

CHAPTER 8

A REVIEW OF AGRICULTURAL MECHANIZATION STRATEGIES FOR SMALL SCALE FARMERS IN SWAZILAND

by

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INTRODUCTION:

The Kingdom of Swaziland is a small landlocked country in Southern Africa surrounded on three sides by the Republic of South Africa, and on the remaining side by the Republic of Mozambique. The country has been independent since 1968. With a total area of 17,364km² Swaziland is the second smallest country in Africa. The country is also small in terms of population which is about 800,000 with an average population density of 28 per km². Being an agriculturally based economy, 86% of the population reside in rural areas. Though well diversified and enjoying favourable growth, the economy is also characterized by the familiar dualism which exists between traditional and modern sectors of many developing nations. The modern sector is chiefly engaged in production and processing of primary products for export e.g. timber, sugar, cotton, citrus and pineapples.

The country is physically divided into 4 ecological regions running from North to South. In the West there is the Highveld at 900-1800 meters above sea level; Middleveld, 300-1000 meters; Lowveld 600-700 meters; and the Lubombo region at 300-800 meters which is in the eastern part of the country. The rainfall varies according to the ecological zone as:

Highveld	- 1200mm average rainfall
Middleveld	- 800-900mm average rainfall
Lowveld	- 300mm average rainfall
Lubombo	- 900mm average rainfall

Most of the rain falls in the summer (October-March) while the winter months are usually dry. The agriculture sector plays a crucial role in Swaziland's economy and is by far the most important sector in the economy.

In this paper we shall review the agricultural mechanization policies and strategies in Swaziland with special reference to the small holder sector. Before doing this however we need first to briefly highlight the main features of Swaziland's agriculture. This will be followed by analysis of agricultural mechanization policies adopted by the Government and the implementation

strategies. We should however caution that our analysis concentrates mostly on the small holder sector where Governments efforts have been directed. However this sector produces only a fraction of Swaziland's agricultural output and mostly for subsistence. The bulk of the agricultural production is undertaken in the large scale commercial sector. The picture may not therefore be complete in so far as agricultural mechanization in Swaziland is concerned.

AGRICULTURE IN SWAZILAND

Swaziland's agriculture is characterized by its duality which is based on two forms of land tenure systems. On one hand, is the traditional system of land tenure practised on the Swazi Nation Land (SNL) where all land is held in trust by the King and small scale farmers predominate in these areas and practise mostly subsistence agriculture (Table 22). This Swazi Nation Land now constitutes about 63% of the total land area of the country and is owned communally by the Swazi people and vested in the King who holds it in trust for the Nation (close to 10% of the land under the SNL is managed on commercial basis in the so-called Lifa and Tibyo land or used as Government livestock fattening and breeding ranches). On the other hand are the freehold lease lands owned under the Individual Title Deeds (ITD). About 518,393 ha of this land is owned by foreigners or large multinational corporations growing cash crops such as sugar, citrus, pulp-forestry; and some ranches. A comparatively large number of Swazi nationals have brought land from foreigners and are now farming it as medium and large scale commercial entities. They now farm close to 100,000 ha under this system (Table 22).

TABLE 22: **Land Ownership in Swaziland**

	Hectares	% of Total
Total rural land area	1 643 530	100
Swazi National Land (SNL)	874 924	53
Purchased for SNL since independence	157 743	10
Total SNL	1 032 667	63
Title deed farms		
owned by Swazi citizens	92 520	6
owned by foreign companies	518 343	31

SOURCE: Low (1986)

The ITD farms are predominantly capital intensive and in many cases managed by expatriate managers. They are quite important as they account for about 53% of the Agricultural GDP (AGDP) - (which in turn contributes about

43% of the GDP - including forestry - and employs about 50% of all employees in the wage sector). On the other hand although the SNL constitutes about 53% of the land area it contributes only about 21% of the agricultural GDP, with the remaining 26% of AGDP coming from agro industries. The production of the major commercial crops (excluding forestry products) is shown in Table 23. Thus only maize production (which is mostly a subsistence crop) is dominated by the SNL.

AGRICULTURAL MECHANIZATION STRATEGIES

As with the dual structure of the agricultural sector, the mechanization strategies have by and large followed a dual system with the ITD farms being highly mechanized and the SNL farms relying to a large extent on Draught Animal Power (DAP) and handtool technology. The proximity of Swaziland to South Africa, where the white farmers have had a long tradition of mechanized farming and many Swazi nationals were hired as farm workers and miners there from the last century, has made it easy for many Swazi nationals to adopt the draught animal technology. The adoption of DAP was also assisted by the fact that the Swazi's traditionally keep cattle and hence this made it easier for them to use them for tillage and transport.

