OPTIMISING INDUSTRY PRODUCTIVITY: RE-THINKING THE STRATEGY OF TECHNOLOGY TRANSFER USING A BENCHMARK FARM CONCEPT

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Abstract

The popular press is citing poor extension services or inadequate technology transfer as a principal reason why many land reform beneficiaries throughout South Africa are not developing into successful small and medium agricultural businesses. In the South African sugarcane industry, where technology transfer is largely considered to be significantly above par, many sugarcane growers are experiencing financial hardships arising from rapidly increasing costs of production and a suppressed cane price. Under these circumstances, industry sugarcane productivity is under threat. In the context of large-scale land reform initiatives throughout the South African sugarcane industry and the challenging economic climate, there is merit in re-thinking the sugarcane industry's strategy of technology transfer. This paper attempts to unpack some of the reasons why technology transfer is not the principal reason why many land reform beneficiaries and others fail to develop and prosper. Moreover, technology transfer is a 'lever' to facilitate productivity enhancements of inherently viable businesses. Consequently, economics must form the basis of extension, where benchmark farms provide 'live' case study insights into the economics of cane farming, how productivity improvements are made within an economic context and how the adoption of new technology can be improved. Increased collaboration between SASRI agronomic extension and CANEGROWERS economic research and extension is essential to enhance this benchmark farm concept. This proposed benchmark farm concept should complement the parallel role of monitor farms, which validates the commercial implementation and roll-out of new technology developed at SASRI.

Keywords: productivity, technology transfer, extension, financial viability, profit

Introduction

The popular press is citing poor extension services or inadequate technology transfer as a principal reason why many land reform beneficiaries throughout South Africa are not developing into successful small and medium agricultural businesses. In the South African sugarcane industry, where technology transfer is largely considered to be significantly above par, many sugarcane growers are experiencing financial hardships arising from rapidly increasing costs of production and a suppressed cane price. Under these circumstances, industry sugarcane productivity is under threat. In the context of large-scale land reform initiatives throughout the South African sugarcane industry and the challenging economic climate, there is merit in re-thinking the sugarcane industry's strategy of technology transfer. Important questions that need to be answered include (i) how can limited technology transfer resources be focused to better influence a mill area's average recoverable value yield per hectare and (ii) what selection criteria should be applied to selecting benchmark farms? This paper attempts to answer these questions using an empirical analysis of all the mill areas in

the South African sugarcane industry. What follows is the underlying hypothesis, and the methodology and results supporting the hypothesis, followed by some discussion and final conclusions.

Hypothesis

Generally, research is conducted on specific elements of the farming operation, within a controlled environment, with the objective of maximising yields or profits and in some instances optimising a combination of specific elements. The outcomes of such research are helpful but, on a commercial farm where there are competing needs for scarce capital in a dynamic environment of changing input prices and cane revenue, growers should prioritise the innovations that they need to implement. It is expected that the 'market' is the best determinant of this process; i.e. the study of actual 'benchmark' farms.

The concept of 'benchmark' farms is different to the concept of 'monitor' farms. Monitor farms in essence comprise volunteer commercial growers with above average agronomic farming conditions, above average management abilities and a willingness to partner researchers in implementing new research initiatives. This approach best serves the purpose of validating the commercial implementation of new research initiatives and facilitates the demonstration thereof to other growers. Benchmark farms have no bias towards new research. Essentially, benchmark farms are selected using predetermined criteria and are analysed holistically to determine how growers prioritise and combine available resources to optimise outputs. It is hypothesised that the most appropriate selection criteria are farm size and a measure of output deviation from mill area average (personal communication[1]). In the South African context, farm output is best measured by tons relative Recoverable Value (RV), as this is the unit on which growers are paid.

Larger farm sizes impact farm management because (i) economies of scale reduce production costs per hectare, (ii) qualified management is affordable, but (iii) the implementation of the best management practice can be compromised because management's time is dispersed over a greater area. For these reasons and due to their dominance in a local mill area, larger farms are expected to approximate the mill average relative tons RV per hectare. Conversely, volatility of relative tons RV per hectare amongst smaller farms is expected to increase because either constrained economies of scale limit on-farm investment, or off-farm income can result in 'excessive' on-farm investment in the case of recreational or retired growers. Furthermore, smaller farms may have limited management capacity because either the enterprise is unable to attract suitably qualified management or management time is shared with off-farm activities. Alternatively, capacity could be 'excessive'. Therefore, it becomes obvious that cost structures vary widely between farms, particularly small farms. The question that arises is how can profits be maximised on farms with different cost structures?

