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programming analysis, because, as many workers have shown, the optimum solution is not altered even if the factor-product prices change within reasonable margins and the price ratio remains almost the same.

SUMMARY

Budgeting and linear programming are both useful tools of farm management analysis. Depending upon the objective in view, one or the other may be used. Where the choice is to be made between many alternatives and high accuracy is needed, linear programming may be preferred. The computational procedure involved in linear programming provides guides that enable even a less skilled worker to reach an optimum solution. Linear programming is, therefore, a useful tool of farm management analysis even in under-developed countries.

MANAGEMENT AS A FACTOR IN FARM BUDGETING AND PROGRAMMING

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In a number of studies relating to the reorganization of farming systems through the use of budgeting and programming procedures, management has not been specifically recognized as an input factor; nor have reasonable adjustments been made in the enterprise budgets to indirectly take into account the varying levels of managerial ability. This applies not only to India and similar other countries with a short history of farm management investigations, but also to countries like the United States where farm management studies have recorded impressive gains over the past two decades. Until a few years back the chief contribution of American farm management research workers was limited to the furnishing of information of a technological nature in a *combined* farm, alongwith, in some cases, tentative forecasts of demand and supply situation and expected prices of inputs and output. "Farm Management research workers and teachers did not develop a systematic concept of management, define its tasks, nor develop a set of managerial principles. Their contribution was one of helping managers solve problems, not by making the problem-solving processes employed by managers more effective, but by furnishing data and information to managers. Historically, the data and information furnished to farmers by farm management men have tended to be rather technological, mainly from the fields of agronomy and animal husbandry."¹

Yet, it is not the agricultural sector of the economy alone that is characterized by a delayed and still incomplete realization of the value of the human agent

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1. Glenn L. Johnson, *Managerial Concepts for Agriculturists*, Bulletin No. 619, Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, 1954, p. 23.

in managing production processes. In the fields of industry and business also, management is a recent development as a science and art. The difficulties that have come in the way of the advancement of scientific business management are the same as are attendant upon the discovery and acceptance of new ideas in general.² These difficulties have greatly hindered the advance of management principles in the field of agriculture. Tangible aid to increased production, e.g., improved strains of seeds or chemical fertilizers have met with instantaneous appreciation and ready acceptance on the part of discriminating farmers, and extension personnel have laid stress on the adoption of these by the large body of farming population. The farm management approach is not easily understood by the farmers. In India, farm planning and management as an operational programme has received emphasis only recently; policy-makers, administrators and scientific and extension personnel are also, therefore, not uniformly well-informed about the meaning, scope and procedures for the formulation of farm plans. The even greater lack of appreciation of the management principles as a key factor in farm budgeting and programming should not, therefore, come as a surprise.

Of late, management problems in agriculture have rightly been the subject of attention on the part of research workers and teachers of agricultural economics. Of course, farm management has still to find its rightful place and be the focus of attention of a large number of painstaking research workers and extension people; the value of such concentrated endeavours can hardly be over-emphasized in the context of the over-present need for increasing the volume of production and for reorganizing the agricultural set-up with a view to gearing agricultural economy to the needs of rapid economic process.

In order to grapple with the basic problems in farm management, some work has been done on the concepts and the issues involved in decision-making processes in agriculture.³ An American Inter-State Managerial Study has thrown valuable light on the various facets of the problem.⁴