TABLE 23: **Production of various crops by ITF & SNL (1981/82) (Tonnes)**

	<u>ITF (%)</u>	<u>SNL (%)</u>	<u>TOTAL</u>
Cotton	5 810 (41%)	8 445 (59%)	14 255
Sugar	408 000 (100%)	0 (0%)	408 000
Pineapples	35 150 (100%)	0 (0%)	35 150
Maize	4 724 (8%)	52 267 (92%)	52 991

SOURCE: **HUNTING (1983)**

As an agency responsible for the development of small-scale agriculture in Swaziland on the SNL, the Ministry of Agriculture and Co-operatives (MOAC) is also responsible for encouraging the development of appropriate mechanization techniques which should hopefully enable the sector to maximise its productivity in food production especially maize and cash crops in the most economic and most effective manner having regard to holding size, labour availability, skills and support activities. The traditional sector consists of about 58,000 small scale Swazi Nation Farms with an average size of less than 3 hectares. These farms are run largely on traditional lines employing family labour and draught animals and producing food mainly for subsistence. About 80% of the crop area is utilized for maize production, maize being the national staple food.

USE OF DRAUGHT ANIMAL POWER

The use of draught animals (mainly oxen) for the first ploughing is still widespread - over 60% of homesteads use them for ploughing and planting although the use of oxen typically results in the maize crop being planted at least 4 weeks after the optimum planting date. Research indicates that late planting can lead to losses of up to 5% in yield for each week of delayed planting. A mechanization study undertaken in Swaziland by a team from British ODA in 1979 found that, at that time, the economic cost of using oxen for first ploughing was double that of hiring of a tractor. There is also a conflict between the use of oxen as the principal source of farm power, and the strategy of cattle destocking to reduce overgrazing of the veld in particular as cattle numbers are already quite high and this is major cause of soil erosion (Ebinu 1985).

Modern industrialization is giving rise to labour migration to towns and to S. Africa leading to a shortage of physically fit men to train and operate the oxen. There is significant and continual leakage in the skills available to train and operate oxen as traditionally women do not perform such tasks. On the other hand, oxen represent a sustainable source of farm power from renewable resources, and cheaper in pure cash terms and thus animal draught power is likely to have a place in Swaziland's small scale agriculture for the foreseeable future.

TABLE 24: Livestock Population on the SNL

	No.	No. per homestead
Total cattle population on SNL	527 593	9.09
Draught oxen	137 342	2.37
Donkeys	16 881	-
Horses and mules	1 316	-
Total No. of homesteads	58 000	-

SOURCE: Swaziland (1984) - Agricultural Census

The use of draught oxen in agriculture in Swaziland has, by and large, evolved on its own. There has been little Government activity in this sector other than the little work undertaken on improvement of the single row maize planter through the foreign funded programmes like the RDA project in 1980/81 and CSREPT - Cropping System Research Project in 1988/89. The bulk of the Government assistance on mechanization on the SNL has been concentrated on the Tractor Hire Scheme. Nevertheless draught oxen cultivate about 45% of the arable land in the SNL and it is estimated there are over 130 000 draught oxen in Swaziland (Tables 24 & 25).

TABLE 25: Level of Mechanization in Swaziland (1988)

(a) Swazi Nation Land (SNL)		Area (10 ³ ha)	%
(i)	Cultivated by draught oxen	45	45
(ii)	Cultivated by Govt. tractors hire	4	4
(iii)	Cultivated by Private tractors hire	14	14
(iv)	Cultivated by own tractor	2	2
(v)	Left fallow due to lack of power,etc.	35	35
(Total potential arable area 100 000 ha.)			
 (b) Individual Title Deed Land			
All cultivated by tractors			100

SOURCE: MOAC - Swaziland 1988

Further about 59% of the small scale farmers on the SNL rely on oxen only for cultivation purposes while another 12% rely on a combination of tractors and oxen (Table 26). It is rare to see any farmer in Swaziland who uses entirely the handtool technology for primary land preparation. The main problem facing oxenization in Swaziland includes oxen teams being often poorly trained and implements drawn by them being of poor design and in poor operating condition. The use of oxen power almost always has an adverse effect on timeliness of planting and consequently, is a major cause of low crop yield. The usual reason quoted for delays in seedbed preparation concern the poor physical condition of draught oxen after the dry winter. Delays can also be caused by lack of manpower on the homestead to span the oxen and carry out the work. Men working in the industrial places cannot always get home at the critical time.

