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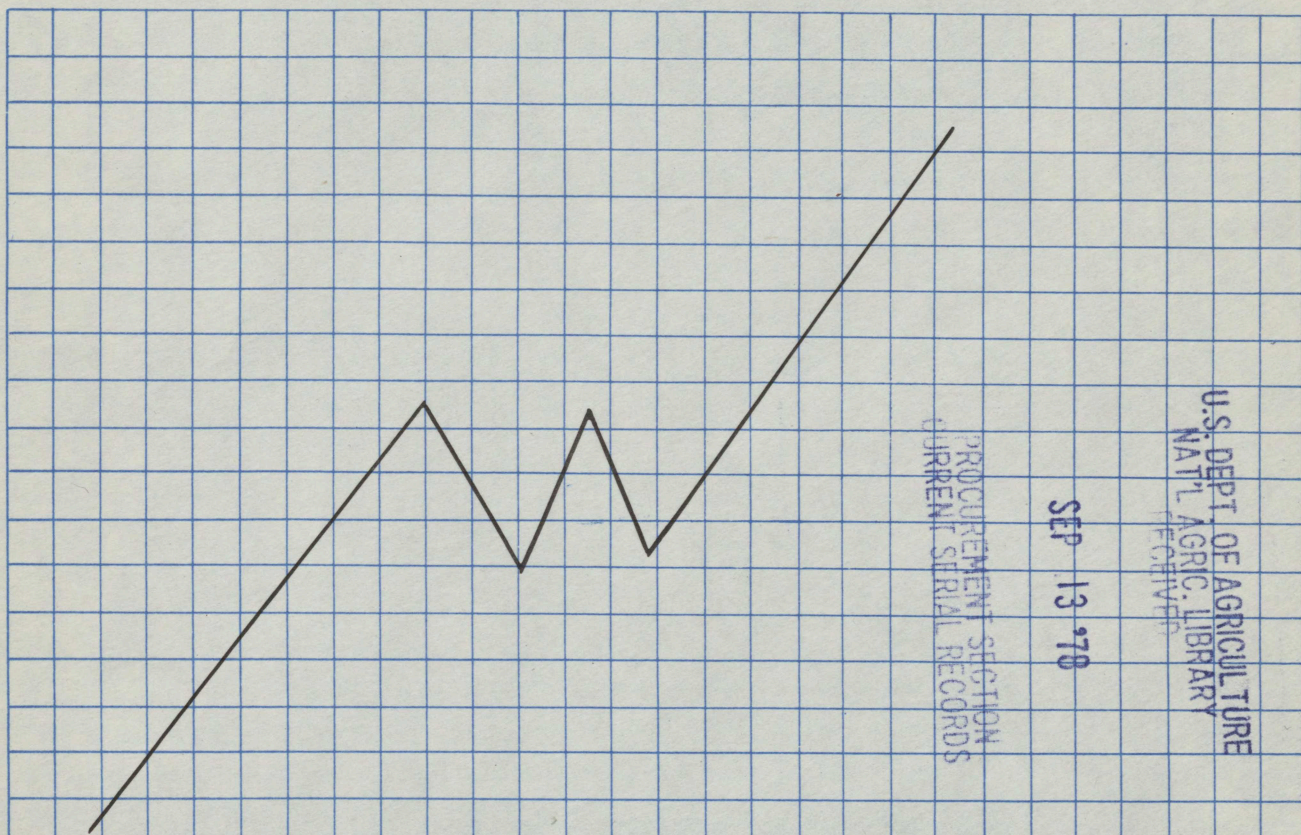

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AN APPROACH TO FARMING EFFICIENCY ANALYSIS AS APPLIED IN RÛENS*

by

P. VILJOEN
Division of Agricultural Production Economics

and

J.A. GROENEWALD
University of Pretoria

1. INTRODUCTION

The traditional method of measuring management results in farming was a residual method; remuneration to management was measured as the residue of total income after remuneration to other production factors was deducted. Alternatively, net or gross income was often expressed per unit of certain inputs, for example per hectare, per R100 of capital investment, per labour day, etc.

This method has certain defects, among others that it does not properly set out differences in management inputs and in the quality and composition of other resources and the effect of returns to scale and of chance events in such a way that these effects can be realistically distinguished. For example Bessell[1] uses a series of indices to describe the problem such as a productivity index, an intensity index, indices of real and potential technical efficiencies and a complexity index.

