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EFFICIENCY ANALYSIS OF SMALL SCALE WOOL PRODUCTION IN THE FORMER TRANSKEI, SOUTH AFRICA

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Specialising in wool production could be a good opportunity for farmers in the former Transkei to upgrade to fully commercial and economic viable enterprises. This paper investigates the efficiency of the current practises of wool producers in three villages. Two of those villages are beneficiaries of the LandCare project of the National Department of Agriculture, and receive help on technical matters and marketing. The analysis shows that in the two villages beneficiary of the LandCare project the technical, allocative and economic efficiency of the wool production is higher than in the third village. In the latter, the technical efficiency of some of the farms is still good, but the difference is made in the marketing of the wool.

1. Introduction

Sheep farming is widespread in the rural areas of the former Transkei in the Eastern Cape province of South Africa. Households keep sheep for own consumption of the meat (especially at ceremonies and special family gatherings) and as long-term investment of savings (living money-boxes). Selling the wool is traditionally considered to be extra cash income. The wool is usually of low quality and is sold to local traders at very low prices. But wool production has potential as a source of cash income that can substantially contribute to household income, if the quality and quantity of wool production is improved. In so far it can lead to extra income, it has the potential to alleviate rural poverty and stimulate rural economic growth. A recent joint initiative between the National Wool Growers Association (NWGA), the government, and the Agricultural Research Council (ARC) has as its objective to improve the situation of the rural households by intensifying agriculture and in particular by the development of the small scale wool production. Small-scale wool production is stimulated by investment in shearing sheds and training in wool sorting, shearing and other farming practices. Farmers who have benefited from the programme have already achieved better prices and higher income from their wool production (Aucamp, 2000).

In our case study, three villages were selected, two of them being beneficiaries of this programme. The objective of the paper is to analyse the efficiency of the wool farmers through the application of Data Envelopment Analysis (DEA). In a first section, the case study area is introduced, and an overview of the characteristics of the wool production in those areas is given. The second part of the paper deals with the efficiency analysis, whereby first the theoretical framework is explained and the results of the application of the DEA methodology on the wool production are given.

2. The case study area

The case studies chosen for this study are three villages in Transkei area. The three villages under study are Xume and Mhlahlane, which are part of the Tsomo[1] administrative district, in the central part of Transkei area and Luzie, part of Mount Fletcher, in the north. Xume and Luzie are beneficiaries of the LandCare project of the National Department of Agriculture. In the frame of the LandCare programme, a project in the Eastern Cape has been launched to integrate livestock and crop production in the communities. A part of the project is the intensification of wool production. The National Wool Growers Association (NWGA) provides for the installation of shearing-sheds, for training local women to sort wool, for improved knowledge of farmers on wool farming practices and for material to build a dipping tank. The NWGA also organises the marketing of the wool securing a fair price for the farmers.

Xume, Luzie and Mhlahlane are poor rural areas, with agriculture as main productive activity, poor infrastructure and poorly developed or even non-existing labour markets. Perret (1999) describes the community of Xume as ageing and local born, stricken by severe poverty, economically mostly dependent on welfare and resorting

[1] The names of the districts have recently been changed. “Tsomo” is still the old name, the new name is “Intsika Yetu” and of “Mount Fletcher” it is now “Elundi”. But in this paper, the names at the time of research are used.

of different sources of income. Stock-keeping and production of wool are the major agricultural activities.

3. Characteristics of wool production in the case study area.

3.1 Household typology

Perret et al. (2000) identified 6 household typologies in the survey area. Of these only three could be classified as households involved in farming. In Xume for example, these households are the following:

- Stock-keepers pensioners: their main source of income is pension, they produce sheep and goat to slaughter for own consumption, and some lambs are sold locally. Wool is sold to speculators.
- Part time stock-keepers, with off-farm activities and source of income: most husbands work outside the community and send remittance on a monthly basis to the household. Also these households have sheep and goats for own consumption and sell wool speculators.
- Full-time farmers: although their income is supplemented with occasional jobs and remittances, they make a living mostly out of agriculture. The crops grown are for own consumption. Young animals and wool are sold at the market (Perret et. al., 2000).

Farming is a relative concept, being absolutely not specialised nor managed. Although almost every households practices 'agriculture' only a low percentage is full time farming (According to Perret (1999) only 13% of the interviewed household are classified as full-time farmers).