TRACTOR HIRE SCHEMES

Government Hire Schemes

As explained above, the fairly large and strong commercial agriculture, which is almost entirely mechanized, has inevitably affected the pace and rate of adoption as well as attractiveness of tractor cultivation in Swaziland. Almost every family in the SNL has had a relative employed on the commercial agriculture sector either in Swaziland or in neighbouring South Africa. Thus many of them have seen the advantages of using tractors for cultivation and even more important this commercial agriculture sector has acted as training ground for tractor operators, artisans, mechanics, etc. for the nation.

The MOAC has therefore been actively promoting the development of tractor power facilities in the rural areas since 1973. The project history is long and complicated and has its share of problems. It started with the Rural Development Areas Project, initially funded by ODA in 1974 which had 13 tractors in 4 Tractor Hire Pools. The aim of the pools were to demonstrate to farmers the benefits of timely deep ploughing and secondly to provide a transport service for the infrastructural development of the project. Hire charges set were strictly unsubsidized. The idea was to phase out the pools after 6 years (the tractors life span) assuming that the demand for tractor hire, deliberately unsatisfied by the tractor pools would encourage either the establishment of private tractor hire services by individuals or the starting of co-operative tractor hire schemes.

However by 1980 (when six years had elapsed) and despite a heavy demand for tractor hire services, it was not possible for the Government to phase itself out of such schemes due to popular demand. There were quite a number of emergent farmers who had obtained individual title deeds and who owned their own tractors and who provided tractor hire services to the small scale farmers who did not own either draught oxen or tractors. Such farmers however provided the tractor hire services rather late as they had to plough their own fields first.

The Government tractor hire service was thus the only one providing exclusive service. The Government tractor hire service was thus retained for a second period of six years and the number of pools was increased to 10 with 34 tractors obtained through loans from the African Development Bank and the World Bank. However due to the bureaucracy inherent under most civil service systems and the cumbersome financial regulations in Government systems it became apparent that the cost to the Government of running its tractor hire scheme was increasing sharply and utilization rates were low as well as the overall efficiency of the programme.

Consequently in 1982 IFAD funded a project which included a component whose sole objective was the conversion of the tractor pools to a self-financing, self managing operation in order to introduce commercial efficiency, raise utilization levels and thus approach economic viability. The start of this project was however delayed until 1987 during which time the tractor pools all but collapsed through under funding and inherent civil service problems. The project finally started but the Government still questioned the establishment of tractor pools as a self-accounting unit with power to open commercial bank accounts, whilst the pools remained within a Government department. In 1988 the IFAD project commissioned a study by a commercial consulting firm - Cooper and Lybrand to examine the alternatives of operating the tractor hire scheme outside direct Government control. This report has however yet to be accepted and implemented by the Government. Thus the Government Tractor Hire Scheme is still in limbo.

TABLE 26: Tractor Numbers in Swaziland (1984)

	No.	%
Total in country	3520	100%
of which		
- on large scale farms	861	25%
- on Swaziland Nation Land	2083	59%
- on Medium scale ITD (Swazi owned)	576	16%

SOURCE: FAO (1988); Swaziland (1984)

TABLE 27: Method of Ploughing - SNL

Method	No. of Homesteads	% Total
Tractors only	9 063	15.61
Oxen only	34 353	59.17
Tractors & Oxen	6 903	11.89
Other methods (e.g. donkeys)	4 353	7.49
No cultivation	3 389	5.84

SOURCE: Swaziland (1984)

Private Hire Schemes

As can be seen from Table 26, Swaziland had about 3520 tractors in 1984 with around 860 of them being on the large scale commercial farms in the ITD lands. About 2659 tractors according to the 1983/84 agricultural census were used outside the large commercial farms with 2083 of them on the Swazi National Land (SNL). The 576 tractors which are neither in the SNL or ITD's farms are owned by individual medium scale farmers (resident expatriate and Swazi nationals) in an increasingly important sector which produces quite an amount of the marketed food surplus and some of them grow on contract cash crops such as sugar cane, seeds, etc. as well as intensive livestock production. These figures indicate that the tractor number on the Swazi National Land is quite large at 2083 units. Given that the census also shows only about 16 000 ha of land are cultivated by tractors this means each tractor on the average ploughs only about 8 ha per annum (Table 25) on the SNL. Obviously a lot of the tractors on the SNL are owned by individual emergent farmers who

concentrate on their own land first and too often are involved in intensive livestock production as well as growing of cash crops. Therefore such average figures should be treated with caution. It is also clear that a lot of these individually owned tractors on the SNL are in a state of disrepair. Many of them have been bought as second hand tractors - usually those boarded off from the large commercial farms or imported as second hand tractors from South Africa. A more detailed survey of these tractors, what they do and extent of their utilization will have to be undertaken to assist in better policy formulation.