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2. According to L. F. Urwick, a well-known authority on business management: "Any new branch of human knowledge encounters two major difficulties. First, it is disturbing to human complacency. Novelties in thinking are disturbing, particularly in old and established societies. While in material things man is quick to seize on fresh concepts, devices which may make for his comfort and advantage, it is otherwise when he is dealing with ideas. A new gadget, a novel machine, is something he can see and touch and especially when it is new, often smell. It challenges his sensory perceptions and excites his curiosity. He can explore it with his eyes and fingers. To be sure, he can only learn to understand it by an intellectual process by setting his wits to work. But the difficult act of thinking is detonated and stimulated by these sensory experiences. With a novelty in thinking, one which moves purely in the intellectual sphere, he not only lacks this sensory self starter. If the new idea affects his folkways, his normal pattern of thought about his behaviour toward and his relations with other people, he has also to overcome an obstacle." *The Pattern of Management*, Sir Issac Pitman & Sons, Ltd., London, 1956, pp. 3-4.
 3. Glenn L. Johnson, *Op. cit.*, Also see Glenn Johnson and Cecil B. Haver, *Decision-Making Principles in Farm Management*, Bulletin No. 593, Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, 1953.
 4. See, for example, "Progress and Problems in Decision-Making" (Seven Articles on Managerial Problems), Reprinted from *Journal of Farm Economics*, 1955 and 1956.

II

A recent study in the United States emphasized the role of management and sought to focus attention on the role of management factor in increasing farm earnings.⁵ It also indicated that, if resource adjustment studies of typical farm situations are to be used to estimate aggregate adjustments or to make action recommendations to farmers, the management input should be included as an explicit restriction. The relevant findings are briefly presented here in the hope that these would be of interest to farm management workers in India and to others interested in the subject.

A relatively poorer county, inhabited by low income receiving farm families⁶ was selected as the locale for investigations; among other things, the choice was dictated by the magnitude of the usefulness of the study as a problem solving exercise. Eleven farms were selected in the county with a view to determining for typical farms as to what kind of adjustments in resources and in resource use will maximize farm incomes. Following this an examination was made of the problems likely to be encountered in making the recommended changes in order to suggest ways and means of overcoming the principal obstacles to change. The analysis for determining the combinations of enterprises and the level of each individual enterprise in order to maximize incomes for given resource situations was carried out through the use of linear programming procedures; some improvements were effected in the conventional procedure to permit appraisal of a larger number of active processes.⁷ In addition to obtaining reasonable representativeness of physical characteristics, an effort was made to achieve some representativeness in the differences in the quality of the human element in farming, viz., differences in management ability, in attitudes toward improved practices and willingness to change. Several types of farmers were chosen—those who were moderately progressive and also those who were not very enthusiastic about proposed changes. Some of the selected farmers were poorer than average managers while some did a good or excellent job of managing their farms. Table 1 shows the management level for each enterprise considered, as well as the overall management ability for the selected farm operators. The management ability of the farmer was judged on the basis of the quantity of output he is getting per unit of inputs for certain key enterprises. The type of inputs, their quality and quantity, as well as the attitude of the operator towards improved practices, were examined and used to classify the selected farms into four management classes. All the selected operators were contacted personally for this purpose as no census data are designed to give facts regarding the abilities and attitudes of farmers. Even where the distribution of farms according to the various characteristics associated with the level of managerial ability is available, how these different characteristics combine for individual farms or for specific groups of farms is not available.

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5. See H. S. Singh, "Evaluation of Alternative Income Opportunities for Farm Operators in Macon County, North Carolina" unpublished Ph.D. thesis submitted to the University of North Carolina, 1958 and also, L. R. Martin, A. J. Coutu, and H. S. Singh, "The Effects of Different Levels of Management and Capital on the Incomes of Small Farmers in the South", *Journal of Farm Economics*, Vol. XLII, No. 1, February, 1960.
 6. Modal size of the farm—only 10 to 29 acres.
 7. For details see, A. J. Coutu, L. R. Martin, and H. S. Singh, "Note on the Use of Transfer Procedures in Linear Programming," *Journal of Farm Economics*, Vol. XLI, No. 3, August, 1959.