In Mount Fletcher, relatively more households of the sample were part of one of the farming types, compared to Xume, with the full-farmers being the relative largest 'farming type' group.

3.2 Wool production

According to Perret et al. (2000) between 68 and 94% of the households in the case study villages do own sheep. The average size of the flock is between 47 and 97 sheep (see table 1). Table 1 also gives a broad overview of some of the characteristics of wool production in the three villages. It was also determined that all households keep sheep with the purpose of selling wool, although local status, cash reserve and source of main income are also considered as a reason for keeping sheep.

Table 1. Comparison of key characteristics of wool production in three villages

	Mhlahlane (n = 18)	Xume (n = 47)	Luzie (n = 40)	F
Number of sheep per farmer	47.2	96.9	76.1	6.39 **
Number of farmers with local breed	16 (88%)	46 (98%)	10 (25%)	
Number of farmers with Dohne Merino	2 (12%)	1 (2%)	30 (75%)	
Number of hours grazing	8.2	8.0	10.9	
Number of farmers giving extra feed	7 (38%)	7 (15%)	30 (75%)	
Cost of deworm/sheep	1.3	4.6	9.0	17.25**
Cost of dipping/sheep	0	0.68	10.30	35.70**
Cost of innoculation/sheep	4.06	4.63	8.69	6.78**
Medical cost/sheep	5.39	9.92	28.04	23.78**
Number of farmers dipping		24 (51%)	36 (90%)	
Wool price/sheep	2.76	1.68	13.13	45.10**
Number of farmers sorting the wool	1 (5%)	0 (0%)	29 (72%)	
Number of farmers member of shearing shed	0 (0%)	9 (19%)	29 (72%)	
Cash flow/sheep (Rand)	-9.88	-0.96	17.73	0.79

** = Statistical difference at 5% confidence level

A F-test was performed to indicate the statistical validity of the difference between the three villages in a variance analysis on the log-transformed data in order to fulfil the statistical requirements. Farmers in Xume and Luzie have distinctively larger flocks. The farmers in Luzie show a better management of the production (e.g. higher numbers of Dohne Merino, extra feeding, more deworming, inoculation, dipping occur). Luzie is the only of the three villages with a shearing shed in operation securing for a higher wool price (if the wool is sold through the shearing shed and of a better quality than in the other villages) and this is reflected in the higher cash flow per sheep.

The correlations found in the data collected in Xume and Luzie reveal that the condition of the sheep can be improved by extra feeding and more intensive inoculation, dipping and deworm. The best farms are those who apply appropriate technologies. Also an increase in the number of grazing hours can have a positive effect on the condition, if increased deworming and inoculation is adapted. The condition of the sheep has a positive effect on the wool production and increases wool price, which increases the cash flow. The income of wool, expressed per sheep, is positively correlated with the number of hours grazing per day (correlation: 0.421**) and with the expenditures of feed per sheep (correlation: 0.625**). A better condition also increases the meat production (that will increase the selling price, correlation between price of a sheep and the expenditures of feed per sheep is 0.632**) and will increase reproduction, resulting in a higher birth ratio. This increase in number of sheep, will diminish the need to buy sheep. The possibly larger flock and the increased selling price result in a higher cash flow. Figure 1 summarizes.