Figure 1 graphically presents the principles of profit maximisation, which can be defined as Total Revenue (TR) less Total Costs (TC), where the profit-maximising output per annum (Q) is determined where (i) the tangent to TC curve is parallel to TR curve whereby surplus revenue (line A-B) is greatest, or (ii) the profit curve is at its maximum (point C). If TR and TC figures are difficult to procure, a marginal approach can be used to determine the profit-maximising farm output per year; i.e. output should be increased to the point where Marginal Costs (MC) equal Marginal Revenue (MR, or price of RV). Point D in Figure 2 represents this

[1]E Wallis, Bureau of Sugar Experiment Stations Ltd, Brisbane, Australia.

point. The shaded block represents the maximum economic profit; i.e. MR less Average Total Cost (ATC) multiplied by Q, with Q being the same in both Figure 1 and Figure 2.

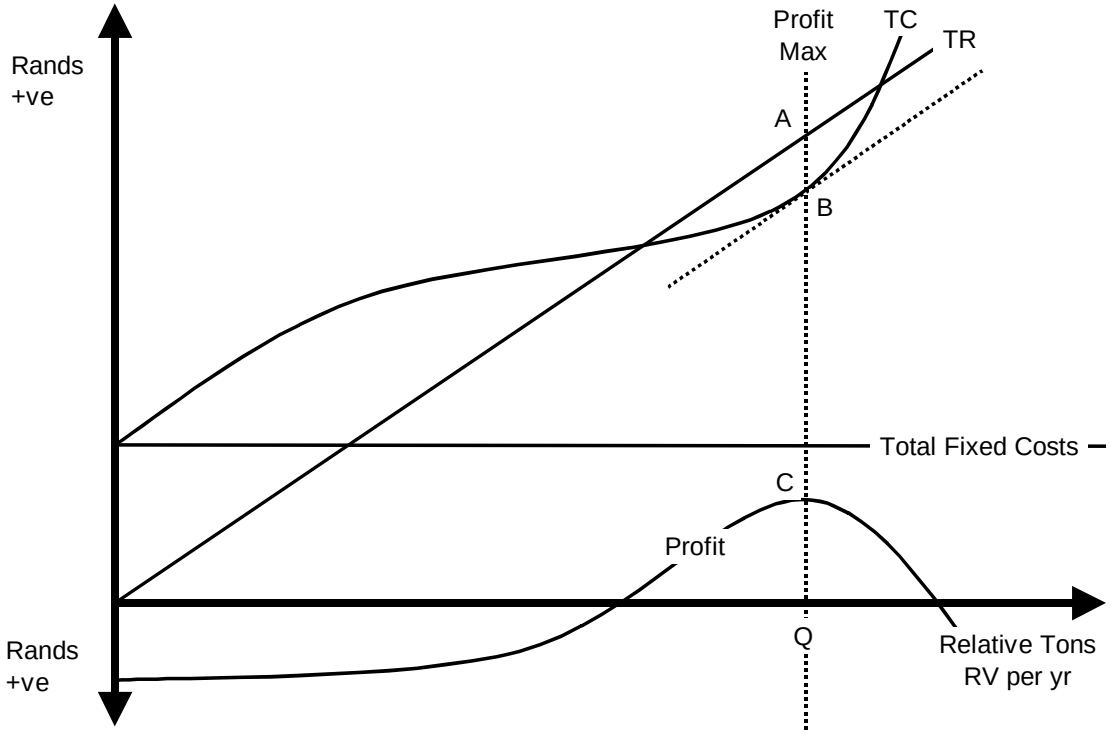

Figure 1. Profit maximisation – total cost, total revenue method.