Various authors, including Westermarck,[2] Van den Ban,[3] Mueller,[4] Burger[5] and Jansen *et al*[6] have indicated that different management methods of approach have an effect on farming results.

However, the problem is often first to measure differences objectively without differences in resource availabilities or scale relationships causing a serious disturbance in measuring instruments and sometimes also to identify causes for such differences at the operational level.

In this article an objective measuring instrument will be presented and used, followed by an analysis of factors that cause differences.

2. METHOD OF APPROACH

The statistical fitting of cross-sectional production functions has often been applied during the past few decades not only to agriculture, but also to other industries. It may be definitely stated that this type of analysis, particularly because of the value that it gives to marginal concepts, has been a big and important step forward.

Cross-sectional production functions, however, also have a few important shortcomings. Among other things, it has been pointed out that the omission of management as an input in functions can result in an upward bias in the output elasticity of capital and a downward bias in estimates of return to scale.[7] One important problem with a cross-sectional production function is that it does not reflect a true production function, but in fact a locus of points that were obtained on a number of different production functions because it may be expected that different firms, because of factors mentioned earlier, will move along different production functions.[8]

Precisely the last-mentioned point of criticism may come in useful in the measurement of management success. Because it may be accepted that the more efficient producer will operate organisationally and operationally on a higher production function that the less efficient producer the results he actually obtains may be compared with the results that may be expected according to cross-sectional production functions. From this it may be deduced whether, given a certain application of resources, he showed above or below-average management. This aspect may be presented symbolically as follows:

$$Y = f(X_1, X_2, X_3 \ldots\ldots X_n)$$

where Y = output

X_1-X_n = inputs of production agents

From a cross-sectional production function an expected output, $\hat{Y}$, can be determined for the farmer:

$$\hat{Y} = f(X_1, X_2, X_3 \ldots\ldots X_n)$$

If the difference $(Y - \hat{Y})$ is positive, it implies that the enterprise is working on a higher production function than that presented by the locus of points given by the cross-sectional production function. A negative value for $(Y - \hat{Y})$

* Based on an M.Sc.(Agric.) thesis by P. Viljoen, University of Pretoria.

would imply lower efficiency, as reflected in a lower individual production function.

3. EMPIRICAL RESULTS

The above-mentioned approach was applied to a random sample of 46 farmers in the part of Rûens that is delimited as region K3 in the agro-economic survey of South Africa.[9] A study of physiographic reports on the area (topography, soils, plant growth and climate) indicates a high degree of physical homogeneity.[10]

Cobb-Douglas type cross-sectional production functions were fitted to the sample data, with Y, the dependent variable, defined as gross farm revenue. The variable inputs ($X_1 \ldots X_n$) consisted of various formulations of soil, labour, capital and livestock inputs. Six different functions were fitted. In all six functions satisfactory fittings were obtained, as reflected by F values, that were significant at the $p=0{,}001$ level of significance, coefficients of determination that varied between 0,65 and 0,85 and acceptable coefficients and signs for calculated coefficients. The sums of elasticities of production did not deviate significantly from 1,0 and it was therefore accepted that constant returns to scale obtain.[11]

Next the expected gross revenues were calculated in accordance with each of the six functions for each of the farmers in the sample. The geometric average of the six calculations was accepted for each farmer as his expected result ($\hat{Y}$). By expressing the difference between his actual result (Y) and his expected result ($\hat{Y}$) as a percentage of the actual result, a management index was calculated.

$$\text{Management index} = 100\left(\frac{Y - \hat{Y}}{Y}\right)$$

This implies that a positive index indicates above-average results and a negative index below-average results.

The highest index in the sample was +60 and the lowest was -54. A frequency distribution is shown in Table 1. According to this the index of about 61% of the farmers is between -19 and +20.