Apart from the census, baseline data on tractor and oxen utilization is lacking. In order to remedy this, the IFAD funded Smallholder Credit and Marketing Project (SMCP) is commissioning a Rural Mechanization Study (ongoing at time of writing) to provide such data. It is estimated that out of the 2083 tractors that the Swaziland census of Agriculture of 1983/84 had found on SNL only about 350 can be said to be fully operational by 1989 (including the Tractor Hire Pool) and collectively they plough about 18 000 ha for primary/secondary cultivation each year. Another 1500 tractors are marginally serviceable covering perhaps about 2000 ha between them.

Assuming a potential productive area of 100,000 ha it is believed that about 65,000 ha was planted in 1988/89 cropping year. Mechanization section of MOAC estimates that around 20,000 ha was ploughed with tractors and 45,000 ha was ploughed by oxen. By deduction this means that 35,000 ha of potentially productive arable land lay fallow in 1988/89. There are many socio-economic reasons why more land is not put into production but it is generally agreed that the shortage of tractors and good draught animals at the critical first rains is one of the major constraints both to the area cropped and the yields because of the timeliness constraint in the rainfed agriculture practised in Swaziland.

Waiting for cattle to regain strength on fresh spring veld grass after a dry winter means for 60% of homesteads no maize planting is done till mid November. According to the Mechanization Section the farm power situation is deteriorating. Despite a high seasonal demand for tractor hire, especially ploughing for maize planting but also increasingly for winter ploughing the number of tractors available for hire is decreasing. This is attributed to the very sharp increase in capital costs and running expenses over the last few years. The cost of a new tractor has tripled in 5 years, while spares/repair costs have more than doubled and indeed the number of second hand tractors in the S.Africa market has decreased and even the few available are quite expensive. Now that a new tractor and plough costs about US\$25,000 it requires good business management skills to hire the unit out at a profit, with high enough utilization rates to repay the loan over the economic life of the tractor.

THE TINKABI TRACTOR

The Tinkabi tractor was originally developed in Swaziland in 1973 as a low cost prime mover for developing countries (Tinkabi is the Swazi word for many oxen). The two Catterick brothers were heavily involved in its development (Catterick 1978). The original tractor consisted of two cylinder four stroke cycle engine. The engine (20 hp) is hand started and is air-cooled by means of a belt - driven fan. The Tinkabi as a manufacturing enterprise was undertaken over a period of about 10 years in Swaziland. This period saw the development of this farm power input for Swazi farmers that included not just the supply of the tractor unit but also a support service covering the provision of credit and after sale training, servicing and provision of spares. Two hundred and eighty one units were sold between 1973 till 1979, of which 197 were sold in Swaziland and the rest to Botswana (5); Kenya (4); Malawi (3); Nigeria (1); Senegal (3); S.W. Africa (1); UK (2); Zambia (36); India (2); Lesotho (4); Mozambique (2); S.Africa (18); Tanzania (2); U.S.A. (1). In early 1980's about 200 more units were manufactured most of which were exported to Tanzania and other countries under a World Bank assisted scheme.

It can be safely stated that the Tinkabi tractor did a satisfactory job in maize shelling, water pumping, generating electricity (as a stationary power source) but it failed to do it's intended primary job of ploughing. This factor accompanied by ever rising financial cost of production meant that Government's support in the manufacture of the tractor became inadequate so production stopped in the early 1980's. A later improved model using the Perkins 31kw three cylinder direct injection water-cooled diesel engine was developed in the mid 80's but it also over-costed itself and production was stopped in 1988. It is encouraging to note however that a number of the original tractors do still exist and do maize shelling in Swaziland. Writtle College (U.K.) made some modifications in 1988 on the prototype and is hoping to do trials and eventually have it produced for horticulture, landscape maintenance, and other smaller farmwork jobs.