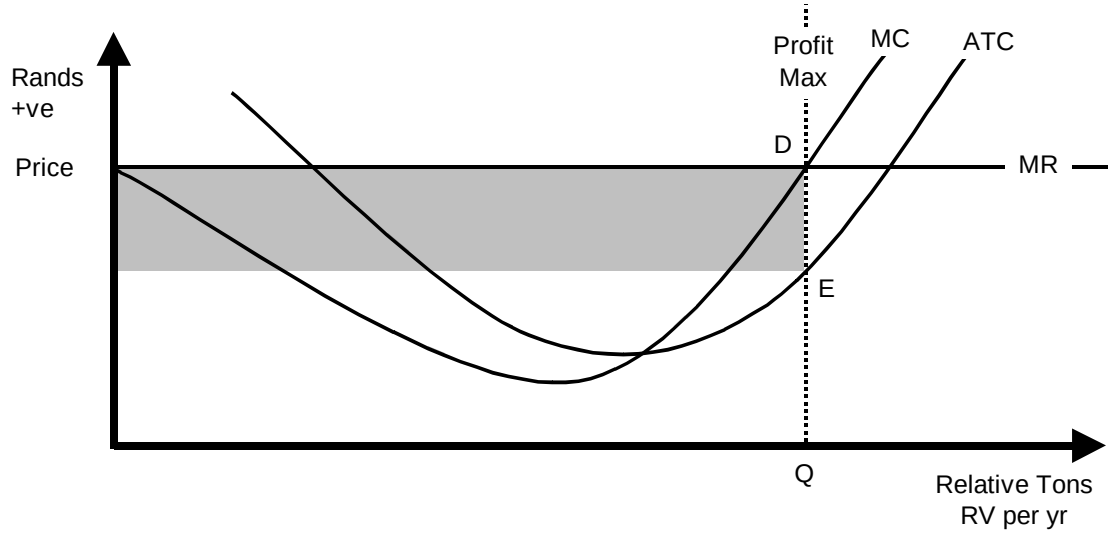

Figure 2. Profit maximisation – marginal cost, marginal revenue method.

Other than costs relating to economies of scale and financial gearing, it is expected that the cost structures of cane farming in a particular mill area are otherwise largely homogenous; i.e. farms of similar sizes have relatively consistent MC. As financial gearing is predominantly a fixed cost, it has the effect of increasing ATC and compromising profits (shaded block in Figure 2, but has no bearing on the intersection of MC and MR that determines the profit-maximising output per annum (Q). Therefore, assuming profits remain positive (i.e. financial

gearing and other costs are not excessive), a scatter plot of farm size (hectares) on the X-axis and deviation from the mill area mean output per annum (relative tons RV) on the Y-axis should provide insights into the relationship between economies of scale and farm productivity, as illustrated in Figure 3. Profitability per hectare is expected to be higher for farm sizes above the simple average mill area farm size; i.e. ATC per hectare is lower for farms to the right of the simple average farm size line. Similarly, profitability per hectare is expected to be higher if the relative tons RV per hectare deviation from the mill area mean is positive; i.e. MR per hectare is higher for farms above zero on the Y-axis. It is further anticipated that most of this benefit is already achieved by farms to the left of the line representing the average farm size weighted by tons relative RV. As a consequence, farms with the best chance of maximising profit per hectare are those farms that lie above mill average productivity and between the simple average farm size and the average farm size weighted by relative tons RV; i.e. benchmark farms (represented by heavily shaded area). Within this group of benchmark farms it is anticipated that agronomic circumstances will vary, providing a suite of appropriate like-with-like benchmarks for other growers to learn from. Therefore, a detailed and ongoing analysis of these benchmark farms should provide insights into how growers prioritise farm management decisions and enhance productivity and profitability. The results thereof are expected to be invaluable to other growers in the same mill area.