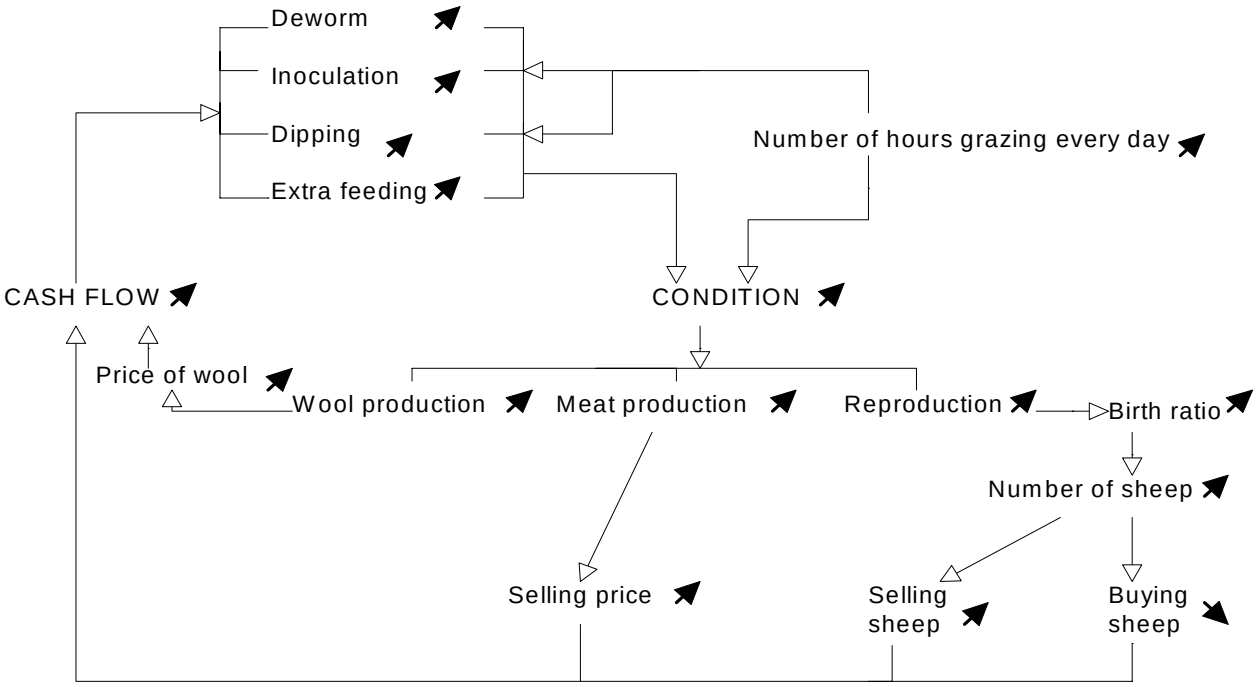

Figure 1. Relations explaining how by increasing the condition of the sheep, the cash flow can be raised

The analysis shows clearly that farmers can obtain a higher cash flow through better management. If we compare the practices in Xume and Mhlahlane with those in Luzie, it is obvious that farming in Luzie is a more serious business. This is not only a result of a relative higher number of full time farmers, but also of 'better' farming. It is translated into a higher average wool income that farmers in Luzie generate from wool, compared to the farmers in Xume and Mhlahlane (see table 1). The higher average income is also the result of the establishment of the shearing shed and its committee by the NWGA. Farmers selling wool through the shearing shed will get a higher price (on average R4,5/kg compared to R1/kg when selling to the local traders) because of the wool being shorn in a proper way, being classified and marketed directly to the brokers.

4. Efficiency analysis

To measure the performance of the wool production on the farms in the Transkei area, the efficiency by which input is converted into output is calculated. In this paper, we will discuss the technical, allocative and economic efficiency of the wool production. Therefore we will introduce a production frontier, which is the maximum output attainable (in physical quantities) from each input level (Coelli et. al., 1999). Farm-firms under this frontier, are supposed to be technically inefficient, as opposed to those operating on the frontier (Coelli et. al., 1999; Farell, 1957). If prices of input and output are taken into account, we can measure allocative efficiency by calculating the output that can be realised at minimum cost (Coelli et. al., 1999; Farell, 1957).

In this paper, the Data Envelopment Analysis (DEA) method is used. It measures efficiency from a piecewise-linear production frontier, drawn by enveloping the data

points representing farms that are technical efficient (Otsuki & Reis, 1999). The points on the frontier represent farms that are technical efficient, are calculated in separate linear programming models, maximising for each firm the output over input ratio, given a set of input constraints (Otsuki & Reis, 1999, Coelli et. al., 1999). The efficiency analysis can be input- or output-orientated and constant and/or variable returns to scale can be assumed (Coelli et. al., 1999). In this research, an output-orientated measurement was chosen to answer the question " by how much can output quantities be proportionally expanded without altering the input-quantities used?" (Coelli et. al., 1999). An efficient farm will score 1.0, and a score above 1.0 depicts inefficiency (Bowlin, 2000). The model used, accounts for variable returns to scale, because some of the farms will have a high relative output by using much more input, while other farms use only few inputs for they are not in the possibility to increase in scale.