TABLE 1 - Frequency distribution of 46 farmers in Rûens according to management index, 1972/73

Management index interval	Number of cases	% of total
41 tot 60	2	4,3
21 tot 40	9	19,6
1 tot 20	13	28,3
-19 tot 0	15	32,6
-39 tot -20	6	13,0
-59 tot -40	1	2,2
Total	**46**	**100,0**

4. RELATIONSHIPS: FARM BUSINESS ORGANISATION AND MANAGEMENT INDEX

The following part of the analysis consists of the consideration of relationships between certain other phenomena in farming and the calculated management index. For this purpose the sample was subdivided into three groups as follows: *Group A* consists of the 16 most efficient farmers, *group B* (15 farmers) forms a middle group and *group C* consists of the 15 farmers with the lowest management indices. The three groups were compared.

The comparisons between the groups included a wide variety of characteristics - land use, capital investment and application, burden of debt, cost distribution, enterprise ratios and efficiency factors. Only the most important findings will be shown here. The rest are dealt with elsewhere in more detail.[12]

Differences between the three groups were calculated statistically throughout by means of the t test.

4.1 Land use, capital investment and cost structure

In this article, in addition to its potential use in the explanation of efficiency differences, information on land use serves the purpose of giving a convenient picture of the type of farming. Table 2 shows relevant data.

The average total area is sharply influenced by one farm with a total area of 9 308 hectares, of which the greater part is not arable. This farm falls under group B.

It appears that the greater part of the area is used in all three groups for dryland cultivation with wheat as the most important crop. Tested in accordance with the t test no significant differences were found between the three groups in respect of total area, area cultivated or area under specific crops. It was found that the A group had a significantly smaller percentage of the arable area under fallow land than group B ($t= -2{,}95$; $p<0{,}01$) and group C ($t= -3{,}84$; $p<0{,}001$). Group B in its turn had a smaller percentage than group C ($t= -1{,}96$; $p<0{,}05$).

In itself this gives an indication of farmers' inclination to use new practices; in this particular area fallow land is regarded as an obsolete agronomic practice.

The fixed capital investment per farm was R123 500 for group A; R114 400 for group B and R136 800 for group C, respectively. In total and per hectare (if the farm of 9 308 hectares is left out) this shows no important differences between the three groups.

As regards investment in movable assets (livestock and equipment), the only difference worth mentioning is that group A showed the highest investment in livestock and group C the lowest. These differences are not statistically significant.

An analysis of fixed and variable cost items similarly did not reveal much difference between the three groups except as regards fertilisation. It therefore appears that causes for efficiency differences are to be sought in deeper reasons.

TABLE 2 - Land use pattern, 46 farmers, Rûens, 1972/73

Use		Group A		Group B		Group C		Whole sample	
		Area (ha)	%*	Area (ha)	%*	Area (ha)	%*	Area (ha)	%*
Drylands cultivated		643	74,3	708	55,2	578	61,0	643	62,3
Irrigated		11	1,3	0	0	29	3,1	13	1,3
Natural grazing	a	206	23,8	575	44,0	340	35,9	374	36,2
Unused		5	0,6	0	0	0	0	2	0,2
Total area		**865**	**100,0**	**1 283**	**100,0**	**947**	**100,0**	**1 032**	**100,0**
Cultivated land									
Wheat		260	52,2	274	58,3	229	67,2	254	58,3
Oats		21	4,2	20	4,3	14	4,0	18	4,2
Barley		32	6,3	23	4,9	20	6,0	25	5,7
Lupins	b	9	1,8	3	0,7	3	1,0	5	1,2
Fodder and grazing crops		162	32,6	149	31,8	74	21,5	128	29,4
Other crops		14	2,9	0	0	1	0,3	5	1,2
Total sown		**498**	**100,0**	**469**	**100,0**	**341**	**100,0**	**435**	**100,0**
Fallow land	c	156	23,8	239	33,8	266	43,8	221	33,7
Total cultivated		**654**	**100,0**	**708**	**100,0**	**607**	**100,0**	**656**	**100,0**

*In section a: % of total farm
In section b: % of sown area
In section c: % of cultivated area

4.2 Mechanisation policy

The 46 farmers in the sample show an average investment of R20 033 in machinery and equipment, with relatively little difference in the total amount between the three groups. Costs of machinery and equipment amount to an average of R8 178 per year. In view of these large capital and cost sums a further analysis of mechanisation aspects is justified.

Table 3 provides information on tractors, accompanying implements and combines. No important explanatory differences were found in respect of vehicles and other power machinery except in respect of numbers and ages of motor cars.