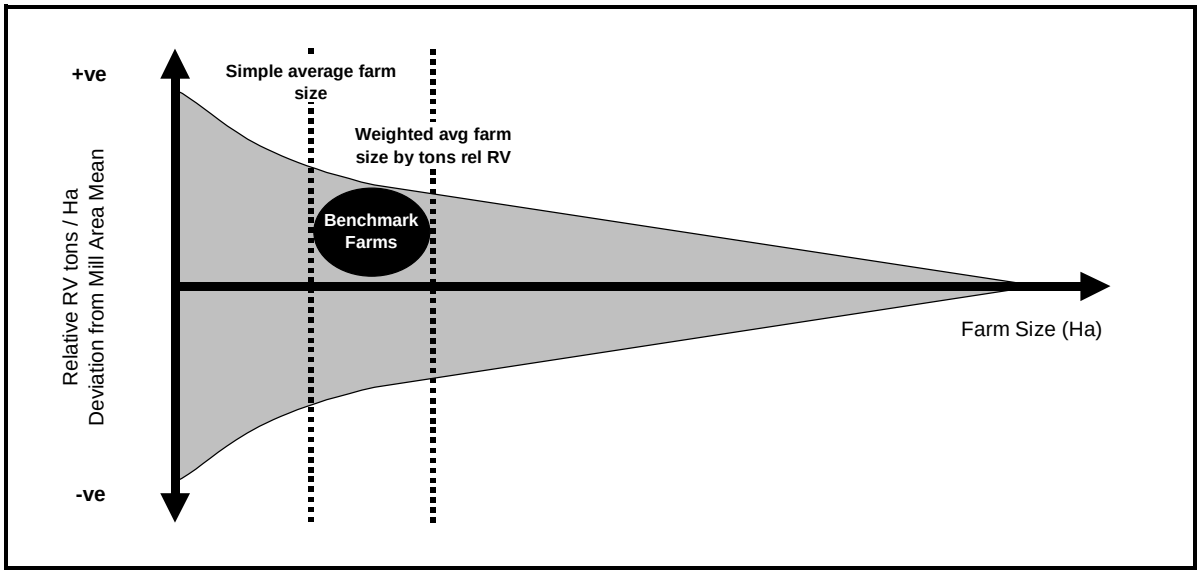

Figure 3. Hypothesis of identifying benchmark farms.

Methodology and Results

In an effort to partially validate the selection criteria for benchmark farms, farm size and relative RV tons data were sourced from the South African Sugar Association (SASA) central database and plotted in accordance with Figure 3. The outputs are presented in Figure 4, with results for each of the 14 mill areas in the South African sugar industry. The farm size scale has been standardised for each mill area (some of the mill areas have numerous growers in excess of 1000 hectares which are not plotted). All data points were used in the calculation of the simple average farm size (left hand vertical line) and the average farm size weighted by relative tons RV (right hand vertical line), except for Felixton, where three of the very large growers were excluded because of the excessive bias caused.