One major lesson which can be learned from this Tinkabi enterprise is an individual's role in such projects. For the Tinkabi project was conceived and essentially developed by the two Catterick brothers. They as individuals, were the prime movers behind the whole project and for about 20 years worked tirelessly and with admirable dedication on this project. It may well be that if there were more players in the whole project, it may have developed into something else. However it could also be argued that more players would have reduced the zeal and perhaps even the little progress obtained would not have been there. Perhaps this is one project which requires to be studied further, in particular the individual's role in such a project. This does not mean that we are saying that projects conceived, developed and implemented by individuals should not be encouraged. On the contrary they should be supported, but it is necessary to have the whole system behind the project in addition to having more people actively engaged in the project.

OTHER INSTITUTIONAL LINKAGES

Training for agricultural mechanization personnel is undertaken at the University of Swaziland, Luyengo Campus - in the Faculty of Agriculture. The Department of Land Use and Mechanization of this Faculty offers agricultural engineering courses to students enrolled in the BSc. degrees in general agriculture and in agricultural education as well as those enrolled in the diplomas in agriculture and agricultural education. There is no specialized programme in agricultural engineering/mechanization offered at diploma and degree levels and the few staff in the country trained in this area have been trained overseas through scholarships offered by, among others, USAID and British Council. The Swaziland College of Technology offers a certificate programme in agricultural mechanics and many of the mechanics working in Government departments and the large scale farms are trained in this college. Tractor drivers are recruited locally and intensive tractor operation and maintenance courses of 1 week duration are offered with the help of the main dealers and extension personnel. The large scale farms also do provide on the job training to most of their tractor operators and mechanics.

There is very little research on agricultural mechanization being undertaken in Swaziland. Most of the research work has been undertaken through individual initiatives of staff at the Department of Land Use and Mechanization of the University of Swaziland and also of the Agricultural Research Station at Malkerns. In the former case many of the researchers have been expatriates and the research initiatives have usually stopped when they leave the country on the expiry of their contracts. The National Agricultural Research System in Swaziland is in itself quite small and it concentrates its efforts on the Biochemical and Socio-Economic problems of Swaziland's agriculture. It is unlikely that Swaziland is going to be able in the near future to embark on any large scale research efforts in the field of agricultural engineering given the scarcity of both human and capital resources. In addition manufacturing is quite limited and the Tinkabi tractor was a major undertaking in this regard. Swaziland, being a member with S.Africa, Botswana, Lesotho, and Namibia of the South Africa Customs Union (SACU) and there is free trade between these countries, therefore given the much more developed agricultural machinery industry in S.Africa, it is difficult for any entrepreneur to establish a competitive agricultural machinery and implements industry in Swaziland as he will have to compete with the well established industries in S.Africa.

CONCLUSION

We have in the preceding sections reviewed the agricultural mechanization policies and strategies as they have evolved over the past 2 decades in Swaziland. Given the proximity of Swaziland to South Africa, Swazi farmers adopted the draught animal technology much earlier than in most African countries. The tradition of livestock husbandry which the Swazis have had also

made it easier for them to adopt this technology in particular for tillage. The migration of young men, who have traditionally been responsible for training and harnessing oxen for ploughing, for work in the urban areas as well as in the mines in South Africa would appear to be affecting the future of this technology. Emergent and medium scale Swazi farmers have, by and large, adopted the mechanical technologies for their tillage and transport requirements.

These emergent farmers together with the large scale farms contribute a larger proportion of the marketed agricultural output as well as of the export commodities. There is however a dearth of knowledge on how these large scale farms and the emergent farmers, operate and manage the agricultural mechanization components of their farming enterprises. The fact that they are able to commercially run their enterprises and make a profit indicates that they must be utilizing the mechanization inputs profitably. There are also quite a number of tractor owners who hire out their tractors for ploughing fields owned by the small scale farmers. Such farmers supplement the services provided by the Government Tractor Hire Units which so far have faced a number of teething problems, primarily because of the fact that they have to operate within the civil service administrative and financial regulations. Proposals to delink these units from the civil service and allow them some degree of autonomy are still being considered. Swaziland also happens to be the only country in SubSaharan Africa where there has been an attempt to design, develop and manufacture a small tractor (less than 20 hp) - the Tinkabi. This enterprise has however had to be abandoned after 2 decades of research, development and manufacturing activities. The exact reasons why the project failed have still to be researched on and documented. It is our belief that such a research undertaking will go a long way towards avoiding similar mistakes in the future not only in Swaziland but also in other African countries which might venture into developing small tractors. On the institutional front and linkages between the various sectors involved in the whole agricultural mechanization development efforts, Swaziland would seem to still have a long way to go. It is perhaps in this regard that Swaziland might greatly benefit if there is more cooperation in this field among African countries, by learning how the sister countries in Africa have been handling their mechanization programmes.