According to Table 3 there are no significant differences between numbers of tractors per farm. Although the average age of tractors was higher in the case of group A than in the other groups, the difference is not statistically significant. Farmers in group A use significantly smaller tractors (measured in kilowatts) than the other two groups. The area cultivated by tractor does not differ significantly between groups A and B, but group A does cultivate significantly more ($p=0,10$) hectares per tractor than group C. These three factors mean that farmers in group A show significantly smaller tractor investment and tractor costs ($p=0,05$) per hectare than farmers in the other two groups. Also as regards accompanying implements group A shows statistically significantly smaller investment and costs ($p=0,05$) than groups B and C.

Combine investment per hectare of land does not differ significantly between the three groups. The differences in tractor and implement investments in total result in group A showing a lower total equipment investment per hectare of cultivated land than group B ($p=0,10$) and group C ($p=0,05$). Fuel cost in the case of group A is a higher percentage of total tractor costs than in the case of group B ($p=0,20$) and group C ($p=0,05$). This indicates a higher directly productive application (proportionally lower repairs, depreciation and interest) in the case of group A. Nevertheless, fuel costs per hectare cultivated are significantly lower ($p=0,10$) in group A than group B and in the case of group A they are also insignificantly lower than in the case of group C. Tractor and implement costs per R100 of labour costs are in the case of group A (respectively, $p=0,20$ and $p=0,10$) significantly lower than in the case of group B, but not significantly different from group C. Cultivation costs per hectare are significantly lower ($p=0,05$) in the case of group A than with the other two groups.

The picture that therefore emerges clearly here is that farmers in the most efficient group (A) economise more in the provision and use of equipment, particularly tractors and implements, than is the case with the other two groups. It may therefore be expected that, if this economising is accompanied by at least comparable yields, this factor could make an important contribution towards explaining this group's higher general efficiency.

It would appear that group B does better than group A only in one aspect, namely in the area of wheat per combine. This analysis showed few differences between groups B and C except that group B keeps significantly bigger tractors than group C, shows a higher tractor cost per R100 of labour cost and has more hectares of wheat per combine.

Mechanisation aspects therefore do contribute towards explaining group A's higher efficiency, but not towards explaining the differences between groups B and C.

4.3 Yields and certain variable inputs

A further step in the investigation was to determine whether yields per unit could make important contributions towards explaining

Table 3 - Aspects concerning tractors, accompanying implements and combines, three groups of farmers, Rûens, 1972/73

	Averages per group			t values for differences between groups		
	A	B	C	A-B	B-C	A-C
				Degrees of freedom		
				29	28	29
Tractors:						
Number per farm	2,81	2,80	3,13	0,03	- 1,16	- 1,07
Average age (year)	9,07	7,31	5,91	0,68	0,31	1,04
Average kilowatts	38,48	47,80	41,79	- 3,39**	2,52*	- 1,53 (0,20)
Average area cultivated per tractor (ha)	95,14	80,16	70,25	0,96	0,76	1,81 (0,10)
Tractor investment per hectare of cultivated land (R)	7,24	12,44	13,22	- 2,48*	- 0,31	- 2,69*
Tractor costs per hectare of cultivated land (R)	5,36	9,37	8,47	- 2,62*	0,56	- 2,52*
Fuel as a percentage of variable costs (tractor)	61,55	57,27	53,20	0,53	0,59	1,09
Fuel as a percentage of total tractor costs	42,41	33,65	30,02	1,42 (0,20)	1,04	2,17*
Repairs as a percentage of variable costs (tractor)	38,45	42,73	46,80	- 0,53	- 0,12	- 0,68
Tractor fuel per hectare cultivated (R)	2,11	3,45	2,64	- 1,91 (0,10)	1,21	- 0,53
Tractor cost per R100 of labour cost (R)	97,56	130,33	102,47	- 1,43 (0,20)	1,35 (0,20)	- 0,20
Implements:						
Implement investment per hectare of cultivated land (R)	12,76	19,36	20,25	- 2,36*	- 0,24	- 2,62*
Implement cost per hectare of cultivated land (R)	1,15	2,52	2,55	- 2,05*	- 0,04	- 2,80*
Implement cost per R100 of labour cost (R)	20,79	36,67	26,80	- 1,89 (0,10)	1,05	- 0,87
Combines:						
Number per farm	1,12	1,28	1,20	- 0,09	0,04	- 0,07
Average age (years)	3,55	3,61	5,00	- 0,14	- 0,38	- 0,29
Wheat area per combine (ha)	231,94	312,77	190,61	- 1,98*	2,23**	2,91***
Combine investment per hectare of cultivated land (R)	10,62	15,28	13,20	- 1,26	0,51	- 0,77
Total equipment:						
Equipment investment per hectare of cultivated land (R)	40,82	57,47	58,55	- 1,89 (0,10)	- 0,12	- 2,51*
Cultivation cost per hectare (R)	19,24	28,66	29,61	- 2,06*	- 0,16	- 2,02*