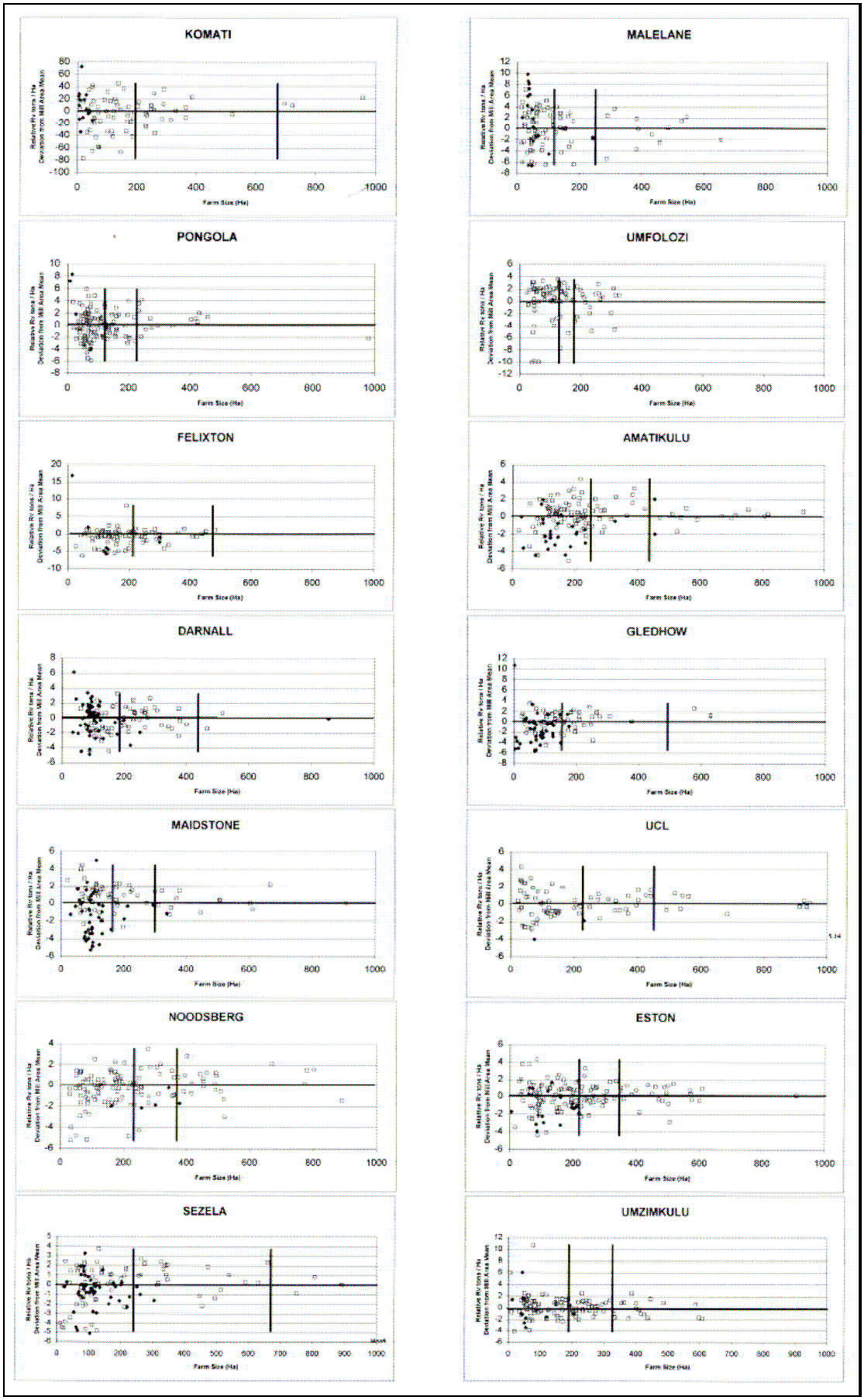

Figure 4. Results of benchmark farm selection criteria.

The gap between the vertical lines in Figure 4 differs between mill areas, which is in accordance with *a priori* expectations. Of significance is the narrow gap at Umfolozi; the reason for this is speculated to be homogenous agronomic conditions and management practices between smaller and larger farms (the Umfolozi Co-operative may have a role to play in this regard). In terms of mean farm size, irrigated areas are generally slightly smaller than dryland areas, but are on average approximately 200 hectares. The average farm size weighted by relative tons RV varies more widely between mill areas. Of significance are the Komati and Sezela mill areas, which could arise from the larger farms operating on the better soils.

Dark triangular data points represent commercial farms owned by previously disadvantaged individuals (PDI) and hollow square data points represent the remaining commercial farms. As expected, few of the PDI farms exceed the mill area average farm size. However, it is encouraging that, despite poor economies of scale, a significant number of PDI farms have a positive deviation from the mill area mean relative RV tons per hectare, particularly in the Komati and Darnall mill areas. This implies that their MR per hectare is high, but profits might continue to be elusive because of a high ATC associated with high financial gearing.

The benchmark farms are those data points that lie between the two vertical lines and above the line of zero deviation from mill area mean relative RV tons per hectare. These selection criteria provide a simple sampling frame that identifies approximately 10 representative farms with high MR per hectare from which further benchmarking analysis/research should be developed. Further validation of these benchmark farms is required to ascertain whether their ATCs are lower (e.g. reduced gearing), which is what enables them to better reinvest in optimising productivity and maximising profits. Extension Officers need to understand these dynamics, and furthermore need to identify a range of best practice standards that can be used to benchmark like-with-like growers to facilitate ongoing improvements.

Discussion and Conclusions

The extension service offered by the South African Sugarcane Research Institute (SASRI) has been the envy of many agricultural industries within South Africa and many sugar industries abroad. However, growers have competing needs for scarce capital, which is particularly acute in a difficult economic climate. An extension service needs to take cognisance of these economic drivers to help growers better prioritise which changes need to be made on-farm to maximise profits per hectare. Conversely, the principal reason why land reform beneficiaries and others fail to develop and prosper is an inappropriate cost structure relating to poor economies of scale and high financial gearing. Even a ‘Rolls Royce’ extension service becomes ineffective under these circumstances. Consequently, extension services should focus their attention on sound economic entities for maximum effect.

Where farm businesses have an appropriate cost structure as the foundation for success, extension services and technology transfer are ‘levers’ to facilitate and fast-track productivity enhancements. As a consequence, extension staff that identify and analyse benchmark farms should be better able to provide appropriate agronomic and other technical advice within an economic context. Showcasing benchmark farms might also be an effective extension tool, because high profile successful farmers are often the best ‘change’ agents in a local mill area.

The current approach of having SASRI agronomic extension and CANEGROWERS economic extension as discrete entities is not ideal. Going forward, economics must play an increasingly important role in extension, where benchmark farms provide ‘live’ case study

insights into the economics of cane farming; i.e. how productivity improvements are made within an economic context and how the adoption of improvements can be improved. Increased collaboration between SASRI agronomic extension and CANEGROWERS economic research and extension is essential. This benchmark farm concept should complement the parallel role of monitor farms, which validates the commercial implementation and roll-out of new technology developed at SASRI.