TABLE I—MANAGEMENT LEVEL OF THE SELECTED FARM OPERATORS FOR EACH ENTERPRISE CONSIDERED,* AS WELL AS THE OVERALL MANAGEMENT LEVEL**

Enterprise	Farms, and the Overall Management Level of the Operator										
	1	2	3	4	5	6	7	8	9	10	11
	Good	Fair	Excel- lent	Fair	Fair	Excel- lent	Medi- um	Good	Good	Medi- um	Good
Alfalfa	G	G	G	G	G	G	G	G		G	G
Forestry and Christmas trees									G		
Bottomland corn for grain	G	F	G	F		G	F	G	G	F	G
Upland corn for grain	G	F	G	F	F	G	F	G	G	F	G
Sweet corn											
Pickling cucumbers											
Potatoes		F		F	F	G	F	G		F	G
Tomatoes						G					G
Snapbeans		F		F	F	G					G
Peppers	G	F		F	F	G	F	G		F	G
Cabbage		F							G		G
Raspberries											G
Strawberries		F	G	F	F	G	F	G		F	
Aromatic tobacco		G									
Burley tobacco											
Brood sow	F	F	E	F			G		G	F	G
Feeder Pigs	G	F	E	F			G		G	F	G
Brood cow for veal calves	G	F	G	F	F	E	F	G	G		
Feeder calf		G			G	G					
Dairy heifer											
Grade A dairy herd								G			
Grade C dairy herd	G			F			F			G	G
Beef herd									G	G	
Beef herd and sheep			G		F		F	G	G		
Bees				G			G				
Hatching eggs	G	C	G	C	C	G	C	G		C	
Commercial layers	G	F	G	F	F	G	F	G		F	
Broilers†					C						

* The enterprises shown in italics appeared in at least one optimum plan for that farm.

E means excellent; G, good; F, fair; and C, on contract. The enterprises on contract correspond to the fair level of management.

** Ranking of the management level of the operator from low to high is: fair, medium, good and excellent.

† Four broods annually of 10,000 birds per brood.

The personal knowledge of the extension staff who are working with the selected farmers fairly intensively was fully made use of in arriving at a decision about the level of the operator's management ability.

III

For each farm, alternatives were considered for three different resource situations and each situation considered for two levels of capital; in general, there are six plans per farm. Certain other variations were introduced on some of the selected farms and for these the number of plans was higher, *e.g.*, twelve different plans were considered for Farm 8. Coming back to the three common plans, Situation I considered the farmer's own resources—own land and own labour and only the farm possibilities were examined; for Situation II, in addition to the owned resources, renting in of land and hiring in of labour were allowed and again, only the farm possibilities were examined; for Situation III, both renting in and out of land and hiring in and out of labour were allowed and, with a few exceptions, non-farm as well as farm possibilities were examined. All three situations were considered at two levels of capital, A or low level and B or high level. The amount contemplated for the A levels is the amount that can be raised against the valuation of owned resources if security is the only consideration. For B levels, the sum represents the maximum amount of investment capital that the farmer could employ profitably on that farm, on the basis of potential productivity.

Since different farm operators did not have the same managerial ability, enterprise budgets were varied for different levels of management. The first thought which comes to mind is that the poor manager will get lower yields than the good manager. In other words, the input-output ratio will be higher for the poor manager. This stands to reason, but in most cases, inputs used by the poor manager will be different, too—quantitatively as well as in quality. A poor manager will ordinarily apply less fertilizer. He will probably also allocate less money and efforts on insect control. Or, as in the case of poultry, he may have to spend more on feed because of greater wastage due to inefficiencies in handling and feeding. On labour the poor manager generally will be on the high side per unit of output. Differences in the budgets of commercial layer (poultry) enterprise for two management levels are discussed in the following paragraphs in order to show what is involved.

A comparison between the two levels of management reveals that the good manager will earn a net revenue of \$1,346 per unit (500 layers), whereas the fair manager can earn only \$284 per unit. The difference is accounted for by the following:

1. Difference in laying rate: 240 eggs per hen per year for the good manager and 188 for the fair manager.
2. Difference in mortality: 10 per cent of the chicks purchased by the good manager will not reach laying age but 20 per cent purchased by the fair manager will not reach laying age.
3. Difference in culling rates: 6 per cent for the good manager and 12 per cent for the fair manager; culling rate for the fair manager is higher for all ages of birds.