**Significant at p=0,01
* Significant at p=0,05

(0,10) significant at p=0,10
(0,20) significant at p=0,20

Table 4 - Yield difference between three groups of farmers, Rûens, 1972/73

Particulars	Averages per group A	B	C	t values for differences between groups A-B (Degrees of freedom)	B-C	A-C
Wheat:						
Yield, /ha	1,48	1,41	1,03	0,40	2,19*	3,18**
Average price per ton produced (R)	69,82	63,48	60,40	2,54*	0,93	3,91***
Gross production value per ha (R)	104,03	92,43	71,21	1,89(0,10)	2,71*	4,03***
Directly alloctable costs, R/ha	20,32	27,06	21,94	- 1,92*	1,48(0,20)	0,79
Fertiliser costs, R/ha	12,78	13,30	9,53	- 0,20	1,96*	1,61(0,20)
Nitrogen: % of total mass of nutrients	24,76	28,85	31,03	- 0,91	- 0,30	- 0,66
Phosphorus: % of total mass of nutrients	74,75	71,15	65,52	1,27	2,13*	2,21*
Potassium: % of total mass of nutrients	0,49	0	3,45	-	-	-
Oats:						
Yield, /ha	0,97	1,09	1,12	- 0,38	- 0,12	- 0,75
Gross production value per ha (R)	65,25	71,60	58,80	- 0,50	0,73	0,24
Directly allocable costs, R/ha	15,35	14,61	18,93	0,08	- 1,28	- 0,92
Barley:						
Yield, /ha	0,90	1,30	1,061	- 2,83*	1,38(0,20)	- 0,92
Directly allocable costs R/ha	13,98	20,61	18,12	- 1,97(0,10)	0,81	- 1,85(0,10)
Gross production vaiue per ha (R)	58,56	95,87	69,42	- 2,67*	2,34*	1,07
Dairy produce:						
Yield, litres per cow milked	2 340	1 468	1 323	1,72(0,10)	0,45	2,01*
Gross production value per R100 of feed costs (R)	32,59	54,00	37,15	- 1,03	0,79	- 0,46
Sheep:						
Gross production value per small stock unit (R)	15,69	12,88	11,65	1,59(0,20)	0,85	2,98**
Gross production per R100 of feed costs (R)	23,19	30,47	33,34	0,75	- 0,28	- 1,72(0,10)
General:						
Yield index	1119,80	103,73	79,06	1,26	3,16**	3,22**

***Significant at p=0,001
** Significant at p=0,01
* Significant at p=0,05
(0,10) significant at p=0,10
(0,20) significant at p=0,20

efficiency differences between the three groups. The first step was the calculation of a yield index for each farmer according to the method presented by Hattingh.[13] Next the actual output of the farm is expressed as a percentage of the standard output that would be obtained if average yields per hectare or livestock unit were achieved in all enterprises. A yield index of over 100 implies above-average yields and a yield index of below 100 implies below-average yields per unit.

The average yield indices for the three groups of farmers were as follows:

Group A: 119,80
Group B: 103,73
Group C: 79,06

Although the average yield index of group A is higher than that of group B, the difference is statistically not significant at =0,20 (t=1,26). At a lower test level (p=0,30) it would in fact be significant. As against this, the yield index of both group A (t=3,22) and group B (t=3,16) deviated highly significantly (p=0,01) from that of group C. It therefore appears that yields can give an important explanation for the lower efficiency of group C, but not indicate such a clear distinction between groups A and B.

Yields within certain enterprises were also investigated, as were other related factors (Table 4).