Based on Coelli et. al. (1996); (1999) the following models were assumed and tested:

Technical efficiency of all farms with variable returns to scale: (efficiency is defined as the ratio of weighted sum of output over the weighted sum of inputs)

Max TE s.t. $X\lambda \leq X_i$

$Y\lambda \geq TE_i Y_i$

$\lambda \geq 0$ & $\sum\lambda = 1$

λ: 105 x 1 vector of weights; X: input vector of 5 x 105 matrix; Y: output vector of 1 x 105 matrix

Allocative efficiency of all farms with variable returns to scale:

Max AE s.t. $X\lambda \leq X_i$

$Y\lambda \geq AE_i Y_i$

$\lambda \geq 0$ & $\sum\lambda = 1$

λ: 105 x 1 vector of weights; X: input vector of 11 x 105 matrix; Y: output vector of 5 x 105 matrix

Economic efficiency: the multiplication of the technical and allocative efficiency:
EE=TE x AE

In measuring the efficiency, the focus was solely on the sheep enterprise although farmers have other activities. For calculating the technical efficiency, the output of the wool farms is measured as kg wool per sheep. In a regression analysis the main inputs influencing the wool production were determined. These include: the breed, dipping, inoculation, deworming and number of hours grazing a day. In the calculation of the allocative efficiency, the cash flow of the farm is taken (in Rand), with as inputs: selling of sheep and wool, expenditures on new sheep, dipping, inoculation, deworming, and losses due to theft. Selling and buying sheep appear to have a large influence on the cash flow for the selling of sheep provides relatively large profits.

5. Results

5.1 Technical efficiency

When plotting the results of technical efficiency, the efficient farms are situated in Luzie and Xume, while Mhlahlane is counting more inefficient farms. The fact that

Mhlahlane is not a beneficiary of the LandCare project, and does not have access to a shearing shed and technical assistance for it, would explain this. For the farms in Luzie and Xume, two distinct groups can be identified: a small group of farms with efficiency between 70 and 100%, and a larger group with efficiency peaking around 25%.

In the analysis of the farms in Xume (where 10.6% of the farmers are efficient at 100% score), it was found that more efficient farms are characterised by practises of dipping and grazing. Dipping can be a remedy against the severe losses due to sheep scab. As sheep graze in communal areas, non-dipped flocks easily contaminate them. Regular dipping is needed. The inefficient farmers are also characterised by longer grazing times with no dipping. More grazing in a day, augments the possible contamination of both internal and external parasites. In Luzie, 12.5% of the farms score a technical efficiency higher than 70%, the gap between efficient and inefficient is larger than in Xume and Mhlahlane. This is due to a combination of less efficient use of all production factors included in the analysis.

5.2 Allocative efficiency

In the calculation of the allocative efficiency, the cash flow of the total farm (sheep and wool) is taken into account. To compare the farms on the wool production, a second analysis was done omitting the benefits of selling and buying of sheep, and in a third exercise, the cash flow from wool only was divided by the number of sheep on the farm.

In Luzie, the number of allocative efficient farms is higher than in Xume and Mhlahlane. In Luzie the 75% of the farms are considered allocative efficient when the total sheep production is considered which is very high compared to Xume (42.6%) and Mhlahlane (44.4%). This clearly shows the importance of the shearing shed for marketing and dispatching information. When expressed per sheep, 55% of the farms in Luzie are 100% allocative efficient. The inefficient farms have relatively higher costs for medical care, shearing and feeding costs. If the selling and buying of sheep are not taken into account, the number of efficient farms further decreases to 37.5%, expressing the importance of the sales of sheep for the cash income of the farms. The factors inducing inefficiency are the labour costs, and as before the costs for shearing, medical care and feeding.

Analysing the allocative efficiency in Xume, the number of farms being allocative efficient is higher than the number of farms being technical efficient. This shows that the benefits of a good technical production system are smoothed by the fact that the better farms cannot expand due to marketing problems.

5.3 Economic efficiency

The farms of Mhlahlane are economic inefficient. Only one farm reaches an economic efficiency of 80%, all others are below 50%. Xume displays a large variety of economic efficiency, most of the farms having an efficiency between 0 and 35%. The relatively good technical results of the Xume-farms reveal that the situation of the farmers could improve dramatically if the shearing shed, currently renovated, becomes operative. In Luzie, most of the farms score an economic efficiency between

20 and 55%. A well-organised marketing of the wool through the shearing shed validates the higher technical efficiency of the farmers.