4. Difference in the quality of chicks bought: \$0.55 per chick for the good manager and \$0.50 per chick for the fair manager.
5. Difference in the quantity of feed: 22 pounds per bird till the end of the 24th week for the good manager and 26 pounds per bird for the fair manager; 100 pounds per bird from 25th week through the laying period for the good manager and 103 pounds per bird for the fair manager.

Similar budgets were developed for other enterprises considered for the county. For certain enterprises where the operations are simple, and too many decisions are not required to be made, the management level will not make any appreciable difference and only one budget was developed. More than two management levels were needed for certain enterprises where the number of decisions to be made or their complexity or a combination of these factors strained the managerial ability of the operators. Further adjustments, wherever needed, were made while considering an individual budget for a farm. For example, in the case of Farm 6, the budget for brood cows had to be adjusted in an upward direction since the operator was already getting five veal calves per year as against four in the budget for good managers. Not just the output but also the rates of input flows per unit of output were adjusted. Similarly, the Grade A dairy budget was adjusted upward for the operator of Farm 8. Since this operator was short of land suitable for hay, provision was made to enable him to buy hay and thus get over this limitation. As these and other conditions varied between farms, enterprise budgets were adjusted for individual cases.

IV

The effect of quality of the human element was considered by observing the effects on net revenue and resource productivity of different levels of management ability on various farms. Further, Farm 2 was programmed at two levels of management, viz., fair level, appropriate for the operator at present, and good level, in order to see what the effects on net revenue and resource utilization and productivity would be if the farm operator could be developed into a better manager than he now is.

While the conventional approach focussed attention on the enterprises, this approach had the operator as its focal point, without ignoring enterprise combinations. What is best for the operator not only under the actual resource situation but also when changes in the quality and quantity of resources are permitted is one really significant question. Perhaps the most important point in this connection is what happens to the productivity of resources and to net returns when the farm management ability of the operator is improved. If the possibility of raising the management level of low-income farmers is ruled out, then these farmers are, in effect, condemned to a low income status as long as they remain in agriculture.

Coming back to Farm 2, its operator is a fair manager and, owing to this limitation on managerial ability, his earnings are low. At low levels of investment capital he can make \$2,722, \$3,505 and \$4,026 under Situations I, II and III respectively, as will be seen from Table II. If the level of capital is raised, his income goes up by \$678 under Situation I, and all the additional capital made available, \$4,000, is utilized. Under Situation II, \$1,876 of additional

TABLE II.—INCOME FOR FARM 2 UNDER DIFFERENT LEVELS OF MANAGEMENT

Situation	Net Revenue			Increase in Income		
	Good Management:			Fair to Good:		
	Fair Management: Optimum Organization	Farm Organization same as under Fair Management	Good Management: Optimum Organization	Fair to Good: Optimum Organization	Good: Optimum Organization Unchanged	Fair to Good: Optimum Organization
(dollars)						
I. Farm possibilities with own land and own labour						
A. Investment capital at \$ 1,000	2,722	3,239	3,285	517	563	
B. Investment capital at \$ 5,000	3,400	6,880	8,017	3,480	4,617	
Increase from A to B.	678	3,641	4,732	—	—	
II. Farm possibilities with own land plus land rented in and own labour plus Labour hired in:						
A. Investment capital at \$ 1,000	3,505	4,193	4,491	688	986	
B. Investment capital at \$ 2,876	4,212	5,585	8,452	1,373	4,240	
Increase from A. to B.	707	1,392	3,961	—	—	
III. Farm and non-farm possibilities with land rented in and out and labour hired in and out						
A. Investment capital at \$ 1,000	4,026	4,731	5,143	705	1,117	
B. Investment capital at \$ 1,979	4,637	5,262	8,880	625	4,243	
Increase from A to B.	611	531	3,737	—	—	

capital is utilized and income raised by \$707. Under Situation III only \$979 of the additional capital is utilized resulting in an increase of \$611 in net returns. Thus the availability of more capital does not appear to be very helpful in this case where management ability is low.