In the most important enterprise (wheat) there were no significant differences in physical yields (tons per hectare) between groups A and B, but group C fared significantly worse than group B (p=0,05) and group A (p=0,01). Group A, however, produced a higher quality product, as reflected in the average price per ton of wheat. The consequence is that group A's gross production value per hectare was significantly higher than that of groups B and C (p=0,10 and p=0,001 respectively). Group B also showed a higher gross production value per hectare (p=0,05) than group C. Directly allocable costs per hectare did not differ significantly between groups A and C, but those of group B were significantly higher than those of groups A (p=0,05) and C (p=0,20). It therefore appears that the combination of physical yield, quality of product and directly allocable costs for the main crop, wheat, gives an important indication of differences between the three groups. The average gross margins (gross production value minus directly allocable costs) were as follows:

Group A: R84,00 per hectare
Group B: R65,37 per hectare
Group C: R49,27 per hectare

It also appears that group C spent less per hectare of wheat on fertiliser than group A (p=0,20) and group B (p=0,05), but expenditure by groups A and B did not differ significantly. An analysis of the fertiliser composition shows that group C, which produced the lowest yield, concentrated significantly less (p=0,05) on phosphate fertilising.

In respect of the wheat enterprise it appears that group A, by acting more judiciously, obtained a higher production value together with lower expenditure than group B. Group B, on the other hand, spent more than group C on directly allocable costs, but this expenditure was more than compensated for by higher production values.

No significant differences were found between the three groups in respect of the oats enterprise. As regards barley, group B did significantly better than groups A and C and also obtained higher gross margins per hectare. However, because barley is a relatively less important enterprise (see Tables 1/2) the effect of the wheat enterprise completely overshadows that of the barley enterprise.

In the dairy enterprise group A shows a higher yield per cow than group B (p=0,10) and group C (p=0,05). In the sheep enterprise again the gross production value per small stock unit of group A is higher than that of group B (p=0,20) and group C (p=0,01). There is no indication of differences in efficiency of feed utilisation between groups A and B or between groups B and C; group A's gross production value per R100 of feed costs for sheep is lower (p=0,10) than that of group C.

Taking everything into account, it appears that the performance in the wheat enterprise, where group A did better mainly qualitatively than group B (and at lower costs), makes an important contribution; in the same enterprise group B does better than group C, mainly quantitatively in higher yields which compensate for higher costs.

4.4 Enterprise mix

The results of a farm enterprise can evidently be influenced by the enterprise mix. If all other factors were equal - yields per unit, costs, etc. - it is obvious that a farm enterprise in which the more profitable enterprises are concentrated on relatively more should produce better results than one that concentrates less on these enterprises.

In order to investigate this aspect a system index as presented by Hattingh,[14] was calculated for every farmer in the sample. In these calculations the output that the farm would produce if standard yields were obtained in all enterprises (i.e. average yield) is first calculated and defined as the farm's standard output. This standard output is then reduced to a standard output per hectare of farm. Next the average standard output per hectare of all farms in the sample is calculated. The system index for the farm concerned is then the standard output per hectare of the farm expressed as a percentage of the average standard output per hectare. A standard index of over 100 implies an above-average concentration on profitable enterprises. A system index of below 100 implies concentration on relatively less profitable enterprises.

Table 5 shows results obtained in calculating system indices.

It is evident, first, that there is no significant difference between groups B and C. Group A's average index, on the other hand, is significantly higher than those of group B (p=0,10) and group C (p=0,05). It therefore appears that farmers in group A specialise more in relatively profitable enterprises.

TABLE 5 - System indices, three groups of farmers, Rûens, 1972/73

Particulars	Average	t value
System index, group A	112,62	-
System index, group B	95,00	-
System index, group C	91,66	-
Difference, A-B	+17,62	1,73(0,10)
Difference, B-C	+ 3,34	0,31
Difference, A-C	+20,96	2,41*

(0,10): significant at p=0,10
* : significant at p=0,05

4.5 Summary

In summing up it may therefore be stated that certain explanations were found for the reasons why the most efficient group (group A) beats the other two groups. It appears that this group, compared with the other two groups, is more realistic and economical about mechanisation. In the main enterprise, wheat, this group does better qualitatively (measured by price for the product) than the other two groups and also does better quantitatively than group C, the least efficient group. Group A also does better than the other groups with sheep, which is the most important livestock enterprise. (Sheep constitute 76 per cent of total large stock units in the case of group C and 83 per cent in the cases of both groups A and B.) In the dairy enterprise group A also obtains greater yields than the other two groups. Group A's farming systems are also concentrated more on profitable enterprises than those of groups B and C.