Figure 2 shows the spreading of the farms of economic efficiency over cash flow for the three case studies. Stars are efficient and make a profit. Luzie accounts for most of the stars, showing again the influence of the organisation of marketing by the shearing shed and the good functioning of the extension service. On the other end of the efficiency axis, the sleepers generate a positive cash flow but are not efficient. Problem children are neither efficient nor profitable, also being farms of the three villages. In Xume, a lot of farms work at a break-even, even slightly negative (see also table 1). Dogs are efficient, but not profitable, but do practically not occur. Low technical efficiency can be due to the geographical situation, lack of technical knowledge and a bad condition of the sheep. The allocative efficiency is negatively influenced by the high costs of medical care, feed and labour. A combination of all factors generates a low economic efficiency.

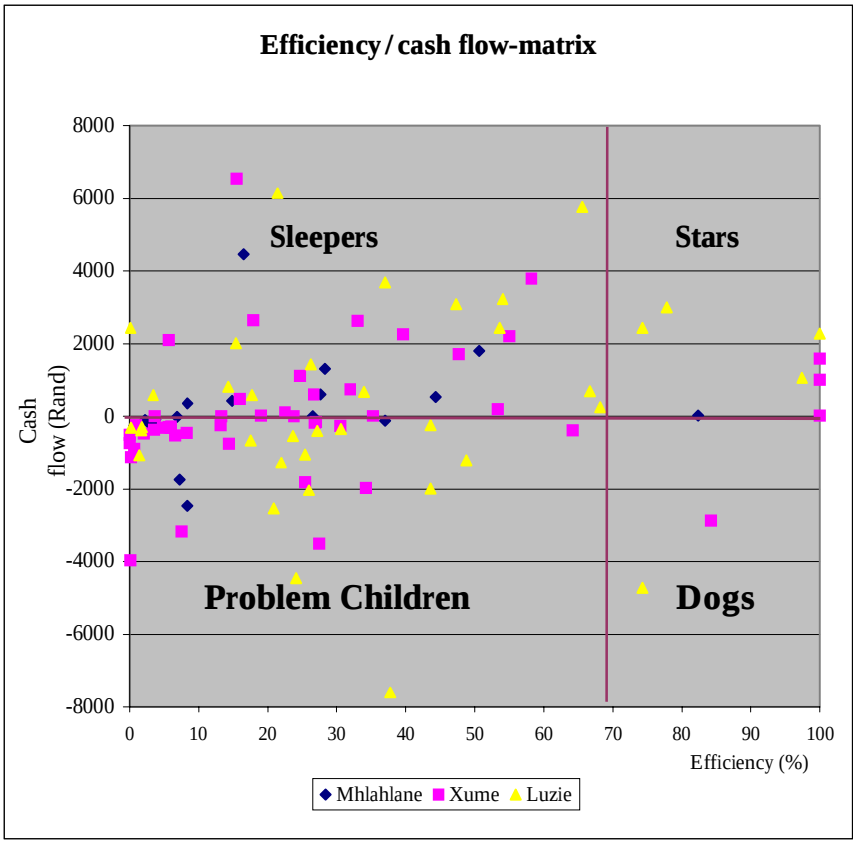

Fig. 2: Farms classified as sleepers, stars, problem children and dogs

6. Conclusion

The above analysis identified the factors of production influencing the efficiency of the wool producer farms in rural former Transkei. Not only these factors mentioned are problematic to the not efficient farmers, an even longer list of problems is withholding the farmers to upscale their business to a commercial level. Farm-level problems, mostly due to a lack of knowledge of the farmer and a lack of financial means to buy the necessary products and feed, cause a low wool production. Some of those problems and also problems causing a low price for the wool are due to the

institutional arrangements and the village organisation. These are traditionally linked by a strong community feeling, aiming at providing a livelihood for all and reducing risk of hunger. But globalisation and integration of the villages into the economy obliges the farmers to commercialise to have a viable business. Producing wool would be an obvious option, because it is a raw cash crop, which can sustainably generate income. The increase in income of a group in the community can because of the increased demand, enhance the development of markets and by that develop the village.

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