If the management ability of this operator could be raised to the level of "good" manager and if he operated the same enterprises as before (farm organization unchanged), his income at low levels of investment capital will go up by \$517, \$688 and \$705 under Situations I, II and III respectively. But when his management ability is raised, he will change the farm organization. He will go into enterprises which give higher returns to management ability. This change in farm organization coupled with higher returns from enterprises under good management level will raise his income by \$563, \$986 and \$1,117 under the three situations at low levels of capital. Although the raising of management level makes an appreciable difference in income, and investment in the learning process is definitely worthwhile, income still does not increase appreciably if the level of capital availability cannot be raised.

When more capital is made available on Farm 2 at the good management level, earnings go up by \$4,617, \$4,240 and \$4,243 under the three situations respectively, and all the additional capital made available, \$4,000, is utilized under all the situations. Considering all the three situations, whereas the addition of capital at low levels of management increased incomes in the range of \$600—700, and the raising of management ability at low levels of capital increased income in the range of \$500—1,000, raising the level of both the management ability and capital at the same time results in addition to income in the range of \$4,200—4,600. It is, therefore, really a combination of higher management ability and availability of more capital that provides for a significant increase in net farm income. The high degree of complementarity between management level and capital is readily illustrated by the example of Farm 2.

V

It is obvious from the foregoing discussion that a good deal of attention (funds and energy) could be devoted to investments to improve the farmer's managerial ability for enabling him to utilize his resources more effectively. The added profitability from the use of capital and other resources under better management, as shown above, will more than justify sizable investments. In order to emphasize this point, with everything else equal, the availability of \$4,000 more capital to the operator of Farm 2 under Situation I raised net returns by \$4,732 at the high level of management.

Differences in incomes and resource utilization on farms having more or less comparable resources, but operated by managers with different managerial abilities, also point to the sharp differences in the returns to management as reflected in much higher incomes for better managers. If the management ability of the fair operators can be raised and that of good operators further improved, incomes will be much greater than could be achieved by changing the level of any other single resource or even of all other resources combined.

The conclusions of the above study apply with equal or greater force in the case of Indian farmers. In an under-developed stage, even smaller gains in managerial competence will make a lot of difference in terms of earnings. Raising management ability, an integral part of improving the quality of the

human factor, will thus open up new vistas for our farm population and will make unprecedented gains in incomes possible. Raising the quality of the human element or the educational problem, as it may be called, is the fundamental problem and should be tackled if a long-run solution of the problem of under-developed agriculture is desired.

FARM PLANNING—A TECHNIQUE OF BETTER FARM MANAGEMENT

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How can an individual farmer so organize the factors of production—land, labour, capital and managerial ability—on his farm, so adopt farm practices to his particular environment and so dispose of his products, as to yield him the largest continuing net returns? With the myth of self-sufficiency and production for consumption receding to past, every farmer, big or small, is posed with this question more sharply than he had been ever before. And rightly, therefore, in India, the need of the use of farm management as a tool of practical help to the farmer has now been realized. The present study (the results of which will be presented in this paper) was undertaken to test the role of better farm planning in increasing the farm and family welfare.

Basic Facts

An ordinary farmer with a small holding of 6 acres was selected for the study. An extensive soil survey of the holding showed that, broadly speaking, 4 acres of land possessed heavy soil with bad drainage system remaining under water for about 4 months in the rainy season. The remaining 2 acres had a sandy, well drained soil and was situated relatively at a higher level. The village from where the farm was chosen was situated in District Bijnor in U. P. and thus had the general climatic conditions of the region. The average annual rainfall of the region being 40", the land was suitable for growing both types of crops requiring high as well as low humid conditions.

Besides rainfall, the village has a perennial system of canal irrigation, although never had the requirements of the cultivators been met in full.

The village was connected by *kachcha* road with a railway station at a distance of half a mile and the nearest *tehsil* town was $3\frac{1}{2}$ miles away from the village although well connected by a *pucca* road.

* The views contained in this paper are the author's own and have nothing to do with his official capacity.