts of the State. This small per hectare agricultural extension investment indicates that this variable is operating somewhere in the first stage of production, and the contribution of this input variable to the dependent variable suggests intensive use of this variable.

Marginal Value Productivity of Agricultural Extension Investment

In economic analysis it is customary not to work out the marginal value productivity (MVP) of the non-significant regression coefficients. In the present analysis, since the contribution of this variable to the dependent variable stands second, its MVP was worked out. The MVP of agricultural extension investment was highest in Ambala district, being 9.35 kg. /rupee followed by district Mohindergarh (6.76 kg./rupee). The MVPs of agricultural extension investment for the districts of Hissar, Gurgaon, Jind, Karnal and Rohtak were 2.93, 2.59, 1.94, 0.71 and 0.45 kg. /rupee, respectively. According to the agro-climatic regions represented by different districts, the return to agricultural extension investment was highest in the rainfed region (Ambala district) having the least per hectare agricultural extension investment followed by the drought-prone region (Mohindergarh, Hissar and Guragon districts) standing second in per hectare agricultural extension investment. It was lowest for the assured irrigated region (Karnal district). At this stage when the all round agricultural extension investment is negligible no reallocation of existing allocation could be suggested. Looking to the comparative low existing allocation and high return in drought-prone and rainfed regions, these areas may be favoured in future agricultural extension allocations.

CONCLUSION

Though the average agricultural extension investment ranged from Rs. 2 to Rs. 8.48 per hectare of total cropped area in different districts, its contribution to the total agricultural production stands second. The contribution of irrigation to the total agricultural production was highest in general. The marginal productivity of agricultural extension investment was positive in each of the districts. Based on agro-climatic regions, the return per rupee of agricultural extension investment was higher in the rainfed (Ambala district) and drought-prone (Mohindergarh, Hissar and Gurgaon districts) regions as compared to the assured irrigated region (Karnal district)

of the State. The contribution of fertilizer to the total agricultural production stands third in all the districts except for Karnal where it stands second.

APPENDIX

LOG LINEAR FUNCTIONS

District	Constant (a)	Regression coefficients				R^2
		Agricultural extension investment $x_1(b_1)$	Fertilizer consumption $x_2(b_2)$	Gross area irrigated $x_3(b_3)$	Total cropped area $x_4(b_4)$	
Hissar	1·0007	0·2027	0·2895	0·6862	—0·3522	0·9095
		(0·3211)	(0·2854)	(1·5502)	(0·0025)	
Rohtak	0·1894	0·1298	0·1569	0·9389	0·0025	0·9489
		(0·3160)	(0·4454)	(0·6708)	(0·0367)	
Karnal	0·1197	0·2551	0·1698	4·5912	4·3692	0·9998
		(0·1938)	(0·1265)	(2·8954)	(2·5295)	
Ambala	1·0000	0·0235	—0·2502	0·7440	0·4576	0·8895
		(0·2867)	(0·4677)	(0·9665)	(0·5319)	
Jind	562·3400	0·0478	—0·4641	—0·2032	—0·0946	0·9998
		(0·1103)	(0·1103)	(0·0960)	(0·1477)	
Gurgaon	18·5730	0·7304	—0·0064	0·0230	—0·4952	0·9882
		(0·1519)	(0·0509)	(0·0505)	(0·3580)	
Mohindergarh ..	1·0012	1·5582	0·3328	—2·0938	0·0009	0·8302
		(3·4103)	(0·4305)	(3·4531)	(0·0021)	

Figures in parentheses indicate standard errors.

RETURNS FROM INVESTMENT IN EXTENSION SERVICE IN AGRICULTURE

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Genesis of Extension Services

Soon after Independence the country realised the need of increasing agricultural production with a view to mobilizing farm and rural industrial resources for economic development. This necessitated the establishment of a permanent administrative set-up for rural reconstruction. Several measures were undertaken, here and there, for bringing about quick increases in agricultural and industrial production, but only a few could succeed for one reason or the other. Later this led to the emergence of a nation-wide Community Development (CD) Programme and National Extension Service (NES) encompassing the whole country into its realm of activities in agriculture, animal husbandry and rural welfare. A three-tier administrative structure at district, block and village level took shape in all the States in which administrative control rested at district and technical expertise at the block level. A field level

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