There is little difference between groups B and C as regards mechanisation and farming system. The biggest differences between these two groups lie in efficiency and yields in the main enterprise, wheat. Group B obtains considerably higher wheat yields per hectare (quantitatively, but not qualitatively), and evidently fertilises better. Group B also obtains higher barley yields than group C, but not significantly higher yields in oats or livestock. The consequence in each case is a considerably higher yield index.

Farmers in group C could therefore increase their efficiency to the level maintained by group B by directing their attention largely to yield-increasing technology in crop cultivation. Such adjustments can be made easily without much additional strain on management.

The typical farmer in the middle group B will find it more difficult to make his efficiency comparable with that of the typical group A farmer. In addition to qualitative improvements in wheat production and higher production per stock unit, it would require important adjustments in his enterprise composition and mechanisation. Careful planning would be required. These adjustments would probably require big adjustments in his whole system of management.

5. MANAGEMENT INDEX: CERTAIN FUNCTIONAL RELATIONSHIPS

In a further analysis an attempt was made to determine relationships between calculated management indices and certain generally used efficiency yardsticks. The approach is in certain respects similar to that of Joubert and Viljoen[15] who in another study determined functional relationships between a technical efficiency index and certain inputs. To a certain extent the approach may be regarded as an unconventional production function in which management efficiency as a product is a function of inputs of different efficiency factors.

It may be expected that the relationship between general management efficiency, as reflected by the management index and different partial parameters of efficiency, will not be rectilinear. In addition, interaction between the influences of different parameters may be expected.

Consequently it was decided to use a Cobb-Doublas type formulation such as the following in the preparation of this model:

$$Y = b_0 \; X_1^{b_1} \; X_2^{b_2} \; X_3^{b_3} \; X_4^{b_4}$$

where Y = management index
X_1 = gross farm revenue per R100 of variable costs, representative of short-term technical efficiency
X_2 = system index showing the tendency of the farmer to concentrate on profitable enterprises and therefore his selection ability
X_3 = gross production value per R100 of labour costs, being a parameter of labour efficiency
X_4 = gross farm revenue as a parameter of the scope of the enterprise

The function was fitted by means of least squares regression to the data of the 46 farmers in the sample. Results appear in Table 6.

TABLE 6 - Regression coefficients with related data for management index explanation, Rûens, 1972/73

Item	Value	t value of b	Parameter of
b_0 Cut-off	-4,651		
b_1 Gross farm revenue per R100 of variable costs	0,2569	2,9855**	Short-term technical efficiency
b_2 System index	0,3751	2,1826**	Selection ability
b_3 Gross production value per R100 labour costs	0,1248	2,4824*	Labour efficiency
b_4 Gross farm revenue	0,1399	3,2464**	Size of farm enterprise
R^2	0,5730		
F value	13,7623***		
$\sum_{i=1}^{4} b_i$	0,8967		

* = statistically significant at p=0,05
** = statistically significant at p=0,01
*** = statistically significant at p=0,001

6. CONCLUSION

Results such as those obtained in this study show that an approach to using deviations from fitted cross-sectional studies as yardsticks of managerial success potential can make an important constribution - not only diagnostically, but also prescriptively and, it is to be hoped, prognostically.

The function gave a good statistical fit, as appears from the highly significant F value. The coefficient of determination was 0,573. All the calculated regression coefficients deviated significantly from nought at p=0,01 or p=0,05.

Because the b in Cobb-Douglas type functions indicates elasticity of production of the independent variables concerned it may be deduced from Table 6 that, if each of the independent variables increases by one per cent, the management index will increase by the following percentage:

0,2569 per cent because of higher short-term technical efficiency

0,3751 per cent because of better selection ability

0,1248 per cent because of better labour efficiency

0,1499 per cent because of increase in scale of operation

Should all these variables increase at the same rate, would indicate the sum of the regression coefficient that would be the effect on the management index. It appears that a combined increase of one per cent would cause the management efficiency to increase by 0,8967.

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